PLAINTIFF'S
EXHIBIT
DUP-2360

139

S4T, p1

MEASUREMENT AND CONTROL OF ASBESTOS DUST EXPOSURE

SAFETY ENGINEERING STANDARD

ISSUED	APRIL 1973
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STANDARD REAFFIRMED	NOV 1984

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This standard includes requirements of the Occupational Safety and Health Act of 1970 (OSHA) as published in the Federal Register OSHA information is printed in red.

1. SCOPE

1.1 This standard presents the permissible asbestos dust exposure limits, methods of controlling asbestos dust exposures, special OSHA requirements for removal of asbestos insulation, respiratory protective equipment, and method of sampling asbestos dust concentrations in the work areas. It provides sufficient information to comply with OSHA and EPA regulations but guidance from the Du Pont Legal Dept (via the Departmental OSH Coordinator) should be sought whenever an interpretive problem arises.

1.2 An Asbestos Compliance Package can be obtained from the Occupational Health and Water Treatment group of ESD. Ref (1) contains extensive additional information.

1.3 A comprehensive book on asbestos removal and control has been published, Ref (14). It contains useful and detailed information on asbestos removal techniques, monitoring, and disposal. Also included are checklists for removal jobs and sample specifications for contractors. The removal technique detailed in the book is called "negative air filtration" and involves the use of a portable, HEPA equipped powered exhaust unit. That technique is also explained in an Environmental Protection Agency report that has been reprinted under the title "Controlling Asbestos Contamination with Negative Air Filtration Systems," Ref (15). The report contains a detailed operating procedure for asbestos removal and an evaluation form that would be useful in auditing the removal job. It also contains much of the same information in the more expensive book identified as Ref (14).

2. GENERAL

2.1 Asbestosis and cancer are associated with overexposure to asbestos. Historically, the incidence of these diseases has been significantly higher among asbestos workers than among the general population. Cigarette smoking greatly increases the incidence of respiratory cancers arising from exposure to asbestos. Asbestos-exposed persons who smoke have a 53-fold increase in risk from lung cancer over nonsmokers, Ref (2).

2.2 Principal potential sources of exposure to airborne asbestos dust in Company operations are:

a. Removing old asbestos-containing insulation from lines and vessels, including gaskets on high-temperature lines

b. Removing, handling, and laundering of asbestos-contaminated clothing

c. Cutting new or removing weathered asbestos cement (Transite) siding, roofing, pipe, etc. or Haveg pipe and equipment

d. Maintenance and operation of machinery and vehicle brake linings

e. Opening boxes and removing new asbestos materials

f. Handling asbestos materials used in production of Company products

g. Repair of laboratory equipment with asbestos insulated heaters, e.g., gas chromatographs, lab ovens

h. Cleaning and maintenance of vacuum systems for collection of asbestos fibers

i. Asbestos welding blankets and cloths

j. Removing old asbestos floor tile and adhesive

2.3 Suitable nonasbestos substitutes should be used where practical and feasible whenever the use of asbestos-containing materials can release asbestos fibers. ESD can furnish information on asbestos substitutes.

2.4 Some materials containing bound asbestos fibers, e.g., Transite siding or roofing, are not hazardous during normal use. Examples are: bonded compressed asbestos gaskets, asbestos roofing felt, Teflon® impregnated asbestos packing and fibrated asphalt cutback (mastic). These materials could become hazardous if asbestos fibers are released because of loss of binder or a physical action such as grinding. Supervision should inspect use of these materials to determine if respirators are needed.

2.5 A material which contains asbestos which might become airborne should be treated as asbestos unless it is determined that the asbestos present is not a potential health hazard. Talc, vermiculite, and other minerals are listed by Appendix 1 of Ref (1) as possibly containing asbestos.

Vendors and merchandise designations are given to describe materials and may not include all acceptable products. Substitutions by suppliers are to be made only on approval of the local authority initiating the use of this standard.

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DUP 1011058

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3.1 Amosite, chrysotile, and tremolite asbestos fibers concentrations in air shall not exceed an 8-hour (and 12-hour) Acceptable Exposure Limit (AEL) of 0.5 fibers longer than 5 micrometers per cm^3.

