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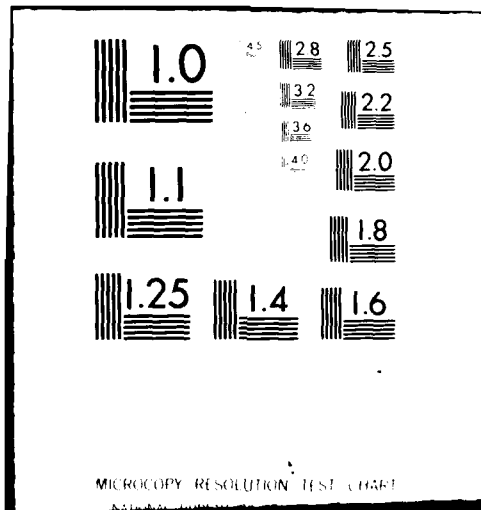
CIVIL ENGINEERING LAB (NAVY) PORT HUENEME CA F/G 5/9  
FACILITY HYGIENE PRACTICES ASSOCIATED WITH ASBESTOS THERMAL INS—ETC(U)  
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# Note

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**author:** E. E. Lory

**date:** October 1980

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## CIVIL ENGINEERING LABORATORY

NAVAL CONSTRUCTION BATTALION CENTER  
Port Hueneme, California 93043

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Guidance on appropriate practices for cleaning workplaces that have significant amounts of asbestos-containing thermal insulation is presented. Recommended procedures for floors, walls, machinery and equipment, and overhead areas are provided. Recommended cleaning methods are given for HEPA-filtered vacuum cleaners, wet-cleaning with amended water, and chemical-impregnated equipment. As a general guide, overhead structures and walls should be vacuumed annually, and floors and equipment vacuumed on a regular cleaning schedule.

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## FOREWORD

Occupational Safety and Health Administration (OSHA) Standards imposed on the Navy by Executive Order 11612 and 11807, followed by OPNAVINST 5100.8C and 6240.30, require implementation of health and safety methods for Naval personnel. OSHA Standard 1910.1001 and OPNAVINST 6260.1A are concerned with the control of asbestos emissions for the protection of personnel and the environment.

OSHA regulations must be adhered to by all Federal agencies. Work performed by Public Works Departments or by private contractors aboard Naval installations must comply with these regulations.

## INTRODUCTION

The Civil Engineering Laboratory (CEL) has been tasked by the Naval Facilities Engineering Command (NAVFAC) to develop guidance on appropriate practices for cleaning workplaces that have significant amounts of asbestos-containing thermal insulation. Many types of asbestos insulation products have been used in Navy construction in a variety of steam and hot water systems. The diversity and various states of maintenance have led to concern in determining appropriate practices for facility hygiene. Also, when the new Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) regulations came into force, the protection of workers from industrial disease became a statutory obligation wherever asbestos materials are used in such a way as to give rise to the emission of dust dangerous to the health of employees. These regulations have placed new burdens on facility and safety managers to insure proper practices for removing accumulated hazardous asbestos dust and achieving satisfactory working conditions.

This technical note is one of a series of documents prepared by CEL on asbestos construction products at Naval Shore Facilities. The primary guidance document is the Management Procedure for Assessment of Friable Asbestos Insulating Products (Ref 1). The information assembled in this investigation was developed through a search of pertinent literature and through contacts with EPA. This type of information is essential to facility and safety managers to insure regulation compliance and cost-effective operations. Also, it provides a basis for decisions regarding the direction of further development in this area. Supplementary technical notes to this guidance document will be prepared on subjects related to asbestos-containing products, such as encapsulation methods, thermal pipe insulation maintenance procedures, applied insulation demolition techniques, and handling and disposal of asbestos-containing waste.

## BACKGROUND

Asbestos is a general term used to describe several fibrous hydrated silicate minerals known for their high tensile strength, high flexibility, durability, and heat and chemical resistance. Only six of these asbestiform silicates -- chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite -- are of major commercial importance. In the past decade, there has been an increasing awareness of the significance of environmental contamination as a cause of disease. The physical characteristics of asbestos fibers and the widespread and varied uses of asbestos-containing products have caused concern for human exposure within buildings that contain such material. The hazard potential from such exposure for the population involved may be relatively high. Because of widespread use and ease of fiber dissemination, asbestos-containing thermal insulation can be considered one of the most significant sources of asbestos fibers in the indoor environment.

