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RECOMMENDED STANDARD FOR
OCCUPATIONAL ASBESTOS EXPOSURE IN
CONSTRUCTION AND OTHER NON-FIXED WORKPLACES

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DUP 094821B

TABLE OF CONTENTS

DUP 0948219

DU 039146

DUP 0948220

DU 039147

RECOMMENDED STANDARD FOR OCCUPATIONAL ASBESTOS EXPOSURE IN CONSTRUCTION AND OTHER NON-FIXED WORKPLACES

I. INTRODUCTION

The occupational health community has recognized for a number of years that the customary occupational health standard -- designed for fixed-site manufacturing operations -- is poorly-suited to construction and other non-fixed, high-turnover jobs. The usual OSHA requirements for a permissible exposure limit implemented through engineering controls, routine monitoring, medical surveillance, hygiene facilities, recordkeeping and the like, have proven ineffective and impractical for an industry characterized by small, transient employers, high employee turnover, and outdoor work activities the nature and sites of which are continuously changing. Thus, OSHA, federal advisory groups on the construction industry, as well as representatives of both management and labor, all have called for a fresh reappraisal of how to regulate toxic substance exposures in construction operations.[1/]

On February 7, 1980, the Asbestos Information Association of North America (AIA/NA) and the Association of Asbestos

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1/ The findings and recommendations of these groups are discussed in somewhat greater detail in Part III, below.

DUP 0948221

Cement Pipe Producers (AACPP) published a recommended asbestos standard -- modelled in part on the "performance-based exemption provision" of OSHA's Acrylonitrile Standard[2/] -- to illustrate how to deal in a cost-effective manner with occupational health hazards in construction and other non-fixed workplaces.[3/] The 1980 Recommendation was built around the concept of identifying products and work practices certified to be safe in the sense that exposures in excess of permissible levels will not occur under any reasonably forseeable circumstances. In brief, the 1980 Recommendation called for --

> (1) the classification of products into three categories according to their potential for occupational asbestos exposure in construction uses;
>
> (2) the application of different regulatory requirements tailored to each product category, with increasingly stringent requirements imposed for products presenting higher levels of risk; and
>
> (3) the use of objective data, including validation by fully qualified testing laboratories and occasional confirmatory field monitoring by OSHA inspectors, to ensure that certified work practices and product formulations are effective in protecting workers.

2/ 43 Fed. Reg. 45762, 45778 (October 3, 1978). See the discussion of the Acrylonitrile Standard in Parts III.B. and IV.B.1., below.

3/ AIA/NA & AACPP, Recommended Standard for Occupational Asbestos Exposure in Construction and Other Non-Fixed Work Operations (February 7, 1980) (hereinafter referred to as the "1980 AIA/NA-AACPP Recommendation").

DUP 0948222

The certification program recommended by AIA/NA and AACPP was designed to provide a strong incentive for the development of safe products and work practices which eliminate the need for routine monitoring, medical surveillance, and other provisions of the customary OSHA standard; to lighten OSHA's enforcement burden; and to promote voluntary compliance in the construction industry.

These advantages led to strong endorsements of the work practice certification concept in 1980 and 1981 by special advisory groups established to study the problem of developing sensible health standards for the construction industry. After extensive deliberations and public hearings, OSHA's Advisory Committee on Construction Safety and Health issued a report on May 16, 1980 concluding that many of the elements of the typical fixed-site OSHA health standard are inappropriate as applied to construction jobs.[4/] Specifically, the Advisory Committee found that repetitive monitoring, medical surveillance, recordkeeping, and other components of traditional health standards that have been "developed with a factory setting in mind," do little to improve worker health in the construction industry, but nevertheless impose costly requirements that simply are not feasible for many construction employers.

4/ Advisory Committee on Construction Safety and Health, Report on Occupational Health Standards for the Construction Industry (May 16, 1980) (hereinafter referred to as the "Construction Advisory Committee Report").

DUP 0948223

In order to provide an effective and practical regulatory program for the construction industry, OSHA's Construction Advisory Committee endorsed the work practice certification concept by recommending that construction industry health standards should "allow an employer or a material supplier to develop and publish work practices" which are shown, based on "legitimate measuring and monitoring," to be effective in "assur[ing] that permissible exposure limits are not exceeded."[5/] An OSHA/NIOSH Task Force, specially set-up to study the same issues and review the findings made in the Construction Advisory Committee Report, reaffirmed on January 2, 1981 the Advisory Committee's earlier recommendation for the use of certified work practices.[6/]

Subsequently, the Building-Construction Trades Department, AFL-CIO (BCTD/AFL-CO) issued in October 1981 a separate proposal[7/] directed at a problem that had not been addressed by the 1980 AIA/NA-AACPP Recommendations, or by the Construction Advisory Committee and OSHA/NIOSH Task Force Reports. In light of the variety of different jobs performed -- often simultaneously -- on many construction projects, and in light

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5/ Construction Advisory Committee Report at p. 6.

6/ OSHA/NIOSH Task Force, Response to the Report on Occupational Health Standards for the Construction Industry (January 2, 1981) (hereinafter referred to as the "OSHA/NIOSH Task Force Report").

7/ BCTD/AFL-CIO, Pre-Job & Job Site Safety and Health Guide (October 1981).

DUP 0948224

of the constantly changing sites, types of work, and personnel involved, there is a pressing need for a more centralized effort on the part of construction employers to formulate careful, project-wide programs for ensuring safe and healthful working conditions. To meet this need, the BCTD/AFL-CIO recommended that Safety and Health Coordinators be designated to develop, implement and oversee health and safety programs appropriate to the particular hazards workers may face on a given construction project, and provide a focal point for resolving health or safety-related complaints by workers and for cooperative labor-management efforts to eliminate unsafe working conditions.

Because they are complementary, the 1980 AIA/NA-AACPP Recommendations and the 1981 BCTD/AFL-CIO proposal have been merged into a single recommended standard, attached to this paper as Appendix A. Specifically, the 1980 AIA/NA-AACPP Recommendations have been amended to require, in the case of employers who intend to use certified products and work practices in lieu of the otherwise applicable provisions of the OSHA Asbestos Standard, the designation of a Compliance Coordinator to ensure that the appropriate products and work practices are used, and to administer employee training and other programs needed to properly implement the health protection goals of the Recommended Standard.

If adopted by OSHA, the Recommended Standard would serve the interests of construction industry employees and

DUP 0948225

employers, and OSHA as well. OSHA's current approach for regulating construction industry health hazards, including asbestos, is undeniably impractical for most employers, largely unenforceable, and, hence, ineffective in protecting workers. In contrast, the standard recommended here would --

(1) provide sound, cost-effective health protection for workers by relying on products and work practices that already have been demonstrated to be safe and that are simple and economical to use;[8/]

(2) create incentives for the development and use of even safer products and work-practices;

(3) encourage voluntary compliance by imposing sensible requirements and by encouraging cooperative labor-management action;

(4) centralize on-site supervision and voluntary monitoring of compliance with health and safety requirements; and

(5) ease the existing enforcement burden on OSHA by simplifying inspection procedures.

8/ As detailed in Appendix B, a considerable amount of work has already been done, in the specific context of asbestos, to identify and develop products and work practices that are unlikely to result in exposures above OSHA's permissible exposure limits in any reasonably foreseeable construction industry use.

DUP 0948226

In addition, apart from the specific context of asbestos, the Recommended Standard can serve as a model for extending the work practice and compliance coordinator concepts to other health hazards involved in construction work.

II. FINDINGS OF SPECIAL GOVERNMENT ADVISORY GROUPS ENDORSING THE PRODUCT AND WORK PRACTICE CERTIFICATION APPROACH RECOMMENDED HERE

The question of how to regulate occupational health hazards in the construction industry has been studied intensively for the past several years. As long ago as 1975, OSHA acknowledged -- in the specific context of asbestos -- that many of the provisions contained in customary OSHA health standards are impractical in construction operations, and, accordingly, "that alternative . . . controls may be more appropriate and feasible" because of "the uniqueness of the construction industry itself (viz., the multiplicity of non-fixed workplaces, and the utilization of highly transient workforces)."[9/] Similar concerns were expressed by industry officials in connection with major OSHA proceedings in 1977 and 1978 on Lead and Cancer Policy.[10/]

9/ 40 Fed. Reg. 47657 (October 9, 1975).

10/ See for example Statement of C.R. Mattson (National Constructors Association (NCA)), Docket H-004 [Lead], Ex. 98; Statement of Harry Taylor on behalf of the Council of Construction Employers, Docket H-004 [Lead], Ex. 64; Statement of Fred Graham (NCA), Docket H-90 [Cancer Policy], Ex. 125.

DUP 0948227

Subsequently, after preliminary hearings in May of 1979, OSHA's Construction Advisory Committee -- a balanced group representing the interests of employers, employees, and the public[11/] -- reached a "consensus" position that "most OSHA health standards were developed for and are best suited to the needs of manufacturing plants where employment is steady and the working environment is more stable and predictable." Accordingly, the Advisory Committee urged "that a separate set of health standards be developed to meet the special conditions of the construction industry."[12/]

In response, Dr. Eula Bingham, former Assistant Secretary of Labor for OSHA, agreed that "[b]ecause of the mobile and transient nature of their industry, construction employers have had difficulty in complying with these standards." Dr. Bingham directed the Advisory Committee to undertake a "thorough[] review" of the problem and to prepare a report making "recommendations that would provide the necessary protection to employees."[13/]

11/ The Committee is composed of five employer representatives, five employee representatives, and five representatives from federal and state regulatory agencies and the general public. See Construction Advisory Committee Report at p. 57.