3.2 The types of asbestos occurring in Du Pont are amosite, chrysotile, and tremolite, a potential contaminant in talc.

3.3 Since crocidolite asbestos is not known to be present in Du Pont, its toxicity was not considered in setting the AEL. (Use the ACGIH TLV 8-hour TWA of 0.2 fibers longer than 5 micrometers per cm^3.) If encountered in Du Pont, Haskell Laboratory should be contacted.

3.4 At no time may exposure to airborne fibers concentration exceed a ceiling of 10 fibers longer than 5 micrometers per cm^3.

4. CONTROL OF ASBESTOS DUSTS

4.1 Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection shall be used to meet the exposure limits in section 3.

4.1.1 Local exhaust ventilation and dust collection systems shall be in accordance with ANSI Z9.2 – 1971, "Fundamentals Governing the Design and Operation of Local Exhaust Systems."

4.1.2 Additional information on the design of ventilation systems is contained in H1U, H3U, DH1U, DG20D, and Ref (1) and (6).

4.2 Handling Asbestos

4.2.1 Insofar as practical, asbestos-containing materials shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits in section 3.

4.2.2 Housekeeping. All external surfaces shall be maintained free of asbestos fibers if, with their dispersion, there would be an excessive concentration.

a. All areas where asbestos is routinely handled shall have a vacuum cleanup system. This can be a system of hoses connected to a central vacuum system designed in accordance with 4.1.1. Vacuum hoses should be inspected periodically to ensure they are free of loose asbestos fibers. These hoses should be appropriately isolated, i.e., placed in a sealed, labeled bag.

b. No dry sweeping shall be performed. Compressed air is not to be used for cleanup.

4.2.3 Caution signs and labels shall be used per section 12.

4.2.4 No asbestos cement, mortar, etc, or similar material containing dry friable asbestos fibers shall be removed from bags, cartons, or other containers in which they are shipped without being either wetted, enclosed, or ventilated to effectively prevent the release of asbestos fibers in excess of the limits in section 3.

4.3 Tools Used on Asbestos

4.3.1 Avoid sawing where possible; knife cutting is preferred.

4.3.2 All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of exposure limits, i.e., saws, scores, abrasive wheels, and drills, shall be provided with a dust-collection system as specified in 4.1.

4.3.3 All asbestos-cutting operations should be isolated to minimize unauthorized access. This can be a temporary area for nonroutine operations with barricades and signs per section 12. Routine work should be isolated in a properly posted separate work area.

4.4 Removal of Asbestos Insulation

4.4.1 If the composition of the material is unknown, it shall be treated as being asbestos. For use of labels to identify nonasbestos insulation, see SN218P.

4.4.2 Proper respirators (per section 5) and special protective clothing (per section 9) shall be provided all employees engaged in removal or demolition of asbestos insulation or covering. Atmosphere supplying respirators are required except where it has clearly been demonstrated that the wet method is effective and monitoring has shown that airborne concentrations of asbestos on the job will not exceed the OSHA protection factor of the air purifying respirator. Respirator selection information is provided in section 5.

4.4.2.1 At a minimum, air-purifying respirators (5.3) and special clothing shall be worn during the removal of asbestos insulation. Many plants have found disposable dust masks (5.3.1) (NIOSH approved for asbestos) and disposable paper clothing satisfactory (5.3.2).

a. This requirement does not apply to removal of insulation, fabricated and protected to withstand repeated removal and reinstallation for equipment maintenance or other reasons, providing the techniques employed have been demonstrated to maintain asbestos concentrations within exposure limits of section 3.

Portions printed in red meet OSHA regulations, Section 1910.1001 (formerly 93a)

S4T, p2
DUP 1011059
DU 053101

S4T. p3

b. The clothing requirement does not apply to removal for maintenance or alterations when the wet method is used and monitoring has shown the precautions maintain asbestos concentrations within the exposure limit of section 3.

4.4.3 The work area shall be barricaded and caution signs shall be posted as described in section 12 at approaches to areas where asbestos materials are being handled.