The potential for fibers to enter the workspace environment depends upon type of construction material, structural form, and building use. Fiber dissemination is a function of the frequency and amount of energy delivered to the asbestos-containing material, normally through the generation of air currents and mechanical agitation.

Relevant characteristics of asbestos fibers include durability and high aerodynamic capability, both of which directly influence the probability for long-term contact. Once in the workspace, the fibers exhibit low settling velocities, remaining in the inhalation contact zone for long periods of time. As calculated from settling curves generated specifically for asbestos fibers, a 1.0  $\mu\text{m}$  fiber with a 5:1 aspect ratio, falling from 3 meters with variable axis attitude, will exhibit a settling velocity of  $10^{-5}$  cm/sec and remain airborne for over 80 hours. Furthermore, settled fibers have aerodynamic capability and may experience reentrainment cycles if disturbed. Such fibers contained within workspaces can repeatedly present an exposure situation and an opportunity for inhalation or ingestion.

#### ENVIRONMENTAL MONITORING

Airborne asbestos dust is usually monitored for one of three reasons. First, large numbers of samples are taken to check compliance with legislation with regard to persons involved directly in asbestos control measures. Second, determinations are made regarding the efficacy of engineering dust suppression measures. Last, the asbestos is monitored for epidemiologic purposes. Therefore, air monitoring is used to estimate concentration levels of airborne fiber before, during, and after facility hygiene operations. The federal government requires monitoring of employee exposure to determine whether each employee's exposure to asbestos fibers is below the current limits.

Sampling and analysis for airborne asbestos may establish the existence of asbestos contamination (see Reference 1 for details). An adequate study of airborne contamination requires sampling during various indoor activities and sampling of outside or community ambient levels, with inclusion of control samples. Sampling within a structure under only quiet conditions may be particularly misleading because asbestos fibers usually become airborne as a result of disturbance through human activity. Direct monitoring of persons engaged in these activities will best define potential exposures.

#### MAINTENANCE OF THERMAL INSULATION

In facilities with asbestos-containing thermal insulation, all machinery, equipment, and internal surfaces of the building should be kept, so far as is practicable, in a clean state and free from asbestos waste and dust. Scheduled preventive maintenance and inspection of thermal insulating systems should be conducted at least once a year, but preferably at 6-month intervals. Reliability of the piping system and trouble-free service life can be increased by such scheduling. Preventive maintenance also insures maximum thermal conservation.

Another aspect of the preventive maintenance inspection is locating pipe insulation damage, which is a potential source of asbestos fiber release and subsequent exposure of workers. Fiber release is dependent on the extent of damage, the incidence of repeated disturbance, and available air currents or turbulence to carry the hazardous fibers into the respirable (breathing) zone. It should be noted that when thermal pipe insulation, including asbestos-containing insulation, is properly maintained and lagged, there is no danger of fiber release.

All damaged thermal insulation should be repaired before the facility's hygiene operation begins (see Reference 1 for details). Proper maintenance will protect the insulation from further damage and will also prevent fiber disturbance during the cleaning operation.

#### SAFETY PROCEDURES FOR PERSONNEL PROTECTION

Safety and health requirements for conforming with OSHA, EPA, and Navy regulations must be complied with according to exposure levels when work is to be accomplished by Navy personnel, civilian personnel, or outside contractors. To insure personnel are not being exposed to asbestos fiber levels, protective equipment must be worn.

Any respirator used must be approved for protection against exposure to asbestos by the Mine Safety and Health Administration (MSHA, formerly MESA) or the National Institute for Occupational Safety and Health (NIOSH). For facility hygiene operations (i.e., nonrip-out asbestos operations), the type of respirator is determined by the asbestos fiber concentration in the breathing zone during worst case conditions. Generally, reusable or disposable single-use air purifying respirators will provide the required protection.

Disposable headcovers and shoe covers, coveralls (or a disposable sock suit constructed of TWEK or other similar material documented to be of equivalent resistance to penetration of asbestos), gloves, and goggles are generally recommended.

For additional guidance, the cognizant safety specialist or industrial hygienist should be consulted.

#### RECOMMENDED HYGIENE PROCEDURES

Procedures for facility hygiene operations have been described by the Asbestos Research Council (Ref 2). Their recommendations include the following.