12/ Construction Advisory Committee Report at p. 2.

13/ Memorandum dated July 18, 1979, attached as Appendix A to the Construction Advisory Committee Report.

DUP 0948228

The Advisory Committee thereafter held further hearings and received additional testimony and advice by "experts and consultants from business, labor, government, and the occupational medical profession."[14/] Based on that record, the Advisory Committee released its report on May 16, 1980, and the Committee's conclusions were largely reaffirmed in a January 2, 1981 report prepared by a special OSHA/NIOSH Task Force set up by Dr. Bingham to review the Advisory Committee Report. As detailed below, the Construction Advisory Committee and OSHA/NIOSH Task Force Reports support two key conclusions:

(1) that many of the provisions of the customary OSHA health standard -- such as routine monitoring, medical surveillance, recordkeeping, and hygiene facilities -- are neither practicable nor effective in construction work; and

(2) the best and only solution is to adopt simple and economical work practices that make the workplace safe and at the same time eliminate the need for most of the impractical components of the typical OSHA standard.

14/ Construction Advisory Committee Report at p. 3.

DUP 0948229

A. Many of the Components of the Customary Fixed-Site OSHA Health Standard Are Neither Practicable Nor Effective in Construction Work

The findings of the Construction Advisory Committee and the OSHA/NIOSH Task Force reconfirm the fact -- already widely acknowledged by the business community, labor groups, and the industrial hygiene and occupational medical professions -- that the usual OSHA approach of implementing a permissible exposure limit through exposure monitoring, hazard-specific medical surveillance, recordkeeping, hygiene facilities, and the like, is simply not practical or effective for construction work. As OSHA had found over five years earlier, this conclusion follows inevitably from the nature of the construction industry itself, and from the fact that construction work bears little resemblance to the fixed, stable "factory" jobs for which OSHA health standards were designed.

Thus, in contrast to factory work, which is "permanently placed and configurated" and involves work activities that are "constant and predictable," most construction employees work in a "continually changing" environment, moving from one temporary worksite to another.[15/] Each worksite is unique, with exposure patterns varying according to shifting weather conditions and the use of different materials and

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15/ Id. at pp. 32, 53.

DUP 0948230

processes over differing lengths of time. As the Advisory Committee found, "in construction work[,] employment is temporary, the work location is continually changing, and environmental exposures are subject to the variability of wind and weather. Workers may use or be exposed to a given material for short periods of time," in some cases "for only a few hours" and in others for "only a few days."16/

In addition, the construction industry does not follow the pattern of "steady" employer-employee relationships that prevail in factory jobs.17/ Quite to the contrary, the construction industry is characterized by small, highly transient firms, whose number fluctuates widely according to seasonal variations and other short-term shifts in demand. Indeed, many construction firms "are created to carry out a single project and then are dissolved."18/

Similarly, the workforce is transient and temporary, with turnover rates as high as 300 to 600 percent per year depending on the job or craft involved. Casual hiring and severance practices (i.e., "walk-on, walk-off") are common.19/

16/ Id. at pp. 15, 32.

17/ Id. at p. 2.

18/ Id. at p. 32.

19/ Statement of Fred Graham (NCA), OSHA Docket H-90 [Cancer Policy], Ex. 125 at 2; Research Triangle Institute, Asbestos Dust: Technological Feasibility Assessment and Economic Impact Analysis of the Proposed Federal Occupational Standard, p. II-36 (Draft dated September 1978) (hereinafter referred to as the "Draft RTI Report").

DUP 0948231

Accordingly, most "construction employees change jobs regularly," and many "may work for three to ten employers throughout the country in the course of a year."[20/]

In short, as the Advisory Committee found, "[t]he only consistent aspect" of construction "is its variability."[21/] Customary OSHA standards, developed for fixed-site, steady employments in manufacturing industries, "do[] not take into account rapid employee turnover, a constantly changing work environment, and the concept of a workforce made up of craftsmen who are expected to bring specialized skills" to short-term jobs.[22/]

For example, the use of repetitive monitoring to implement a permissible exposure limit serves no useful purpose in most construction jobs. Because construction work typically involves short-term tasks, the lag-time needed to complete the necessary sampling and analysis (five to six weeks in the case of asbestos) often exceeds the life of the operation. As the Construction Advisory Committee found:

> Testimony from both labor and management described construction work as temporary, subject to ambient weather conditions, and changing daily with respect to environmental contaminants and physical locations of work operations. Thus, the combination of industrial hygiene lag

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20/ Construction Advisory Committee Report at pp. 21, 33.

21/ Id. at 53.

22/ Id. at 42.

DUP 0948232

> time and changing and unpredictable environmental conditions on the job means that very often by the time the industrial hygiene results are available, the job that was sampled has been finished and the workers reassigned.23/

Moreover, since exposure levels vary widely according to the nature and duration of the task, the work procedures followed by a particular employee, the tools used, the exposure potential of the product used, weather conditions, and other variables, such routine monitoring of particular workers will rarely, if ever, be meaningful for evaluating the exposure of other workers, or even of the same worker on another day.24/ The Advisory Committee agreed that "[t]hese combined variables make it extremely difficult to accurately characterize any particular worker's exposure" -- much less conduct the kind of "representative" monitoring contemplated under most OSHA health standards.25/

Similarly, routine medical surveillance aimed at a particular hazard is, as the Advisory Committee concluded, "a

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23/ Id. at p. 6. See also OSHA/NIOSH Task Force Report at pp. 4, 10-11.

24/ See, e.g., Statement of Lt. Col. David Smith on behalf of the Department of Defense, Docket H-004 [Lead], Ex. 130; Statement of C. R. Mattson (NCA), Docket H-004 [Lead], Ex. 98; Statement of Harry Taylor on behalf of the Council on Construction Employers, Docket H-004 [Lead], Ex. 64; Statement of I. J. Meyerson on behalf of Boeing Aerospace Company, Docket H-004 [Lead], Ex. 30.

25/ Construction Advisory Committee Report at p. 32. See 29 C.F.R. § 1910.1001(f)(2)(ii) (requiring representative monitoring for asbestos).

DUP 0948233

major economic and logistical problem" "for both employees and employers" in the construction industry.[26] The Committee cited high employee turnover as the "primary reason" for the "severe problems" resulting from OSHA medical surveillance requirements in construction,[27] and identified the following particular difficulties:

1. Unnecessary repeat examinations and "potentially harmful" over-exposure to diagnostic x-rays and other medical procedures;[28]

2. Discrimination against employees based on the results of OSHA-prescribed medical examinations;[29]

26/ Construction Advisory Committee Report at p. 21.

27/ Id. The Advisory Committee observed that --

> [i]n construction, employees may be hired for anywhere from one day to many years. One employee may work for three to ten employers throughout the country in the course of a year. The attempt to superimpose initial and periodic physical examinations on such a pattern of employment presents severe problems for both employees and employers.

28/ Id. The Committee explained that "because they routinely change employers," workers in the construction industry "may be required to take an OSHA 'initial' medical examination several times per year throughout their working lives," and added that "if OSHA's standards development effort continues in its present pattern, an increasing group of workers will be subject to multiple medical examinations." Id. at p. 22.

29/ The Committee concluded that "medical judgment . . . may or may not be uniform among employers or even within a given medical office," and, because of the likelihood of repeat examinations, "[s]ooner or later it is possible that [a construction employee] will not be allowed to work for medical reasons that may be quite arbitrary." Id. at p. 22.

DUP 0948234

3. The "lack of qualified medical resources,"30/

4. The ineffectiveness of medical surveillance due to the absence of a continuous physician-patient relationship;31/ and

5. The heavy financial burden of the examinations, as well as costly delays in project start-up due to the need to conduct initial examinations.32/

Quite apart from these serious practical difficulties, there are real questions about the value of medical surveillance in many construction contexts, including those involving the use of asbestos products. Because of the nature of most construction work, occupational asbestos exposures are

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30/ "[A]t the present time, physicians willing to accept OSHA physical examinations are difficult to locate in some parts of the country. Trips of 50 miles between the site and the physician's office are not uncommon in some areas." Id. at p. 25.

31/ "Good preventive medicine requires knowledge of environmental conditions on the job . . . and the ability . . . to follow the employee over time," but "[a]chieving these objectives is difficult in construction," both (1) because "[e]mployees who work for short periods are sometimes terminated before the complete results of the examination reach the employer," and (2) because "[t]he fragmented and imperfect medical system created by the standards" -- including the lack of any "continuity of medical records" -- "is unlikely to discover . . . diseases while the exposure is taking place and is even more unlikely to stimulate the necessary environmental control systems." Id. at pp. 24 & 26.

32/ "[E]mployers may be charged anywhere between $40 and $2000," and "the necessary time lag between making the appointment for the examination and the examination itself" "delays the startup or the progress of work [on some jobs], because employees cannot be put to work until the examinations are completed and the physicians' report has reached the employer." Id. at pp. 24-25.