4.4.4 Insofar as practical, all asbestos materials shall be thoroughly wetted and steps taken to ensure that they remain wet until placed in sealed impermeable bags or other impermeable containers labeled per section 12. The most effective approach to wetting involves one employee applying a fine continuous mist of water and surfactant while another employee slowly exposes the asbestos. Contaminated run-off should be avoided and collected. Wetting may have to be suspended on outside operations, e.g., when temperatures are below 0°C. If asbestos cannot be wetted due to freezing temperatures, or other conditions, it should, to the extent possible, be removed as unit sections. The use of a surfactant in spray water enhances fibers control by approximately 15 percent and should be considered for asbestos. Suitable surfactant suppliers include:

Aquatrols Corporation of America
1400 Suckle Highway
Pennsauken, NJ 08110
(Product: Asbesto Wet)

Occidental Chemical Company
Institutional Division
Box 198
Lathop, CA 95330

Target Chemical Company
1280 N. 10th Street
San Jose, CA 95112

Vineland Chemical Company
Box 745
Vineland, NJ 08360

Caution: Area work surfaces (floors, etc) may be very slippery after surfactant use.

4.4.5 Support fasteners shall be removed with care. Handle asbestos-containing materials in such a manner to minimize generation of airborne asbestos fibers. Do not drop.

4.4.6 Removed asbestos materials shall not be allowed to lie about the work area, but shall be immediately sealed in bags.

4.4.7 Maintain good housekeeping. Vacuum equipment with high efficiency filtration meeting requirements of 4.1.1 shall be used to prevent loose accumulations of fragments or fibers (or both).

5. RESPIRATORY EQUIPMENT

5.1 Respiratory protection shall be provided to all personnel in areas where exposure limits in section 3 may be exceeded or where asbestos is being removed (see 4.4.2.1). Respiratory protection can be used to meet exposure limits only under the following conditions:

a. During the time necessary to install engineering controls per 4.1. Written plans for the installation of engineering controls or reasons why they are not feasible should be available for routine operations exceeding the limits.

b. When engineering controls are not technically feasible or are insufficient to meet the limits in section 3.

c. In emergencies.

5.2 If respirators are required, a written respirator program shall be prepared.

5.2.1 Refer to S2H for further guidance in establishing a respirator program.

5.2.2 All respirators should be NIOSH/MSHA approved for use with asbestos.

5.3 Air-purifying (mechanical filter-type) respirators shall be used when the TWA or ceiling concentrations are reasonably expected to exceed no more than 10 times the limits in section 3.

5.3.1 Although OSHA permits use of both cellulosic and elastomeric half-mask air-purifying respirators for up to 10 times the limits in section 3, the cellulosic disposable types should not be used within Du Pont for more than 5 times the limits unless research has shown them to provide higher protection factors. At this time, only the 3M brand models 8710, 9900, and 9910 have been shown during asbestos workplace protection factor studies to provide a good enough fit to be assigned a protection factor of 10, Ref (16).

5.4 Atmosphere supplying (Type "C" continuous flow or pressure-demand supplied-air respirators, Table 1B of S2H) respirators shall be used when the TWA or ceiling concentrations are reasonably expected to exceed 10 times the limits in section 3.

5.5 Powered air-purifying respirators are seldom used in Du Pont. Contact the Departmental OSH Coordinator or Haskell Laboratory for guidance before such use.

Portions printed in red meet OSHA regulations, Section 1910.1001 (formerly 93a) for all sections except 5.2 which is described by Section 1910.134.

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DUP 1011060

6. IDENTIFICATION OF ASBESTOS IN MATERIALS SUSPECTED OF CONTAINING ASBESTOS

6.1 Field Methods. There is no reliable field method for confirming the absence of asbestos in materials suspected of containing asbestos. Visual examinations alone is not sufficient to confirm the absence of asbestos.

6.1.1 A flame test Ref (9), using a propane torch can be used to screen samples. This test provides reliable indications of the presence of asbestos, but does not provide a reliable indication of the absence of asbestos.

6.2 Laboratory Methods. Polarizing microscopic examination can be used to determine the presence or absence of asbestos in most cases. When results of the microscopic examination are inconclusive, x-ray diffraction, staining and scanning electron microscope will provide reliable results.

6.2.1 Samples (approximately 1 gram) can be sent to Haskell Lab (7.4.1) for microscopic examination. Haskell Lab will arrange for suitable analysis if the results of the microscopic examination are inconclusive.

