FILE NAME: Shipbuilders Council of America (SHIP)

DATE: 1971 July 20

DOC#: SHIP071

DOCUMENT DESCRIPTION: Memo to Accident Prevention Committee with Mt. Sinai Proposed 'Recommended Practices Manual of Asbestos Handling in Shipbuilding and Repair'

SHIPBUILDERS COUNCIL OF AMERICA
WATERGATE SIX HUNDRED | WASHINGTON, D. C. 20037

July 20, 1971

To: ACCIDENT PREVENTION COMMITTEE

Subject: Mount Sinai School of Medicine Proposed "Recommended Practices Manual of Asbestos Handling in Shipbuilding and Repair"

A revised draft of the proposed "Recommended Practices Manuel of Asbestos Handling in Shipbuilding and Repair", prepared by Dr. Duncan A. Holaday, Department of Community Medicine, Mount Sinai School of Medicine is attached. The new draft includes recommendations submitted earlier by Council members through the ad hoc committee on which Mr. Harry Howard of Bethlehem Steel Corporation serves as the Council's representative. As may be noted from Dr. Holaday's covering letter, a further review of the proposed manual is desired.

It is requested that such comments as members of the committee may have on the revised draft be forwarded to Mr. Howard, Bethlehem Steel Corporation, 701 East 3rd Street, Bethlehem, Pa. 18016 with copy to the Council by August 6.

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July 12, 1971

To: Members of Shipyard Manual Committee

From: Duncan A. Holaday and William B. Reitze

Enclosed is a revised rough draft of the proposed shipyard manual which incorporates suggestions and comments sent in by the committee members. We wish to express our thanks for your review of the original material and the suggestions which you made. Personally, I consider this draft to be a considerable improvement over the original version.

Copies of the figures are not enclosed because our Xerox machine will not reproduce glossy photographs. However, the list of captions will give you at least some clues concerning the figures. If you have additional material, such as photographs, sketches or suggestions for figures which would improve this document, please let us have it.

You will note that the section on ventilation is still blank. We have read the material in the pamphlet supplied by Bethlehem but would appreciate any additional thoughts on how to use mechanical ventilation to control dust aboard ship.

We would appreciate it if you could review this document and let us have your comments by August 15. As you probably know, an international symposium on safety and health in shipbuilding is being held in Helsinki August 30-September 1, 1971. We will be listening avidly for any helpful thoughts that are presented at the conference and it would be helpful if we had your opinions of the manual to compare with what others present.

Duncan A. Holaday

DAH:lkh
Encl.

I. Introduction

Much of the equipment installed in ships requires thermal insulation. Because of its desirable and, in some cases, indispensable, properties, asbestos is widely used as a component of insulating materials. Applying, removing or handling insulation can produce airborne dust which contaminates the workroom air. Inhalation of asbestos fibers can cause serious injury to those exposed. Many studies have found that cases of asbestosis, lung cancer and pleural and peritoneal mesothelioma have occurred following exposure to airborne asbestos fibers.

Cases of asbestos diseases have been reported in men who are not usually considered to be asbestos workers. Pipefitters, steamfitters and welders and shot blasters, for example, may remove insulation in the course of their work. Members of these and other trades frequently work in the areas where insulation is being applied or removed and thus are potentially exposed to airborne asbestos dust.

Dusts other than asbestos, such as some forms of diatomaceous earth, may also be important. However, less is known of the hazard which might be created by such exposures as occur in shipyard work. The general goal in all insulation work should be to maintain a clean environment.

Although areas of responsibilities will differ from yard to yard, one responsible person, perhaps the industrial hygienist or the safety officer, should meet with the job superintendent and the job foreman to survey the job before any work is started. The object of this survey would be to determine what dust problems might be created and the areas where they will be. This committee should then recommend procedures to reduce dust exposures during the completion of the job. The committee report should be made available to the cost estimators as well as those concerned for the day-to-day work schedule. Controls will increase costs and contractors should be aware of the procedures which they will be required to follow.

Operations which generate large amounts of dust include:

1. Rip-out of old insulation
2. Mixing asbestos mortar
3. Cutting insulation material either on site or in fabrication shops
4. Blocking or hammering on block or pipe covering to seat material
5. Warehousing and storage of material
6. Clean-up and waste handling.

Particular efforts should be made to control dust dispersion during these operations both to reduce peak exposures and to prevent general contamination of the atmosphere of the work area.

The following sections of this manual discuss in detail procedures which have been found useful in reducing atmospheric contamination by insulation dusts. These procedures have been assembled from research of our Laboratory and from several other sources, with major contributions made by the programs developed at the Puget Sound and Long Beach Naval Shipyards.