DUP 0948235

highly variable and, for the most part, are brief, intermittent, and very low on the average. As OSHA's feasibility contractor for asbestos has concluded:

> Products containing asbestos are not used continuously [in construction work]. Individual workers may work with a product containing asbestos only very occasionally, although some may do so almost continuously. Thus, the total population exposed over time may be much larger than the population at risk at a moment in time, and average annual and cumulative exposure may be quite low.33/

For these and other reasons, the Construction Advisory Committee and the OSHA/NIOSH Task Force agreed that "[n]ew standards for the construction industry should recognize the impracticality of attempting to include a requirement for medical surveillance in every health standard," and recommended consideration of alternative approaches.34/

The Advisory Committee and Task Force also questioned the value and workability of applying other components of the usual fixed-site standard to construction. The Advisory Committee found, for example, that requirements for creating and keeping for lengthy periods detailed records of monitoring and medical examinations serve no real purpose in an

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33/ Draft RTI Report at p. II-35.

34/ Construction Advisory Committee Report at pp. 28-29; OSHA/NIOSH Task Force Report at pp. 2 & 7. The Advisory Committee suggested that a "generic" medical surveillance program for construction be examined.

DUP 0948236

industry "where employment is temporary, the work location is continually changing, and environmental exposures are subject to the variability of wind and weather."[35/] Similarly, the requirements for "hygiene facilities" typically found in OSHA standards are not feasible for many construction operations because of the unavailability of water and other necessary facilities.[36/]

B. The Use of Products and Work Practices, Validated to Be Safe, Is the Only Cost-Effective Way to Provide Good Health Protection in Construction

In essence, both the Construction Advisory Committee and the OSHA/NIOSH Task Force recognized that the best and only way to avoid many of the impractical components of the typical OSHA standard is to adopt simple and practical

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35/ Construction Advisory Committee Report at p. 32. The Committee noted that, for these reasons, exposure and medical records have far less diagnostic value than they do in the manufacturing context, where stable employer-physician-employee relationships are more likely to exist. Id. at 32. In addition, "[t]hese records . . . have little value for epidemiological purposes or other long-term studies," because "a great many of these records will be lost" through business closures, and the remainder "will be scattered among construction firms scattered throughout a geographical region or sometimes throughout the country." Id. at 32 & 33.

In the end, the Committee found, "these records [most likely] will simply fill up government warehouses at significant cost to the taxpayers and the employers who originally collected them." Id. at p. 32.

36/ Id. at pp. 53-54.

DUP 0948237

methods to make the construction workplace safe. The Advisory Committee made this point most clearly in the context of its discussion of the medical surveillance provision contained in virtually all OSHA health standards:

> [OSHA and NIOSH] should mount a major effort to develop and publish economical and practical methods of controlling these hazards so that the work environment can be made inherently safe. New standards should emphasize environmental controls and deemphasize dependence on medical controls unless they are necessary.37/

At the same time, both groups concluded that the customary approach of setting a permissible exposure limit and implementing it primarily through repetitive monitoring is not a workable means of preventing unsafe exposures in construction. The alternative approach they recommended is to rely on work practices which provide reasonable assurance that safe exposure limits are not exceeded. As the Advisory Committee emphasized --

> Because of the transient nature of working conditions in construction, both the worker and the employer could be better served in many cases by simply using an acceptable work practice at the start of a job where a potential exposure exists, and dispensing with the costly and time consuming monitoring process.38/

Specifically, the Committee recommended that "[c]onstruction standards should . . . allow an employer or a

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37/ Id. at p. 28. See also p. 52: "the development of low cost, practicable control methods should be a part of the total standards development process for construction."

38/ Id. at p. 36.

DUP 0948238

material supplier to develop and publish work practices" that are "based on legitimate measuring and monitoring of actual field operations" and "designed to assure that permissible exposure limits are not exceeded."[39/] The Committee added, following the scheme suggested in the 1980 AIA/NA-AACPP proposal and incorporated in the Recommended Standard herein, that "[t]he effectiveness of the workpractices would be checked in the routine course of field work by employers, and by both OSHA and NIOSH."[40/] The OSHA/NIOSH Task Force reaffirmed this recommendation and suggested a number of methods for implementing such a program.[41/] Moreover, the Task Force urged that these work practice recommendations "be reflected as soon as possible in new health standards being proposed by the Directorate of Health Standards Programs."[42/]

39/ Id. at p. 6.

40/ Id. at pp. 6-7.

41/ OSHA/NIOSH Task Force Report at p. 2. Among other things, the Task Force suggested:

1. Use of work practices validated by the employer "in an initial determination, based on monitoring or theoretical calculations of maximum probable exposure";

2. Use of work practices "which have been shown by past experience under equivalent conditions" to be effective; or

3. Use of "published work practices which have been shown, to OSHA's satisfaction," to be effective.

Id. at 11 (emphasis in original).

42/ Id. at p. 2 (emphasis added).

DUP 0948239

III. EXPLANATION OF THE RECOMMENDED STANDARD

Occupational health standards should serve a number of different objectives. They should, of course, be enforceable regulations which adequately protect workers from occupational health hazards. In addition, as contemplated by Executive Order 12291, they should impose practical requirements which promote voluntary compliance, avoid unnecessary burdens on employers and the public, and channel available occupational health resources to areas where those resources will achieve the greatest health gains for workers. And, if possible, occupational health standards should encourage the private sector to develop safer products and work practices which efficiently satisfy the practical and economic needs of the construction industry and the general economy.

The Recommended Standard -- which would replace the current OSHA Asbestos Standard[43/] in "construction work"[44/]

43/ The Recommended Standard (Rec. Std.) contains a provision which clearly separates the coverage of the current OSHA asbestos standard from the proposed new construction standard. The current OSHA standard does not contain any specification of scope and application, but the provisions of the standard make clear that it applies to any workplace where there is occupational exposure to asbestos. Accordingly, the Recommended Standard adds to the current standard a new paragraph which excludes construction and other non-fixed workplaces which would be covered by the proposed new standard. See Rec. Std., Appendix A at p. 1a.

44/ The definition of "construction work" in the Recommended Standard is precisely the same as is contained in OSHA's General Industry Standards. Compare Rec. Std. § (b)(8) with 29 C.F.R. § 1910.12.

DUP 0948240

and other "non-fixed work operations"[45/] -- achieves these objectives in four ways.

First, it establishes a product classification program which would rank asbestos-containing products used in construction operations according to their potential for releasing airborne asbestos fibers in excess of the permissible exposure limits.

Second, the Standard provides for validation and empirical field confirmation of product classifications, including the use of (a) objective data or exposure studies conducted by fully qualified testing laboratories, and (b) empirical field testing by OSHA inspectors and others to confirm the underlying data or tests. These procedures will help ensure that validated products have innate physical characteristics, or identified work practice techniques, that prevent unsafe exposures in construction work.

Third, the Recommended Standard imposes regulatory requirements commensurate with the exposure risk presented by each product category. The Standard applies more stringent requirements for higher-risk products, including full

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45/ The Standard defines the term "non-fixed work operation" to refer to "jobs which do not involve regular assignment to a permanent work location or set of locations." Rec. Std. ¶ (b)(9). The purpose of this provision is to include highly mobile non-construction operations such as oil well drilling, where asbestos exposures (from the use of drilling mud additives containing asbestos) may occur under circumstances similar to construction activities.

DUP 0948241

compliance with the existing OSHA Asbestos Standard for products presenting the greatest risk of exposure above permissible levels.

And fourth, the Recommended Standard includes requirements for a Compliance Coordinator to provide centralized planning, supervision, training, cooperative labor-management interface, compliance monitoring, and other elements critical to ensuring that safe products and work practices are used and followed.

These four elements of the construction industry asbestos standard recommended here are discussed in greater detail below.

A. The Product and Work Practice Classification System

The categorization of asbestos-containing products used in construction operations according to their fiber-release potential is the foundation of the recommended approach. The proposal would establish three classifications (called "Category A," "Category B" and "Category C" Products) which are defined according to a product's capacity, under reasonably foreseeable conditions of processing or use in construction and other non-fixed operations, for releasing airborne asbestos fibers in excess of the permissible exposure limits. As discussed later (Part III.C.), different regulatory requirements would apply to each category, both

DUP 0948242

to reflect the degree of risk associated with each type of operation, and to establish incentives for the development and use of safer products and work practices.

A "Category A Product" is defined in Paragraph (b)(1) as a "product which, based on objective data, including where appropriate an exposure study, does not result in occupational exposure to airborne concentrations of asbestos fibers in excess of the permissible exposure limits under any reasonable foreseeable conditions of processing or use." Category A is the safest product classification and will generally include products in which asbestos fibers are coated, bound or enclosed by other materials in such a way that they will not be released in significant quantities in any reasonably foreseeable construction industry use. As discussed in Appendix B, these products are likely to include mastics, mechanical packings, oil seals, compressed gaskets, sealants and caulks, roof coatings, and electrical insulating paper.

A "Category B Product" is defined in Paragraph (b)(2) as a "product which, based on objective data, including where appropriate an exposure study, does not, under any reasonably foreseeable conditions of processing or use, result in occupational exposure to airborne concentrations of asbestos fibers in excess of the permissible exposure limits when specified fabrication, installation or removal methods are used." In effect, Category B Products are

DUP 0948243

capable of producing airborne asbestos fiber concentrations in excess of the permissible exposure limits under some reasonably foreseeable construction uses, but will not do so if the proper work procedures, tools or other safeguards are employed in those situations.