6.2.2 Samples can be sent to the Analytical and Physical Measurement Group, PPD, Experimental Station for x-ray diffraction analysis.

6.2.3 The K^2 test developed by NIOSH for screening asbestos is not recommended because it is unreliable and uses corrosive HF, Ref (2).

7. MONITORING

7.1 Monitoring is required where employees may be exposed to asbestos dust from work-related activity to determine the employee's exposure.

7.1.1 In the case of bonded asbestos materials, if there is evidence of dust, area monitoring should be performed.

7.2 Types of Monitoring

7.2.1 Personal Monitoring. Samples shall be taken from the breathing zone of employees.

7.2.2 Environmental (Area) Monitoring. These samples are taken from a fixed location where asbestos fibers may be released. Such sampling may be useful in determining the need for local ventilation of asbestos releasing tools. The sampling filter is placed close to the area representative of the breathing zone of employees.

7.3 Sampling frequency and patterns shall be such that samples represent the level of exposure of employees with reasonable accuracy. Samples for determination of both 8-hour time-weighted average and ceiling concentrations shall be taken.

7.3.1 Ceiling samples shall be taken for those short tasks for which highest exposure is expected. Ceiling samples for OSHA compliance testing should be taken for 15 minutes. Short-term samples may also be taken for shorter or longer periods (duration of a given task) for investigative purposes.

7.4 Procedures

7.4.1 Methods of sampling asbestos fibers in air are given in Ref (3). Sampling procedures should be reviewed with the laboratory which will count the fibers prior to sampling to help ensure proper techniques are used. The sample should be taken at a rate of 1.5 to 2 liters per minute. The filter face should be positioned so that fibers will not settle on it.

7.4.2 When sampling atmospheres containing asbestos fibers with **low** levels of other dusts:

a. Where exposures are expected to be below 2 fibers per cm^3, sample for 2 to 8 hours.

b. Where exposures are expected to be above 2, but less than 5 fibers per cm^3, sample for 45 minutes to 4 hours.

c. Where exposures are expected to be higher than 5 fibers per cm^3, sample for 30 minutes to 2 hours, depending upon experience and consultation with the laboratory which will count the fibers.

7.4.3 Where sampling atmospheres containing asbestos fibers with **high** levels of other dusts, sample times will vary depending upon the amount of other dusts present. The laboratory which will count the fibers should be consulted to obtain approximate sample times.

7.4.4 Equipment. All sampling must be done on membrane filters of 0.8 micrometers porosity mounted in an **open-faced** filter holder. The Millipore cellulose acetate 0.8 micrometer filter, catalog number MAWP 037A0, is recommended. Particulate sampling equipment is described in S13T, section 10.

7.4.5 Analysis must be conducted by a qualified laboratory. Completed samples are placed in a mailing tube, sealed, and sent to a qualified laboratory with 2 copies of the sampling record.

a. It is recommended that an unexposed filter be included with each batch of samples as a blank.

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b. All determinations shall be made by the membrane filter method at 400 to 450X (magnification) (4 mm objective) with phase contrast illumination. All fibers meeting the proper aspect ratio (3 to 1 length-to-diameter) will be counted and reported as asbestos.

c. A qualified laboratory:

E. I. du Pont de Nemours & Co
Industrial Hygiene Section
Haskell Laboratory
CR&D Dept
Newark, DE 19711

In addition to Haskell, other accredited laboratories are listed in the AIHA Journal.

7.6 **Employee Notification.** Employees should be notified of exposure monitoring results. Any employee exposed above the OSHA limits [Ref (5)] shall be notified, in writing, within 5 days of the finding and of corrective action being taken. Notification is required even if employee was wearing protective equipment at the time of exposure.

7.6 **Exposure records** shall be maintained at least 30 years. Other record keeping requirements will generally require records be kept for longer periods.

7.6.1 Employees and former employees shall have reasonable access to records which indicate the employee's own exposure to asbestos.

7.7 Affected employees or their representatives shall be given reasonable opportunity to observe monitoring and review the results.

8. MEDICAL SURVEILLANCE

8.1 **Medical Examinations.** Preplacement, annual, and termination medical examinations shall be made available to employees in an occupation exposed to asbestos (as defined in 8.1.1 a through e). These examinations shall include, as a minimum, a PA chest x-ray, medical history, and pulmonary function tests.