II. Control of Asbestos-Containing Dusts by Use of Substitute Materials

Substitution of materials containing reduced proportions of asbestos or no asbestos at all, is becoming more common in ship construction. Before a material is substituted for asbestos, certain points must be carefully considered. From a health point of view, one must guard against that which has happened in other environmental situations -- where in the desire to minimize use of a substance with some known hazard, an untested substance has been substituted which later turns out to be of the same or greater hazard.

A second consideration must be: will the new material meet engineering specifications and will it perform adequately under conditions of use.

Materials containing reduced amounts of asbestos have been used in the following applications:

A. Fiber glass for blanket and pad filling

Amosite blanket covered with asbestos cloth is a standard material for making valve and flange pads. Substitution of the proper grade of fiber glass as a pad filler not only reduces asbestos dust during fabrication and installation but also tends to lessen the problems during subsequent "rip-out". Asbestos cloth which has been treated with a dust suppressant is available and its use should also be encouraged.

B. Pipe covering and block with reduced asbestos content

Over the years the manufacturers of calcium silicate materials have been steadily reducing the percentage of asbestos fiber in their material. Serious consideration should be given to those products containing lower amounts of asbestos fiber. Several British firms have introduced asbestos-free calcium silicate block and pipe covering. To date, however, this material has not been adequately evaluated in the United States to determine how it will perform in use.

III. Reduction of Dust by Changes in Work Methods

In many operations, changes in work practices will reduce dust dispersion very significantly. All of the pro-

cedures discussed in this section have been utilized and found to be effective.

A. Mixing Asbestos Mortar

This operation has usually been done at the job site. While the time spent in mixing is quite short, considerable dust is produced. A tested method of control is to mix the mortar dockside and package the mixed mortar in several containers for transportation to the job site. Mortar is available packaged in several sizes of plastic bags which have a spout through which water is introduced. Sufficient water is added to moisten the mortar; after premixing, the bag is opened and the remaining water added. The carton in which the bag is packaged serves as a mixing box and waste container. Either of these methods minimizes dust dispersion at the job site. One commercially available package is illustrated in Figure 1.

B. Pre-cutting pipe covering and block in the fabrication shop.

Hand-cutting of pipe covering and block should be kept to an absolute minimum. Bend sections, pipe cover lengths and blocks should be cut in the fabrication shop on exhaust-ventilated equipment. The procedure used at the Puget Sound Naval Shipyard is shown in

Figure 2. Cut sections are dipped in water and then packed in plastic bags which are labeled to identify the location where they are to be used. This procedure insures that the cut sections are still damp and relatively dust-free when they are applied. The plastic bags are also available at the job sites for use in collecting wastes.

C. Pre-scoring blocks

Insulation blocks should not be scored at the job site. Blocks which have been pre-scored by the manufacturer can be purchased, or standard blocks can be scored in the fabrication shop using an exhaust-ventilated gang saw.

D. Insulating pipe assemblies in the shop

Some pipe assemblies are quite intricate and are troublesome to lag while in place. A satisfactory method of doing these job, particularly during ship repair, which is employed by the Puget Sound Naval Shipyard, is to remove the assembly in conveniently sized sections and transport them to the shop. Here the old insulation is removed, any necessary repair of the pipes performed and the assembled section re-lagged. Not only is dust dispersion reduced, but it is much more convenient to re-lag the section in the shop than

when it is in place shipboard. Any insulation which is damaged during transport and fitting is repaired after the sections are in place.

E. Hand-cutting at job sites

Some hand-cutting at job sites is unavoidable. However, dispersion of dusts by these operations can be minimized. Figure 3 illustrates a portable down-draft table which is used by the Puget Sound Naval Shipyard. This table has folding legs so it can be carried down companionways and set up conveniently to the work. A small industrial vacuum cleaner is the source of exhaust. Scrap is dropped into a plastic bag and a drop-cloth is placed on the deck under the equipment. These procedures restrict hand-cutting work to relatively small areas, reduce dust dispersion and facilitate clean-up.

F. Fabrication of Pads and Blankets

Pads for valves and machinery should be fabricated in the shop whenever this is possible. Amosite has been largely replaced by fibrous glass filling with covers of asbestos cloth which has been treated with dust suppressants. Figure 4 illustrates an effective means for suppressing dust dispersion. The fibrous glass blanket is unrolled, dampened and re-rolled. This

procedure insures that all the blanket will be dampened. The blanket and asbestos cloth shapes are cut in the lateral draft booth. Figure 5 illustrates another system for dampening pad material before cutting. As there is no lateral draft booth in this shop, all the operators wear respirators.