Obviously, some regulatory controls must be applied to Category B Products to ensure that they are used in a way that prevents the release of excessive concentrations of asbestos fibers. Nevertheless, so long as the use of proper work practices, tools or other safeguards is ensured, most of the fixed-site requirements of the typical OSHA standard are unnecessary or redundant for these products. As discussed in Appendix B, AIA/NA, AACPP and their member companies have developed data showing that work practices for two asbestos-containing products -- asbestos-cement pipe and asbestos-cement sheet -- can be validated under Category B of the Recommenced Standard.

The last classification -- "Category C Products" -- covers products which do not fall into either of the two preceding categories. Rec. Std. ¶ (b)(3). Because they possess neither the innate physical characteristics nor the validated work practice controls which are needed to ensure that the permissible exposure levels are met, Category C Products present the greatest potential for significant asbestos exposures, and accordingly require the most stringent regulatory controls.

DUP 0948244

B. Validation of Product and Work Practice Classifications

For any product classification program to be successful, it is, of course, necessary to provide adequate assurances that products will be properly classified. The Recommended Standard employs two devices for achieving this goal: (1) validation based on objective data or exposure testing conducted by qualified laboratories, and (2) empirical field confirmation by OSHA in connection with workplace inspections.

The validation procedures of the Recommended Standard are modelled on what OSHA has called the "performance-based exemption provisions" of its Acrylonitrile (AN) Standard. 43 Fed. Reg. at 45778. In order to classify an asbestos-containing product, there must exist "objective data, including where appropriate an exposure study," which is significant to support a "reasonable reliance" by the construction employer that the use of the product -- including the tested work practices in the case of a Category B Product -- will not result in a violation of the permissible exposure limits under "any reasonably foreseeable conditions of processing or use." Rec. Std. ¶¶ (b)(1), (2), (c)(1) & (d)(1).[46/] Thus, the Recommended Standard, like OSHA's AN

46/ This formulation closely resembles the approach OSHA adopted in the AN Standard, which exempts --

(Footnote 46 continued on next page.)

DUP 0948245

Standard, requires the use of reliable objective data, and contemplates that an "exposure study" ordinarily will be conducted to support a classification.

Because exposure studies normally will form the basis of product and work practice validations, special requirements are provided for such studies. The term "exposure study" is defined as "a study, conducted by a Certified Testing Laboratory, which shows with reasonable accuracy the concentrations of airborne asbestos fibers to which employees may reasonably be expected to be exposed under specific conditions of processing or use of an asbestos-containing product." Rec. Std. ¶ (b)(7). Paragraph (b)(6) defines a "Certified Testing Laboratory" as "a laboratory accredited by the American Industrial Hygiene Association [AIHA] as qualified to test for airborne concentrations of asbestos fibers" using the method prescribed in the current OSHA asbestos standard. The use of laboratories which are accredited by AIHA provides an important safeguard against

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(Footnote 46 continued from previous page.)

> [m]aterials made from and/or containing AN for which objective data are reasonably relied on to demonstrate that the material is not capable of releasing AN in airborne concentrations in excess of 1 ppm as an eight (8)-hour time-weighted average, under the expected conditions of processing, use and handling which will cause the greatest possible release.

29 C.F.R. § 1910.1045(a)(2)(ii) (emphasis added).

DUP 0948246

invalid or unsupported product classifications. In addition, the requirement that exposure studies provide "reasonable accuracy" is identical to the current OSHA monitoring requirement for asbestos (29 C.F.R. § 1910.1001(f)), and is intended to require that an "exposure study" be designed in a way that provides the same degree of accuracy as under the existing monitoring provisions.

While an "exposure study" ordinarily must be conducted, it is not necessarily the sole basis for classifying a product. As discussed above, exposure testing which identifies exposure levels associated with all "reasonably foreseeable" uses of a product "with reasonable accuracy" might require in some cases a very large number of measurements to take account of the infinite variety of work procedures, product formulations, weather conditions, and other factors which affect exposures. Accordingly, as in the AN Standard,[47/] the Recommended Standard permits the use of "objective data"

47/ See 43 Fed. Reg. at 45778:

> OSHA recognizes that employee exposure conditions can vary greatly between plants, even though they may be using the same materials. All that the standard requires is for the tester to specify the conditions of the testing, such as the temperature of heating, time of heating, distance of sampling probe from the surface of the material being tested, and the like. The duty is on the employer relying upon that data to show that his operating and exposure conditions are within the conditions of the testing.

DUP 0948247

in addition to data from an exposure study to support a classification. Such "objective data" might, for example, identify "worst case" operations which, once tested and found to result in exposures below permissible levels, would provide a sufficient basis for the classification.[48/] Thus, the "objective data" provision will permit limited testing which provides a "reasonably accurate" basis for concluding that permissible levels will not be exceeded under any reasonably foreseeable conditions.

For much the same reason, the Recommended Standard would not necessarily require that "exposure studies" be conducted for each individual asbestos-containing product used in construction. Entire groups of products might be validated by a single exposure study if objective data shows a sufficient degree of physical similarity among the products,

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48/ See 43 Fed. Reg. at 45778-79:

> A manufacturer of a material made from AN cannot anticipate all possible work-place conditions to be encountered in the further processing of his material. However, in developing data on the release of AN from his material, he can provide useful data by performing his testing on a worst-case basis, without any ventilation to dilute the AN emissions. By doing so, and by specifying the other parameters of his testing procedure, the manufacturer can demonstrate the propensity of his materials to release their AN. A down-stream employer who receives data from this testing must then analyze his work-place conditions to determine if he can reasonably rely upon that data for exemption from the standard.

DUP 0948248

or if testing is done on the product which presents the greatest exposure capacity. For example, all "asbestos-cement pipe" products might be classified based on a single exposure study of one of the products, if "objective data" shows that the specific product studied has the greatest capacity to release airborne asbestos fibers.

Finally, the Recommended Standard does not require that an exposure study be conducted in all cases. For some asbestos-containing products, a chemical or structural analysis of how the asbestos fibers are encapsulated, bound, or altered by another material may be enough to show that the fibers will not be released in excessive amounts under expected conditions of construction industry handling, processing, or use.[49/] However, where a product is theoretically capable of releasing significant concentrations of asbestos fibers in foreseeable construction industry uses,

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49/ For example, most asbestos-containing mechanical packings are (1) impregnated with a binding or lubricating material such as petroleum-based or vegetable oils, grease, Teflon, petroleum-based waxes, or natural and synthetic rubbers; (2) coated with materials such as mica, graphite, or petroleum-based oils and waxes; and (3) fabricated by the manufacturer into preformed die cut rings. The use of these products in construction -- i.e., simply installing the performed packing rings into valve stems, pumps, and similar devices -- will not result in excessive asbestos exposures.

Similarly, any asbestos in "black line" asphaltic coatings is bound in a liquid mixture containing asphalt and fillers such as limestone or sand. The spray, brush or trowel application of these liquid coatings in construction work is inherently unlikely to yield excessive asbestos dust.

DUP 0948249

an exposure study will be necessary, particularly if specific work practices are to be validated under Category B.

Regardless of what kinds of data are used, the mere availability of such data is not enough to support a classification. The Recommended Standard requires that the supporting data be of such quality or quantity to justify "reasonable reliance" by the employers using the products involved. Rec. Std. ¶¶ (c)(1) & (d)(1). The term "reasonable reliance" is not specifically defined, but rather is left open for case-by-case determination. At a minimum, however, the employer must study the underlying data and tests, and compare the products and exposure conditions in his own workplace, in order to reasonably conclude that his operating and exposure conditions fall within the parameters of the validating data. In addition, the reputation of the validating laboratory, the employer's previous experience with the laboratory, the completeness of the data and the laboratory's specific conclusions would be relevant considerations.

Another key factor in specific cases would be any findings from previous OSHA inspections of an operation. For example, if an OSHA inspection showed that the applicable exposure limits were exceeded during an operation involving a Category A Product, or during an operation involving a Category B Product where the proper work practices were followed, an employer's ability to continue to

DUP 0948250

rely "reasonably" on the validating data would be placed in doubt, depending on the accuracy and extent of the data provided by OSHA in each case. This feature of the Recommended Standard gives OSHA a vehicle for monitoring and verifying the correctness of classifications.

C. Regulatory Requirements Tailored to the Degree of Risk Posed to Workers

The Recommended Standard regulates occupational asbestos exposure in construction work in two general ways. First, the Standard imposes different regulatory controls on each product category, and tailors the applicable controls to the degree of hazard presented by each type of product or operation. These category-specific requirements are discussed in this section. Second, the Standard imposes certain generally applicable requirements -- i.e., provisions for a Compliance Coordinator, access to records, emergencies, and housekeeping -- which are discussed in the next section (Part III.D.).

Under Paragraph (c) of the Recommended Standard, Category A Products are subject to the least regulation. Since Category A Products present little or no risk of excessive exposure, no category-specific requirements are imposed, and operations involving these safest of asbestos-containing products are subject only to the generally-applicable provisions (Part III.D., below). Rec. Std. § (c)(2). As discussed in greater detail below, the lesser regulatory controls on

DUP 0948251

Category A Products creates a strong incentive for the development and use of products which will not lead to significant exposure.