8.1.1 Each plant shall assure that all employees in the following categories receive the medical examinations prescribed in 8.1:

a. All employees working in jobs that require handling of asbestos which might become airborne (such as carpenters working with Transite, insulators, pipefitters, and millwrights).

b. All employees working in jobs which are exposed to airborne asbestos fiber concentrations of 0.1 fibers per cm^3, or greater, of air 8-hour TWA.

c. Those who during their Du Pont employment have previously worked in jobs with an exposure described in 8.1.1.

d. Those with a known off-plant asbestos exposure prior to or during employment at Du Pont. At time of employment and periodically thereafter, care should be taken to record any history of off-plant exposure to asbestos.

e. Those with an x-ray showing changes of the type which are known to result from asbestos exposure.

8.3 "Guidelines for Physicians" [see Ref (5)] contains additional information on interpretation and frequency of x-rays for asbestos-exposed employees.

9. CLOTHING AND CHANGE ROOMS

9.1 Special clothing, such as disposable coveralls, head covering, gloves, and foot covering, shall be required where exposures exceed the ceiling limit, Section 3, and during removal of asbestos insulation, see 4.4. All employees should be alert for potential heat stress during work, based upon the special clothing selected and work area temperatures.

9.1.1 Contaminated clothing should be vacuumed or wiped with a wet rag before the clothing is removed. The respirator should be removed last.

9.2 Change rooms shall be provided for all employees working in jobs in which the exposure limits in section 3 are exceeded.

9.2.1 Separate clothing lockers or similar arrangements are required in those change rooms to prevent contamination of street clothes from work clothing.

9.3 Laundering of asbestos-contaminated clothes must be done to prevent the release of asbestos fibers into the air.

9.3.1 Those laundering contaminated clothing shall be informed of the need to prevent release of asbestos fibers.

9.3.2 Contaminated clothing shall be transported in sealed impermeable containers labeled per section 12.

9.4 When maintenance is performed on changehouse air exhaust systems (fans, ducts, filters), personnel should be alert to the presence of airborne asbestos fibers and take appropriate precautions.

DUP 1011062

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10. EPA ASBESTOS EMISSION REGULATIONS

10.1 Application. Regulations also have been promulgated by the Environmental Protection Agency (EPA), Ref (7). These apply to friable asbestos materials which contain more than 1 percent asbestos by weight and which can be crumbled, pulverized, or reduced to powder by hand pressure when dry. Du Pont operations within this criterion normally will be limited to renovation or demolition involving asbestos insulation.

10.1.1 Renovation involves removing or stripping away asbestos from pipes, ducts, boilers, tanks, reactors, furnaces, or other equipment or structural member. **Demolition** involves wrecking or removal of a load-supporting structural member (beams or load-supporting walls) and any related removing or stripping of friable asbestos materials. During **demolition,** asbestos shall be removed or stripped prior to the wrecking or taking out of load-supporting structural members.

10.1.2 When an individually scheduled renovation or demolition job amounts to more than the quantities listed below, a detailed report shall be filed with EPA (and in some cases a state or local agency) prior to removal. The removal operation shall follow the other requirements of this standard, particularly 4.4.

a. 260 linear ft (80 m) of asbestos-containing pipe insulation

b. 160 ft^2 (15 m^2) of asbestos-containing insulation on ducts, boilers, tanks, or structural members

For planned, but not individually scheduled, renovations, a long-range estimate of the total amount of asbestos to be removed or stripped must be made. The period covered must be at least 30 days but not more than a year. EPA must be given notice if the amounts estimated exceeds 10.1.2 a or b.

10.1.3 When renovation amounts to less than 10.1.2 a or b, notice to EPA is not required.

10.1.4 When demolition amounts to less than 10.1.2 a or b, a simplified report shall be filed with the EPA prior to removal. The removal operation also shall follow the other requirements of this standard, particularly 4.4.

10.1.5 The requirements of this standard should more than meet the additional precautions specified by EPA regarding wetting, containerizing, disposal, and exhaust control.