G. Housekeeping and Clean-up

Essential parts of a dust control program are housekeeping and clean-up procedures. Meticulous attention must be given to measures for restricting spread of dust and larger wastes. Figure 6 again shows use of a dropcloth under a work area and vividly illustrates how much waste would be distributed over the general area or to lower decks if one were not used. Figure 7 shows use of an industrial vacuum cleaner to collect dust and small scrap. Areas should be cleaned up at the lunch break and the end of each shift. In all possible instances, workmen should clean up their own areas. Where work rules prohibit this, the clean-up crew should be under the direction and supervision of the insulation foreman to insure that proper attention is given to this important subject.

IV. Reduction of Dusts by Use of Local Exhaust Ventilation

A. Ventilation of large power tools

Band Saws

Extensive use of band saws both in dockside fabrication shops and, on larger ships such as aircraft carriers, in the vessel itself, make emissions from band saws a major source of asbestos dust. Figure 8 shows the dust cloud which is produced by use of an un-controlled band saw. Control devices for such saws have been known for years and are relatively simple. Conventional low velocity, high volume systems using a negative pressure bag house for air cleaning are usually more practical in a fixed installation fabrication shop. Figure 9 shows use of a simple device which is very effective in collecting dust produced during cutting of large diameter pipes.

Because some degree of portability is desirable in a temporary shipboard fabrication area, a high velocity, low volume dust collection unit is desirable for such use. In Figure 10, a band saw equipped with this system is shown. The table top has been removed to show the pick-up hood and duct. The air mover is an industrial vacuum cleaner which pulls about 50 cubic feet of air per minute past the saw blade at a velocity of over 10,000 feet per minute. This system is a very

(See Figure 11)

efficient dust collection. Units such as this can also be designed to control dusts produced by table saws and gang saws.

B. Ventilation of Hand Power Tools

High velocity, low volume collection systems control dust emissions from most small power tools adequately. Saber saws for cutting pipe covering and rotary saws for cutting asbestos cement board are well controlled with these systems. Figure 11 shows a saber saw equipped with this system in use. It is apparent that little dust is escaping.

V. Reduction of Dust by Dilution Ventilation

VI. Control of Number of Workmen Exposed

A.. Scheduling of Insulation Work

Standard industrial hygiene practices call for isolating operations which contaminate the atmosphere with toxic materials. Areas where insulation work is being done under conditions in which dust might be created should be isolated by plastic curtains or other means. Whenever possible, work should be scheduled to minimize the numbers of other tradesmen in the area. Ship construction operations are more readily scheduled than are ship repair or ship-breaking jobs. However, every effort should be made to keep the number of men exposed at a minimum. In particular, rip-out of old insulation should always be isolated and if necessary performed on an off-shift. Trained workmen supplied with proper protective equipment should always be used for rip-out work and it should be scheduled for rapid completion.

VII. Personal Protective Equipment

In addition to dust suppression and dust control procedures, personal protective equipment is often necessary to reduce exposure and limit the spread of contamination. The equipment described below is used in control programs.

A. Protective Clothing

Protective clothing is required to keep contamination confined to the work areas. One nethod is to issue disposable coveralls which can be removed when leaving the work area or some time prior to entering the locker foom and placed in plastic bags for disposal. A satisfactory type of protective clothing consists of resin impregnated paper coveralls. These are inexpensive, readily disposable, prevent spreading contamination to laundries and eliminate pilferage. They are worn for one shift, then removed and placed in plastic bags for disposal with other asbestos-containing wastes. These coveralls provide sufficient protection for all but extreme conditions.

B. Respiratory protective equipment

Even if dust suppression and dust control procedures are used, some operations generate so much dust that it is impractical to maintain satisfactory atmospheric concentrations of asbestos fibers and respiratory protection must be provided to the workers. A variety of respiratory protective equipment is available from which devices suitable for various situations can be selected. American National Standard Z88.3-1971, Safety Guide for Respiratory Protection Against Asbestos-Containing Dusts should be referred to for detailed information. It is emphasized that unsatisfactory amounts of

respirable dust can be present in the air even though conditions are not visibly dusty. The fine particles which can be inhaled settle slowly and will remain in the air for some time after dust-dispersing work has ceased and the air is apparently clear.