For Category B Products, the Recommended Standard requires employers to comply with the "fabrication, installation or removal methods" which qualify the products under Category B. Rec. Std. ¶ (d)(1). The expression "fabrication, installation and removal methods" is defined in Paragraph (b)(4) to include any combination of engineering controls, work practices or administrative controls, housekeeping, and respiratory protection. While work practice controls are expected to be the predominant mode of compliance because of the special features of the construction industry, the purpose of the definition is to permit the use of tools with local exhaust ventilation or work scheduling as ancillary protective measures. The use of respirators as part of a Category B classification is not permitted under the Recommended Standard unless no other control method is feasible for a given operation. Rec. Std. ¶ (b)(4).

Employers claiming exemptions for Category B Products must, of course, take all practicable steps to ensure that validated work practices and other protective measures are, in fact, used. Rec. Std. ¶ (d)(2)(i). Several additional requirements are imposed to ensure the use and effectiveness of the validated work practices and other protective measures. The employer is required to provide, before a given job

DUP 0948252

begins, the training and instruction needed to enable employees to use the correct work practices. Rec. Std. ¶ (d)(2)(ii). Further, manufacturers of Category B Products are required to include a product label warning that validated work practices, tools or other measures should be used. Rec. Std. ¶ (d)(3). In addition, several of the generally applicable provisions detailed in Part III.D., below -- particularly those for a Compliance Coordinator to oversee the implementation of safe products and work practices -- will go a long way toward ensuring that employers claiming exemptions for Category B Products follow the fabrication, installation, or removal methods that are essential for the safe use of such products. Rec. Std. ¶ (d)(2)(iii) & (iv).

For Category C Products, which, by definition, pose the greatest potential for exposure, the current OSHA asbestos standard would apply in full. Rec. Std. ¶ (e). As discussed above, Category C Products have neither the structural product characteristics nor the validated work practice controls needed to protect workers against excessive exposures. While many components of the typical OSHA fixed-site health standard (such as the current asbestos standard) are generally inappropriate for construction and other non-fixed workplaces, those provisions should nevertheless be applied in the case of Category C Products to provide a strong incentive for developing safer products and work practices.

DUP 0948253

It is important to note that the regulatory status of Category A and B Products is expressed in the form of exemptions from the current standard. See Rec. Std. ¶¶ (c)(1) & (d)(1). As a result, if a construction employer cannot claim one of the exemptions, the entire existing standard could be enforced against him. The threat of citations and penalties for violating the many individual requirements of the existing standard will provide a powerful incentive for employers to make doubly sure that the criteria for Category A or B classifications are met. In addition, in the case of Category B Products, employers are subject to citation for failing to follow the validated work practices and training requirements, even if the classification criteria have been satisfied. Rec. Std. ¶ (d)(2)(i).

D. The Compliance Coordinator and Other Generally Applicable Requirements

In addition to the category-specific provisions described in Part III.C., above, the Recommended Standard includes a number of general requirements that are not tied to a single product category. These provisions are designed in large measure to ensure that employers who decide to take advantage of the regulatory incentives offered under the Standard for Category A and B Products make sure that the proper products and work practices are in fact used.

The most important of these general provisions is contained in Paragraph (f) of the Recommended Standard, which

DUP 0948254

requires employers using Category A or B Products to designate a "Compliance Coordinator" to assume responsibility for ensuring that uncertified products or work practices are not used. The Compliance Coordinator must be a "competent person" with the training, education or experience needed to oversee or carry out any aspect of the employer's program for complying with the Standard. Depending on the nature or scope of the operations involved, one or more additional persons may be appointed to act as the Coordinator's "designees" on particular phases of a project, or to carry out specific aspects of the Coordinator's duties.

The requirement for a Compliance Coordinator fills an important gap in OSHA's traditional approach to regulating health and safety hazards in construction work by centralizing the planning and monitoring of compliance activities on complex projects. In addition, a Compliance Coordinator requirement provides a much-needed focal point for cooperative labor-management efforts to develop sensible health and safety programs appropriate to the nature and scope of the specific project involved. The flexible, cooperative approach for implementing the performance-oriented certification program recommended here is far better than the customary OSHA practice of enacting rigid and detailed nationwide compliance specifications that are insensitive to the needs of particular employers and employees.

DUP 0948255

The Standard includes several additional general requirements. First, regardless of which product category is involved, employers must satisfy the "emergency" provisions of the existing standard, requiring the use of respirators in the event of an unexpected and massive release of asbestos dust. Rec. Std. ¶¶ (c)(2)(ii) & (d)(2)(iv). This provision is needed because such unexpected releases, by their very nature, would not be included in the "reasonably foreseeable circumstances" under which Category A or B Products are validated.

Second, as discussed in greater detail in Appendix B (pp. 3b-4b), construction employees working (e.g., making repairs) in a facility which manufactures or fabricates asbestos-containing products will generally be protected by the current standard, which applies to the owner of that facility. However, construction workers could be exposed to excessive concentrations of asbestos dust which has accumulated in normally inaccessible places such as on pipes and ductwork. Accordingly, Paragraph (g) makes the "housekeeping" provisions of the current standard applicable in those special circumstances, even where the employer is using only Category A or B Products.

Lastly, Paragraph (h) requires construction employers, at the request of OSHA or NIOSH, any employee, or an employee's designated representative (including a certified collective bargaining agent), to make available any objective

DUP 0948256

data and exposure studies on which the employer relies, together with materials relating to the training of employees in the use of validated work practices and any other materials relating to the activities of the Compliance Coordinator. This records-access provision will not only assist OSHA's enforcement efforts, but in addition, it allows for external review of validating studies by OSHA, NIOSH, unions and others.

IV. ADVANTAGES OF THE RECOMMENDED STANDARD OVER THE TRADITIONAL OSHA FIXED-SITE HEALTH STANDARD

The core of the recommended standard for occupational asbestos exposure in construction is the same "reliable work practice" concept endorsed by the Construction Advisory Committee and the OSHA/NIOSH Task Force as the best answer to the enormous difficulties the construction industry faces in complying with the current asbestos standard, and, by analogy, with other OSHA health standards. As discussed below, the Recommended Standard would --

(1) provide a far more practical and cost-effective system for protecting workers from unsafe asbestos exposures;

(2) increase voluntary compliance and alleviate OSHA's enforcement burdens; and

(3) establish strong incentives for new efforts -- including labor-management cooperation -- to develop and implement safer products and work practices.

DUP 0948257

A. Cost-Effectiveness

Both the Occupational Safety and Health Act[50/] and President Reagan's Executive Order on Improving Government Regulations[51/] require that OSHA standards be feasible and cost-effective in the sense that they are practicable and impose only those regulatory controls that are necessary to achieve a safe working environment.

As the previous discussion makes clear, many of the components of the traditional OSHA health standard contribute little to worker health in the construction industry. At the same time, there is no reason to believe that many of

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50/ The Occupational Safety and Health (OSH) Act requires that health standards be both "feasible" and "reasonably necessary or appropriate to provide safe or healthful employment." OSH Act §§ 3(8) & 6(b)(5), 29 U.S.C. §§ 652(8) & 655(b)(5). As recently construed by the Supreme Court, these provisions not only require that occupational health standards be reasonably achievable in an economic and technical sense, but they also proscribe regulatory requirements which are unnecessary to achieve the necessary level of health protection. See American Textile Mfrs. Inst. v. Donovan, 101 S. Ct. 2478, 2493 n.32 (1981).

51/ Among other things, the Executive Order requires, "to the extent permitted by law," that --

> among alternative approaches to a given regulatory objective, the alternative involving the least net cost to society shall be chosen.

Executive Order 12291, § 2(d), 46 Fed. Reg. 13193 (February 19, 1981).

DUP 0948258

the small, transitory employers in the construction industry[52] are likely to have the personnel or financial resources to meet any of these fixed-site requirements. Indeed, the National Constructors Association has stressed that the routine adoption of such requirements would "place an intolerable economic and logistical strain on the construction industry -- particularly small contractors." NCA added that "the costs are so extreme as to threaten the continued existence of many small and medium size construction companies throughout the nation, without a demonstration of the necessity for such rigid health controls."[53]

In short, OSHA's present approach imposes impractical requirements that would yield little real health benefit even if they could realistically be satisfied. The Recommended Standard would eliminate these difficulties by allowing construction employers to use simple and inexpensive work practices that have been validated to be safe in the sense that exposures in excess of OSHA's permissible limits will not occur in any reasonably foreseeable circumstance. Thus, the Standard meets the requirements of the OSH Act and Executive Order 12291 by providing good health protection to

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52/ According to OSHA's feasibility contractor for asbestos, as much as 70% of construction firms are sole proprietorships averaging 1 to 4 employees. Draft RTI Report at p. II-35.

53/ Statement of Fred Graham (NCA), OSHA Docket H-60 [Cancer Policy], Ex. 125 at pp. 4, 5.

DUP 0948259

workers without imposing the ineffective but costly fixed-site requirements of the customary health standard.