##### Floors

Contamination of working areas from accumulation of waste material on floors must be avoided by regularly cleaning with a dustless method. The first choice of a dustless method for cleaning would be by vacuum, either from a fixed source or a mobile unit. Alternative methods would include thorough damp mopping of the floor or the use of chemical-impregnated mops.

### Walls

Annual cleaning of the walls should be sufficient. Walls may be cleaned either by vacuuming or by washing down using amended water.

### Machinery and Equipment

The method to be used for cleaning equipment depends on the degree of contamination, the type of material, and whether the material is contaminated with oil or water. It is preferable to use vacuum cleaners, either of the fixed or mobile type, with suitable extension leads. Inaccessible parts of the equipment may be cleaned out with chemical-impregnated brushes or cloths and then vacuum equipment used to collect the material so removed.

### Overhead

The most difficult cleaning operation that has to be undertaken on a regular basis in any facility with significant asbestos materials is overhead cleaning in high buildings. The frequency of cleaning overhead structures will vary significantly from one facility to another. As a general guide, overhead structures should be cleaned once a year or when asbestos dust has accumulated.

Ideally, either permanent or mobile lightweight staging would be used by the cleaners to reach the areas that are inaccessible from ground level. Where there are no obstructions at ground level, telescoping equipment would be suitable.

If an area could possibly contain dust, it should be removed by vacuuming, using extension hoses where necessary. Some places may, however, be inaccessible or the accumulation of dust be tenacious; in these cases, it will be necessary to resort to hand brushing with chemical-impregnated equipment.

Where dustless methods of cleaning are not practicable, protective clothing and approved respirators must be worn by all personnel present in the building. It is recommended that such protective clothing and respirators be worn by all personnel engaged in overhead cleaning regardless of the method used.

Equipment located beneath an overhead cleaning area should be covered with plastic sheets, so far as is practicable, in order to simplify the subsequent general cleaning of the area.

Since overhead cleaning may only be possible when work is stopped, cleaning may have to be scheduled for weekends. Night cleaning is not recommended because the area being cleaned is above the level of the light fixtures and, therefore, the lighting is usually inadequate. Cleaning may be undertaken by contract cleaners. However, the nature of the hazard must be made clear to the contractor, and the contractor must comply with all regulations.

### RECOMMENDED CLEANING METHODS

All necessary cleaning must be by vacuum or by wet or chemical cleaning, since dry sweeping and similar procedures create more, rather than fewer, dust problems. Under NO circumstances should compressed air cleaning be used.

## Vacuum

Vacuum equipment intended for collecting asbestos dust and waste, or for normal cleaning operations, must be so designed that the asbestos dust cannot escape from the equipment back into the workplace. With portable equipment, the collecting unit is located in the area where the cleaning is taking place; therefore, the filter must be of such efficiency as to prevent the escape of asbestos dust.

High efficiency particulate air (HEPA) filtered vacuum cleaners or vacuum systems with appropriate asbestos filters that are in accordance with the American Conference of Governmental Industrial Hygienists (ACGIH) Ventilation Manual or the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI 29.2-1971 are required by regulations.

There are two forms of vacuum cleaning units that can be used in the friable asbestos-containing facilities. One is a portable industrial vacuum cleaner that uses filter bags. The filtered air is returned to the working environment. The other system is a central vacuum cleaning setup that consists of a central suction and filtration unit from which ducts run to those parts of the facility in which vacuum cleaning is necessary. The first type of vacuum cleaning is adequate where an extensive facility hygiene operation is used at irregular and infrequent intervals.

In facility hygiene operations, it is very likely that dust will re-enter the air while changing HEPA filters in vacuum cleaning devices. Recommended procedures for handling these types of asbestos-contaminated material include the following:

1. Appropriate respirators and protective clothing must be used during all exposures to the fine dust found in vacuum equipment.
2. HEPA filters for the vacuum system should be disposable.
3. Water will cause damage to an HEPA filter. If a filter is going to be exposed to moisture, a prefilter dryer is required.
4. Asbestos-contaminated filters should be sealed in airtight 6-mil plastic bags.
5. Warning labels must be affixed to plastic bags containing asbestos waste, and they shall state the following warning:

CAUTION  
DO NOT OPEN  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
BREATHING ASBESTOS DUST MAY CAUSE  
SERIOUS BODILY HARM

6. Asbestos waste must be dumped in state-approved sanitary landfill sites.

In the event the internal parts of the vacuum system become contaminated (other than filters), the unit should be removed from the workplace, preferably into the open air. The operator, equipped with approved

respiratory protection and protective clothing, should remove the collected material and place it into an impermeable plastic bag. Any material spilled into the body of the equipment should be carefully collected, preferably by using another vacuum cleaner. However, if this is not possible, the material should be removed by hand using a damp cloth. The contaminated cloth should be disposed of along with the asbestos waste material.