10.2 Waste Disposal. All asbestos waste, including items such as scrap, empty bags or clothing to be discarded, vacuum system collection, and other wastes which may create airborne dust concentrations, shall be collected and disposed of in sealed, impermeable bags, or containers. Caution labels shall be attached conforming to section 12.

10.2.1 All disposal sites must have specific warning signs, fencing, and dust suppression methods as required by the EPA regulation (40 CFR 61.153).

10.3 For specific report and compliance requirements, refer to the EPA regulations Section 61.146, Ref (7). Local or state regulations also should be reviewed since they may be more restrictive.

10.4 Wastes should be managed on-site whenever practicable. When it becomes necessary to send waste off-site, other Du Pont sites with available burial facilities should be the first choice, Ref (13).

11. TRAINING

11.1 In areas where people work with asbestos, employees should be trained with the goal of increasing knowledge of:

a. Work practices involving asbestos and the potential for fiber emissions

b. The physical characteristics of asbestos

c. Diseases which may result from exposure to asbestos fibers including the role of smoking in lung cancer

d. Reasons for, and methods of, exposure monitoring

e. The purpose and nature of engineering and work practice control methods, personal protective equipment and clothing, and personal hygiene

f. The elements of medical surveillance

12. CAUTION SIGNS AND LABELS

12.1 Caution signs conforming to Figure 1 shall be posted at all approaches to areas where asbestos concentrations may be above permissible exposure limits. They shall be placed at a sufficient distance to permit an employee to read the signs and take necessary precautions before entering the area.

12.2 Caution labels conforming to Figure 2 shall be used to identify containers of raw materials, scrap, waste, other products containing asbestos, and asbestos-contaminated clothing.

12.3 Identification labels are suggested for identification of asbestos-containing and asbestos-free

Portions printed in red meet OSHA regulations. Section 1910.1001 (formerly .93a) for all sections except 5.2 which is covered by Section 1910.134.

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DUP 1011063

insulation, see SN218P. It is recommended that storage locations of bonded asbestos gaskets be labeled. Use appropriate procedures when handling, cleaning up, and ultimate removal.

13. REFERENCES

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DUP 1011064

S4T, p 8

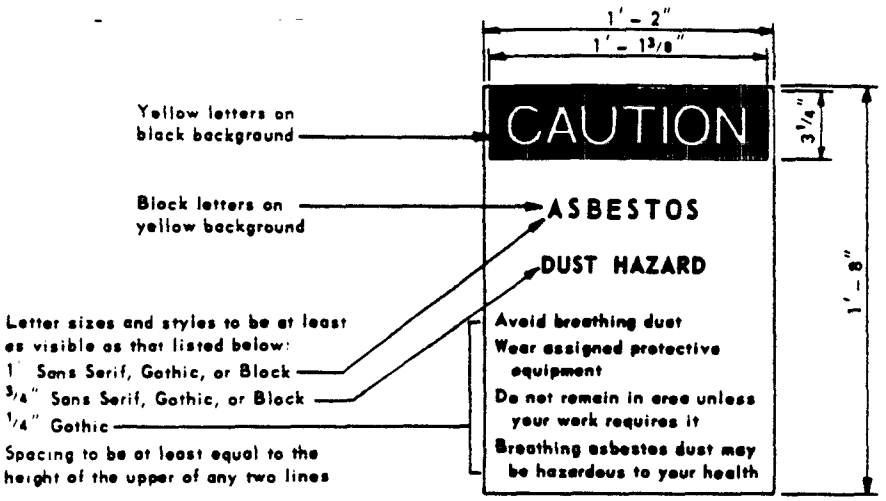
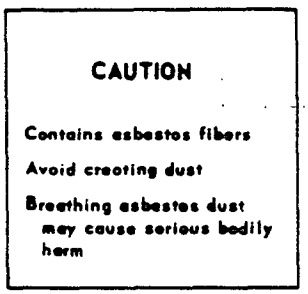


FIGURE 1 – CAUTION SIGN, ASBESTOS DUST



Label size and printing to be readily visible and legible.

FIGURE 2 – TYPICAL CAUTION LABEL *

* Available from M & M Displays, 3301 Maiden Lane, Philadelphia, PA 19145

Figures 1 and 2 meet OSHA requirements, Section 1910.1001 (formerly .93a).

DUP 1011065

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