To be sure, the Recommended Standard departs significantly from OSHA's historical regulatory practice. But OSHA has on a number of occasions limited or modified its traditional approach in an effort to avoid standards that impose sweeping requirements without any significant or commensurate health gain. OSHA's current labeling and waste disposal requirements for asbestos-containing materials, for example, effectively recognize that not all such materials pose an exposure threat which is significant enough to warrant full-scale regulatory controls.[54/] Other OSHA standards -- such as those for inorganic arsenic[55/] and cotton dust[56/] -- incorporate similar

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54/ The asbestos labeling requirement provides that "no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably forseeable use, . . . no airborne concentrations of asbestos fibers in excess of the exposure limits . . . will be released." The waste disposal requirement of OSHA's current asbestos standard contains an almost identical exemption. 29 C.F.R. § 1910.1001(g)(2)(i) and (h)(2).

55/ OSHA's Inorganic Arsenic Standard exempts workplaces where the substance is present in only small amounts because "[i]t is . . . inappropriate to cover situations where very low levels of arsenic may be present in substances or products in the workplace, but where they are handled in such a way that the possibility of airborne exposure is minimal." 43 Fed. Reg. at 19612 (May 5, 1978).

56/ OSHA's Cotton Dust Standard contains a series of exemptions for operations where application of the standard would achieve little at great cost. Specifically, the Cotton Dust Standard exempts: (i) maritime workers, because the "limited duration of exposure makes it unlikely that cotton dust

(Footnote 56 continued on next page.)

DUP 0948260

limitations designed to prevent unduly broad application of monitoring, medical surveillance, and other ancillary requirements.

OSHA's Acrylonitrile (AN) Standard, which more closely resembles the standard recommended here for asbestos exposure in the construction industry, also reflects an effort to adapt the traditional regulatory approach to unique circumstances. The AN standard imposes the traditional fixed-site requirements on manufacturers of products containing AN, but exempts downstream processors and fabricators of such products where "objective data is reasonably relied upon" to show that a designated action level is not exceeded. 29 C.F.R. § 1910.1045(a)(2)(ii). In adopting this and other exemptions from the overall AN standard, OSHA "recognized that the potential for exposure to AN in the workplace extends to a multitude of workplaces, including many small fabricators, extruders, and other downstream processors of materials containing or made from AN," and that "extending the AN standard that far would be burdensome to both industry

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(Footnote 56 continued from previous page.)

exposure is significant for an appreciable number of the workers handling water borne shipments of cotton"; (ii) workers handling "washed cotton," because of the "effectiveness of the washing process in significantly reducing or eliminating the biological effects of cotton dust"; and (iii) harvesting of cotton, because "it is a distinctively farming operation and presents different exposure environments and possibilities of control." 43 Fed. Reg. 27381-82 (June 23, 1978).

DUP 0948261

and OSHA, and would not be reasonable in light of the degree of exposure involved." 43 Fed. Reg. 45776 (October 3, 1978).

Significantly, the Recommended Standard goes beyond the AN standard in protecting worker health. First, it requires that product and work practice exposure testing be performed only by fully qualified testing laboratories. Second, it requires that objective data and exposure studies provide a "reasonable assurance" that the permissible exposure limits will not be exceeded. This latter point is especially important in the case of asbestos, where the OSHA technique for measuring airborne asbestos concentrations is subject to a margin of uncertainty so great that "[a]n actual airborne fiber concentration of 0.5 fibers/cc will routinely produce sample counts of 2.0 fibers/cc or more."57/ Consequently, the "reasonable accuracy" requirement will not be met in practice unless the products and work practices being tested regularly produce measurements far below the permissible exposure limits, adding a significant extra margin of worker safety.

B. Improved Voluntary Compliance and Enforceability

Because of the impractical demands placed on construction employers by traditional health standards, OSHA could

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57/ Comments of Johns-Manville, OSHA Docket H-033 [Asbestos], Ex. 3-185 at ex. D, p. 42.

DUP 0948262

not hope to achieve widespread compliance with these provisions, even if it had unlimited enforcement resources. OSHA does not, of course, have such resources, and accordingly any construction industry health standard is administratively feasible only if (1) a good degree of voluntary compliance can be expected, and (2) the standard can be policed without unduly consuming available OSHA enforcement resources.

The Recommended Standard is designed to achieve both of these goals. Because it imposes simple and economical requirements on construction employers and avoids the unncessary and expensive provisions of the traditional standard, more voluntary compliance can be expected. Moreover, by providing for centralized compliance monitoring by employers and establishing a focal point for labor-management cooperation, the Compliance Coordinator provision of the Standard further increases the likelihood of voluntary efforts to eliminate unsafe products or work practices.

Moreover, the Recommended Standard will ease the tremendous enforcement burden OSHA faces in policing the millions of workers potentially exposed to asbestos dust in hundreds of thousands of construction sites throughout the nation.[58/] Under the Recommended Standard, in a large majority of

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58/ OSHA estimated in 1975 that three to five million construction and shipbuilding workers may be exposed to asbestos dust. 40 Fed. Reg. 47653 (October 9, 1975). An OSHA contractor has estimated the number to be about 2.3 million. RTI Report at p. II-27, Table II-3.

DUP 0948263

cases, OSHA inspectors may have to do nothing more than determine whether the proper products and work practices are being used. This task is much simpler and less time-consuming and expensive than under the current standard, where exposure monitoring may have to be conducted for each operation and the employer's medical, industrial hygiene and other files may have to be searched and reviewed.

Instead of endlessly monitoring individual construction operations to determine whether the permissible exposure limits are being met in each unique case, the Recommended Standard allows OSHA to focus its enforcement activities on identifying improper product classifications. As discussed above, once sampling results from OSHA inspections indicate that a product may be improperly classified, construction employers and upstream manufacturers of asbestos-containing products throughout the nation will have a powerful incentive to develop substitute products or work practices which ensure that exposure limitations are met.

C. Built-in Incentives for the Development and Use of Safer Products and Work Practices

Apart from providing good health protection in a manner that is cost-effective, easily-enforced, and likely to increase voluntary compliance, the Recommended Standard also creates strong incentives for the development of safer products and work practices. Under the current standard,

DUP 0948264

construction employers cannot legally avoid fixed-site requirements no matter how safe the asbestos-containing products or work practices which they employ. Thus, they must either ignore the standard to the detriment of employees, or they must stop using valuable construction materials, to the detriment of the economy.

Under the Recommended Standard, the threat that the current standard might be enforced in full provides a powerful incentive for the development and use of products or work practices which qualify for Category A or B classification. As a result, two critical objectives would be advanced. First, worker health would be protected through the use of products and work practices which present no serious risk of excessive asbestos exposure. Second, the current incentive for across-the-board substitution of inferior non-asbestos-containing products of unknown potential hazard would be eliminated and replaced with a scheme which encourages the use of the best construction materials which do not threaten the health of workers.

V. CONCLUSION

There is a clear need for a new strategy to control health hazards in construction and other non-fixed work operations. The current OSHA approach, which imposes on these operations provisions for endless monitoring, medical surveillance and recordkeeping, as well as other requirements

DUP 0948265

designed for fixed-site factory jobs, is simply not feasible. Nor do many of the requirements of the customary OSHA standard contribute appreciably to the health of construction workers.

The better approach is to substitute a regulatory scheme -- like the one recommended here -- that strongly encourages the use of products and simple, inexpensive work practices which protect workers against excessive exposures without imposing infeasible fixed-site requirements such as monitoring and medical surveillance. As this paper has illustrated in the particular case of asbestos, such an approach provides fully adequate health protection for workers, establishes continuing incentives for the development and use of safer products and work practices, and considerably eases OSHA's enormous enforcement burden. Accordingly, this Recommended Standard plainly meets the objectives and requirements of the OSH Act and Executive Order 12291, and should therefore be carefully considered by OSHA in developing an effective occupational health strategy for construction and other non-fixed work operations.

DUP 0948266

APPENDIX A

DUP 0948267

RECOMMENDED STANDARD FOR OCCUPATIONAL ASBESTOS EXPOSURE IN CONSTRUCTION WORK AND OTHER NON-FIXED WORK OPERATIONS

Part 1910 of Title 29 of the Code of Federal Regulations is amended as follows:

1. Section 1910.1001 of Title 29 of the Code of Federal Regulations is amended by adding after Paragraph (j) thereof the following new Paragraph:

"(k) Scope and application. This Section applies to all places of employment where asbestos or products containing asbestos are handled, processed, used, transported, packaged, repackaged, or released. However, this Section does not apply to construction work or other non-fixed work operations within the scope of Section 1910.1001a, or to working conditions of employees with respect to which other Federal agencies exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health."

* * * * *

2. A new Section 1910.1001a is added as follows:

"1910.1001a Asbestos Exposure in Construction Work and Other Non-Fixed Work Operations

"(a) Scope and application. This Section applies to every place of employment in construction work and other non-fixed work operations where asbestos or products containing asbestos are processed, used, transported, packaged, repackaged, or released.

DUP 0948268

"(b) Definitions.

"(1) "Category A Product" refers to an asbestos-containing product which, based on objective data, including where appropriate an exposure study, does not result in occupational exposure to airborne concentrations of asbestos fibers in excess of the permissible exposure limits under any reasonably foreseeable conditions of processing or use.

"(2) "Category B Product" refers to an asbestos-containing product which, based on objective data, including where appropriate an exposure study, does not, under any reasonably foreseeable conditions of processing or use, result in occupational exposure to airborne concentrations of asbestos fibers in excess of the permissible exposure limits when specified fabrication, installation or removal methods are used.