1. Air-supplied Respirators

Extremely dusty jobs, such as rip-out of old insulation where dust concentrations are very high, require use of air-supplied respirators which will deliver clean, dust-free air to a facepiece or hood. Two general types are available: air-line and self-powered.

a. Air-line respirators in which air is supplied to a hoot, helmet or facepiece give the greatest degree of protection. Air is fed to the facepiece from a compressed air-line. The air source must be located in an uncontaminated area and if the source is not specifically designed for breathing purposes, a temperature sensing alarm must be installed on the compressor or a carbon monoxide monitoring device must be installed in the air-line. Anti-freeze compounds should not be used in the compressor system; water vapor must be removed by drying and oil mists be removed by a filter. Figure 12

shows a plastic, disposable hood developed by the Puget Sound Naval Shipyard tor situations where a very high degree of protection is required. This hood is available commercially. The air-line should be fastened to the hood with a quick-disconnect fitting.

b. ~~Self-powered~~ Air-line respirators connected to a compressed air supply impose limitations on movement, and this limitation can be troublesome. Self-powered respirators do not impose such limitations, but do add to the equipment which the workman must carry and also require careful maintenance. Batteries must be recharged daily, filters replaced and other maintenance done routinely. Workmen usually prefer these devices to air-line respirators.

2. Particulate-filtering respirators

There are several types of particulate-filtering respirators. Those equipped with a half-mask facepiece are considered most suitable for use by insulators. Only those approved for protection against asbestos dust by the U.S. Bureau of Mines should be used. These devices are recommended for protection in those situations where the atmospheric concentration of asbestos fibers is at relatively low levels.

All the recommendations for respirator-fitting, training of workmen and maintenance, detailed in Z99.3-1971 should be followed.

a. Reusable particulate-filtering respirators

A variety of reusable particulate-filtering respirators are available. To insure proper fitting, several different makes should be available from which the workman can select one. No one model respirator facepiece will fit all faces. Routine maintenance is absolutely necessary to replace clogged filters and leaking inhalation or exhalation valves. Unmaintained respirators produce a false sense of security.

b. Disposable particulate-filtering respirators

Operation of an adequate respirator maintenance program can be troublesome and, if only a few men are involved, impractical. Disposable respirators are available which are designed to be worn for no longer than one shift and then discarded. Inherently, these devices are not as rugged as a reusable respirator and no attempt should be made to use them longer than one shift.

VIII. Education and Training

No dust control program can be effective unless workmen and supervisors understand the hazards associated with the jobs, the sources of the hazards and the reasons for following recommended procedures carefully. Understanding is only obtained by education of personnel and training in correct operating procedures. For an education and training program to be successful, both management and labor must be concerned and participate. As with all safety programs, it is essential that first-line supervisors be interested in and cooperate in the work.

The harmful effects of neglect of procedures for controlling asbestos dust are not apparent for many years. Therefore, it is more difficult to convince workmen of the necessity of following rules for working with insulating materials than if physical hazards were involved. However, those shipyards which conduct education and training programs report good success.

Education in hazards associated with use of insulating materials and instruction in correct work practices should be included in apprentice training programs. For the time being, however, training and education must be done at the shipyards. This must be a continuing program and should include not only insulation workmen, but others who may occasionally work with insulation materials.

Figure 1

High temperature mortar packed in plastic bag. Water is added to bag through spout and mortar moistened before opening. The moistened mortar is removed as required and mixing completed in shipping container. All wastes are placed in container and sent to disposal at end of shift.

Photo courtesy Insulation Industry Hygiene Program.

Figure 2

Procedure used at Puget Sound Naval Shipyard for handling bend sections. Sections are cut in fabrication shop, dipped in water and placed in plastic bag. The bag is then labelled with the job-site description.

Figure 3

Portable down-draft table developed by Puget Sound Naval Shipyard for use shipboard. Light weight industrial vacuum cleaner used as air mover. Note plastic bag for scrap and dropcloth on deck.

Figure 4

Dampening fibrous glass blanket filler before cutting. Note lateral draft hood in which fabrication is done. This procedure is used at Puget Sound Naval Shipyard.

Figure 5

Fabrication of pads at Long Beach Naval Shipyard. Fibrous glass filler is dampened before cutting. As no lateral draft hood is available, all operators wear respirators.

Figure 7

Use of small industrial vacuum cleaner for clean-up.

Photo courtesy of Puget Sound Naval Shipyard.

Figure 8

Dust produced by use of an unventilated band saw. Without the back lighting used here, much of the dust would not be visible.

Photo courtesy Insulation Industry Hygiene Research Program.

Figure 9

Dust collection system for cutting large diameter pipe sections. Air is exhausted from the end of the pipe furthest from the cut.

Photo courtesy Insulation Industry Hygiene Research Program.

Figure 13

Air-supplied plastic hood developed by Puget Sound Naval Shipyard. Coveralls are pulled over inner bib which holds the hood in place tightly. This, or similar equipment, is required for such operations as rip-out of old insulation.