#### Amended Water

Wet cleaning methods considerably reduce the possibility of dust reentrainment. Under most circumstances, the effectiveness of wetting can be greatly enhanced by a wetting agent (Ref 1), thus reducing the amount of water required in the cleaning operation. When a wetting agent is added, it alters the surface tension of water, and, as a result, dust can penetrate into a droplet rather than just adhering to its surface, and fine particles are more easily cemented into large agglomerates (Ref 3). Thus, dust capture capability can often be increased many times. Portable pump equipment has been employed to clean large surface areas; however, the treated water could possibly bypass certain types of seals within this type of equipment.

Manufacturers and distributors of commercially available wetting agents\* are listed as follows:

Aquatrols Corp. of America  
1400 Suckle Highway  
Pennsauken, NJ 08110

Leffingwell Chemical Co.  
Box 188  
Brea, CA 92921

Occidental Chemical Co.  
Institutional Division  
Box 198  
Lathrop, CA 95330

Rohm and Haas Co.  
Ag. Chemical Dept.  
Independence Mall  
W. Philadelphia, PA 19105

Target Chemical Co.  
1280 N. 10th St.  
San Jose, CA 95112

Thompson-Hayward Chemical Co.  
Box 2383  
Kansas City, KS 66110

Vineland Chemical Co.  
Box 745  
Vineland, NJ 08360

Amended water may cause flash rusting on ferrous surfaces. In these cases, repainting is in order. The wet cleaning procedure requires, of course, some attention to electrical safety and other operational problems associated with water in the presence of machinery and equipment.

Care must be taken for properly disposing of the wastewater so that a hazard is not created through the drying of surfaces where asbestos fibers accumulated during the wash down. The invisible fibers carried by water droplets can become reentrained in the work space once the water has evaporated. Asbestos fibers would tend to concentrate in bilges, pipe trenches, and sumps unless these areas were thoroughly flushed of residue material.

\*This information should not be construed as a product endorsement by the Navy.

Currently there is not an Environmental Protection Agency criterion on asbestos fibers released into receiving bodies, fresh water or salt-water.

Some of the problems concerning fiber reentrainment from dry surfaces could be reduced if the fibers being washed down bilges and trenches were collected in sumps or bilge collection points. The wastewater from these collection points should be disposed of in a trench within state-approved sanitary landfills. The trench should be covered with an asbestos-free material before the water evaporates.

#### Chemical-Impregnated Equipment

Chemically treated cleaning equipment can be used for routine cleaning but should not be considered for initial or annual facility hygiene operations. The processing of this type of cleaning equipment requires special handling, and the management at the processing establishment must be informed of the potential contamination of the equipment by asbestos fibers.

#### RECOMMENDATIONS

Further investigation into asbestos-containing products is required to clarify the extent of fiber release, conditions under which it occurs, and procedures for controlling its release.

With the vast diversity of existing asbestos-containing thermal insulation products and the difficulties of assessment in the field, a device for rapid detection and assessment should be developed as stricter regulations are implemented by OSHA. A standardized coding system for labeling asbestos-containing products or asbestos-free products should be considered for shore activities as well as a flagging system for Public Works Department maintenance files.

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 NAVSHIPYD Code 202.4, Long Beach CA; Code 202.5 (Library) Puget Sound, Bremerton WA; Code 380, (Woodroff) Norfolk, Portsmouth, VA; Code 400, Puget Sound; Code 400.03 Long Beach, CA; Code 404 (LT J. Riccio), Norfolk, Portsmouth VA; Code 410, Mare Is., Vallejo CA; Code 440 Portsmouth NH; Code 440, Norfolk; Code 440, Puget Sound, Bremerton WA; Code 450, Charleston SC; Code 453 (Util. Supr), Vallejo CA; L.D. Vivian; Library, Portsmouth NH; PWD (Code 400), Philadelphia PA; PWO, Mare Is.; PWO, Puget Sound; SCE, Pearl Harbor HI; Tech Library, Vallejo, CA  
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