"(3) "Category C Product" refers to an asbestos-containing product which is neither a Category A Product nor a Category B Product.

"(4) "Fabrication, Installation or Removal Method" means any method or combination of methods for controlling occupational exposure to airborne concentrations of asbestos fibers, including engineering controls, tools, equipment, work practices, housekeeping, task assignment strategies, and respiratory protection; provided, however, that a fabrication, installation or removal method may not

DUP 0948269

include respiratory protection unless no other method for controlling occupational exposure to airborne concentrations of asbestos fibers is feasibile.

"(5) "The Permissible Exposure Limits" means (i) an eight-hour time-weighted average concentration of two fibers, longer than five micrometers, per cubic centimeter of air, and (ii) a ceiling concentration of ten fibers, longer than five micrometers, per cubic centimeter of air.

"(6) "Certified Testing Laboratory" means a laboratory accredited by the American Industrial Hygiene Association as qualified to test for airborne concentrations of asbestos fibers using the membrane filter method specified in Paragraph (e) of Section 1910.1001.

"(7) "Exposure Study" means a study, conducted by a Certified Testing Laboratory, which shows with reasonable accuracy the concentrations of airborne asbestos fibers to which employees may reasonably be expected to be exposed under specified conditions of processing or use of an asbestos-containing product.

"(8) "Construction work" means work for construction, alteration, and/or repair, including painting and decoration.

"(9) "Non-fixed work operation" means non-fixed as to the location where an employee performs his duties, and refers to jobs which do not involve regular assignment to a permanent work location or set of locations.

DUP 0948270

"(10) All other terms used in this Section shall have the meaning prescribed in Section 1910.1001 and in Section 3(8) of the Act, 29 U.S.C. § 653(8).

"(c) Category A Products.

"(1) Any employer who reasonably relies on objective data, including where appropriate an exposure study, which shows that an asbestos-containing product is a Category A Product, is exempt from the provisions of Section 1910.1001 as they apply to operations where such product is processed or used, and shall comply with the provisions of this Paragraph with respect to such operations.

"(2) Employers whose operations involve the use of Category A Products shall:

(i) comply with Paragraphs (f), (g), and (h) of this Section (relating to Compliance Coordinators, housekeeping, and access to records); and

(ii) comply with Paragraph (d)(1)(iii) of Section 1910.1001 (relating to the use of respirators during emergencies).

"(d) Category B Products.

"(1) Any employer who reasonably relies on objective data, including where appropriate an exposure study, which shows that an asbestos-containing product is a Category B Product, is exempt from the requirements of Section 1910.1001 as they apply to operations where such product is processed or used, and shall comply with the provisions of this Paragraph with respect to such operations.

DUP 0948271

"(2) Employers whose operations involve the use of Category B Products shall:

(i) take all practicable measures to ensure the use of the fabrication, installation or removal methods which qualify such products as Category B Products;

(ii) ensure, prior to the commencement of any operation where such fabrication, installation, or removal methods must be used, that all employees involved in such operation have been specifically instructed concerning the proper use and procedures of such fabrication, installation, or removal methods;

(iii) comply with Paragraphs (f), (g) and (h) of this Section (relating to Compliance Coordinators, housekeeping, and access to records); and

(iv) comply with Paragraph (d)(1)(iii) of Section 1910.1001 (relating to the use of respirators during emergencies).

"(3) Any manufacturer of a Category B Product who has actual knowledge of the validation of such product as a Category B Product shall include a product label that states:

"Follow Recommended Fabrication, Installation or Removal Method."

"(e) Category C Products. The requirements of Section 1910.1001, as promulgated on June 7, 1972 (37 F.R. 11318) and amended on March 19, 1976 (41 F.R. 11504), shall

DUP 0948272

apply to any operation within the scope of this Section which involves the processing or use of Category C Products.

"(f) Compliance Coordinator.

"(1) Any employer who intends to rely on Paragraphs (c) or (d) of this Section (relating to Category A and Category B Products) shall designate a competent person to serve as Compliance Coordinator; such employer may appoint one or more additional competent persons to assist the Compliance Coordinator, to carry out one or more of his duties, or to act in the place of the Compliance Coordinator for specific phases of a project.

"(2) The Compliance Coordinator shall be responsible for taking all measures necessary and appropriate for ensuring compliance with the requirements of this Section.

"(g) Where an operation involving the processing or use of Category A or Category B Products is located in a facility which manufactures, processes or fabricates products containing asbestos, Paragraph (h) of Section 1910.1001, relating to housekeeping, shall apply to such operation.

"(h) Upon request by any employee, any employee's designated representative (including a certified collective bargaining agent), the Assistant Secretary, or the Director, the employer shall make available, in accordance with the procedures set forth in Section 1910.20, the following:

(i) any objective data or exposure studies on which the employer relies pursuant to Paragraphs (c) or (d) of this Section; or

DUP 0948273

(ii) any materials relating to the activities of the Compliance Coordinator, or his designees, under Paragraph (f) of this Section.

DUP 0948274

APPENDIX B

DUP 0948275

APPENDIX

A Preliminary Assessment of How the Recommended Asbestos Standard Can Successfully Be Implemented in Construction and Other Non-Fixed Work Operations

DUP 0948276

TABLE OF CONTENTS

DUP 0948277

APPENDIX

A Preliminary Assessment of How the Recommended Asbestos Standard Can Successfully Be Implemented in Construction and Other Non-Fixed Work Operations

As discussed in the body of this paper, the Recommended Standard for Asbestos Exposure in Construction and Other Non-Fixed Work Operations is intended to replace the impractical requirements of the current OSHA asbestos standard with an enforceable, cost-effective regulation which will both ensure that worker health is adequately protected and provide incentives for the development of even safer products and work practices, all without sacrificing the important economic and practical benefits of asbestos-containing construction materials.

The purpose of this Appendix is to present technical data which show that the Recommended Standard is more than just an appealing theoretical construct -- rather, it is a workable regulation which will impose requirements which are both acceptable and cost-effective.

This Appendix begins with an Introduction which presents background information and data on the situations where exposure to airborne asbestos fibers may occur in construction and other non-fixed work operations. The Introduction also assesses preliminarily, based on the asbestos industry's experience with its products and its knowledge of their

DUP 0948278

physical properties, the classifications (Categories A, B or C) of the Recommended Standard under which the materials now in use are likely to fall.

Following this preliminary qualitative assessment, the two succeeding sections of this Appendix contain detailed quantitative documentation showing that work practices for two asbestos-containing products commonly used in construction and other non-fixed jobs -- asbestos-cement pipe and asbestos-cement sheet -- can in fact qualify under Category B of the Recommended Standard. More specifically, simple work practices which have been developed by the manufacturers of these products (and which, in some instances, are already widely used) have been carefully field-tested by qualified laboratories, and the resulting data demonstrate that both products can be validated under Category B of the Recommended Standard.[1/]

1/ The exposure data presented in the succeeding two sections of this Appendix must be interpreted cautiously. As discussed in the body of this Paper (p. 28 above), the best available technique for measuring airborne concentrations of asbestos fibers is subject to a considerable degree of uncertainty, the magnitude of which (when expressed as a percentage of the actual concentration) increases sharply as concentrations are reduced below 2.0 fibers per cubic centimeter of air.

These statistical monitoring variations would, of course, be taken into account in any formal validation of the products and associated work practices involved. Nevertheless, while the exact range of the uncertainty is not now known (and is currently under study by AIA/NA), the data reported below are so uniformly low that the products and work practices discussed can surely meet the classification criteria for Category B.

DUP 0948279

Introduction: Potential Asbestos Exposure in Construction and Other Non-Fixed Work Operations

There are three distinct situations in which construction industry employees may be exposed to airborne asbestos fibers: (i) when they perform construction, maintenance, alteration or removal services in environments where asbestos fibers routinely may be present; (ii) when they demolish or remove construction materials which contain asbestos; and (iii) when they install or use construction materials which contain asbestos.

The first type of situation will arise when a construction employee performs his services in an existing asbestos products plant. Such a facility is already subject to the current OSHA asbestos standard, and, as a result, construction workers will be protected by the controls installed by the owner of the facility pursuant to the current standard. Two special circumstances deserve attention, however. First, if an emergency arises requiring the use of respirators by the regular employees of the facility, the contractor must either remove his employees from the site or equip them with appropriate respirators. Second, if the work of the contractor disturbs asbestos-containing dust which has accumulated in inaccessible places (for example, on suspended piping, ducts or wiring or on structural surfaces), special precautions (such as spraying with water or vacuuming) may have to be taken to avoid creating

DUP 0948280

airborne fiber concentrations in excess of mandated levels. As detailed above (pp. 21-22), the housekeeping and emergency provisions of Paragraph (f) of the Recommended Standard are intended to deal with these special circumstances.

The second health hazard situation will arise when a contractor performing maintenance, alteration or demolition work must remove construction materials containing asbestos. This is perhaps the most serious asbestos-related health hazard presented in the workplace today. It is serious first, because removal, and particularly demolition, by its nature is destructive and dust generating; second, because the presence of asbestos materials in old structures may be difficult to establish; and third, because friable, dust-producing asbestos products which no longer are marketed may nevertheless be present in older facilities.

As in other construction operations where asbestos health hazards are present, work practices are the only effective means of worker protection in demolition or removal operations. Mandating changes in asbestos construction materials, or even banning their manufacture or sale, will not eliminate the hazard. Nor can permanently installed engineering controls be used to control asbestos dust created by demolition or removal. AIA/NA and AACPP have been studying these operations, and expect to be able to publish in the near future effective work practices which would qualify under Category B of the Recommended Standard.

DUP 0948281

The third health hazard situation, of course, involves the fabrication and installation of asbestos-containing construction materials currently offered in the marketplace. Fortunately, the products which are being used today generate little dust. Sprayed asbestos insulations no longer are used. Spackling compounds and joint tapes contain little, if any asbestos. Air cell thermal insulations have been replaced by cheaper, more efficient glass fiber materials. The asbestos fibers in asbestos-cement products, asbestos-roofing and pipeline felts, drilling muds, paints, and roofing mastics are bonded into or encapsulated by a matrix material, saturant, impregnant or coating. The fibers seldom are released; and the operations which may cause their release are well-defined. Thus, this third asbestos-health hazard situation clearly lends itself to the development and implementation of work practice controls.

As the following table indicates, a variety of asbestos-containing products are presently consumed in the United States, with asbestos-cement products, friction materials, and asbestos-paper products comprising approximately one-half of the total consumption:

DUP 0948282

U.S. Consumption of Asbestos by End Use - 1977

	Short Tons	Percent
Asbestos Cement:		
Pipe	97,000	15.0
Sheets and Shingles	35,000	5.5
Flooring Products:		
Floor Tile	63,000	10.0
Sheet Vinyl	110,000	17.0
Friction Materials	75,000	12.0
Asbestos Paper:		
Roofing Felt	90,000	14.0
Pipeline Felt	10,000	1.5
Other	12,000	2.0
Gaskets and Packings	40,000	6.0
Paints and Coatings	55,000	9.0
Textiles	7,000	1.0
Others	46,000	7.0
TOTAL	640,000	100.0

Source: Johns-Manville Corporation, 1979

Most of the annual production of these materials -- approximately 77% -- is consumed in the construction industry today. 40 Fed. Reg. 47652, 47653 (October 9, 1975). Moreover, based on industry's considerable experience with the use of these products in construction operations, its familiarity

DUP 0948283

with their physical properties, and the results of preliminary testing, there is little doubt that all of these products could be validated under Categories A or B of the Recommended Standard. Because of the efforts of manufacturers of asbestos-containing construction materials to eliminate dangerous products from the marketplace, a large number of products could qualify under Category A for most or, in some cases, all operations in which they are used including the following products:[2/]

Mastics and Black Line Products Roofing Felt

Roofing Felts

Mechanical Packings

Oil Seals

Compressed Gaskets

Sealants and Caulks

Electrical Insulating Paper

In the two suceeding sections of this Appendix, detailed exposure monitoring data are presented showing that effective work practices, which in some cases are already widely used, will ensure that the permissible exposure limits are met for two other products: asbestos-cement pipe and asbestos-cement sheet.

2/ Source: Johns-Manville Corporation

DUP 0948284

DUP 0948285

DU 039212

Recommended Work Practice Procedures
for
Asbestos-Cement Pipe

DUP 0948286

In order to reduce the generation of airborne concentrations of asbestos during the installation of A/C pipe, AACPP designed a field manual containing specific work practices for use with its products. AACPP distributed thousands of copies of this manual to OSHA, construction contractors, municipalities, insurance carriers, states, and others, in an effort to educate and to train their employees in the proper use of the recommended work practice procedures.

Prior to publication, AACPP contracted with Equitable Environmental Health, Inc. (EEH) to study employee exposure to airborne asbestos during field operations. The purpose of the EEH study was to determine the effectiveness of the work practices being recommended. To that end, EEH performed personal monitoring on employees in the following field operations, utilizing, where appropriate, either non-pressure (sewer) pipe and/or pressure (water) pipe:

1. Unloading
2. Laying pipe in the trench
3. Cutting operations on both pressure and sewer pipe
    a. Cutting with hack saw
    b. Cutting with snap cutting equipment
    c. Cutting with abrasive disc, wet
    d. Cutting with abrasive disc, dry
    e. Cutting with hammer, chisel and rasp

DUP 0948287

4. Machining operations
   a. Machining with a manual field lathe
   b. Machining with a power-driven lathe
   c. Cutting and machining with Doty machine
5. Hole Cutting
   a. Hole cutting with power-operated equipment
   b. Hole cutting with drill, hammer and rasp
6. Tapping operations
   a. Dry tapping with Mueller J. tool
   b. Tapping operations with Mueller B-100 tool
7. Coupling removal
   a. Removal of coupling with hammer and chisel

The above operations and processes are representative of the types ordinarily encountered at construction sites installing A/C pipe. Certain qualifications, however, should be identified. First, for those operations monitored by EEH, several options may exist for performing a particular operation, e.g. cutting with various tools or under varying conditions. Where appropriate, these operations are also listed. Second, on any given day, any one or all of those operations listed may be conducted. This, of course, depends on the individual job and its requirements.

Pipe installation, cutting, machining, boring holes, and tapping are considered typical fabrication operations. A/C pipe, as with most other A/C products used in the construction industry, requires minimal field fabrication. For

DUP 0948288

example, A/C pipe is supplied pre-assembled, along with a number of half and quarter lengths to minimize field cutting. When necessary, cutting to length is performed intermittently and only when the pipe terminates, as, for example, in a manhole. During the installation of smaller diameter A/C pipe, tapping is sometimes necessary, for example, when providing customer service lines from the main to the home, or when hook-up from other sources is required. The frequency of these operations is, of course, highly variable.

The total time committed to field fabrication is also quite variable. One particular survey, involving the installation of A/C pipe in seven major urban areas around the United States, reported that an average of 1.1 percent of the total job time involved the cutting, tapping, or machining of A/C pipe. Out of an average of 675 man-hours per job, these operations accounted for approximately 7.5 man-hours per job or 5.3 man-minutes per day.

In conducting their study, EEH considered the intermittent, infrequent, and short-term nature of the operations listed and decided to monitor several successive operations during each sampling period. A short-term sampling period of 15 minutes was selected unless, in the industrial hygienist's judgment, a sufficiently large sample could be obtained in a shorter time period. Additional information on the sampling and anlytical method used in the EEH study as well as a full description of the operations sampled is included in the pages below.

The following tables summarize the results EEH obtained during its validation tests.

DUP 0948289

Table VI

Average Peak Exposures During Unloading/Laying A/C Pipe

Operation	
1. Unloading Pipe	0.1 fibers/cc
2. Laying Pipe	0.1 fibers/cc
Background	Below detectable limit

Table VII

Average Peak Exposures (Up to 15 Minutes) During Other Operations (fibers/cc)

Operation		A/C Sewer Pipe		A/C Pressure Pipe	
		Operator	Helper	Operator	Helper
3.	Cutting Operations				
3a.	Hack Saw	0.18	<0.10	<0.10	0.11
3b.	Snap Cutting	<0.10	<0.10	<0.10	ND
3c.	Abrasive disc, wet	42.10	10.20	65.00	49.20
3d.	Abrasive disc, dry	35.50	64.00	20.30	59.70
3e.	Chisel, hammer and rasp	0.30	0.25	1.99	0.87
4.	Machining Operations				
4a.	Manual Lathe	0.15	0.13	0.51	0.22
4b.	Power Lathe	<0.10	0.10	0.29	0.18
4c.	Cutting and Machining with Doty Machine Dry	3.83	0.29	1.90	2.23
	Dry, Shroud	0.23	0.10	1.29	0.18
	Wet Shroud	0.20	0.10	0.21	0.27
4d.	Tapering Tool with Airduct Pipe	0.18	<0.10		

DUP 0948290

Table VII (Continued)

Operation	A/C Sewer Pipe Operator	A/C Sewer Pipe Helper	A/C Pressure Pipe Operator	A/C Pressure Pipe Helper
4e. Machining with Manual Lathe on Differing Sizes of Pipe				
4-inch pipe			ND	<0.10
8-inch pipe			<0.10	0.13
16-inch pipe			<0.10	<0.10
5. Hole Cutting				
5a. Powerhole Cutter	0.44	0.23	1.65	0.38
5b. Hole Cutting with Drill, Hammer & Rasp	0.23	0.13	0.22	<0.10
6a. Dry Tap with Mueller J Tool	<0.10	<0.10	<0.10	0.10
6b. Tapping Operations with Mueller B-100	<0.10	ND	0.11	0.13
7. Coupling Removal				
7a. Removal of Coupling with Hammer & Chisel	<0.10	ND	0.30	<0.10

It is important to recognize that the above results represent one or more consecutive operations run to a maximum sampling time of 15 minutes. Two operations clearly cannot be recommended and in fact should be prohibited: cutting and machining with Doty tool without a shroud and cutting with abrasive discs.*/ As indicated in the summary data, significant peak exposures can result from their use.

*/ The use of water on specially adapted abrasive disc cutting equipment can reduce asbestos fiber exposures below 2.0 fibers/cc (TWA), as documented by the United Kingdom Health and Safety Executive. Similar results could not be duplicated in the EEH study.

DUP 0948291

As for the other operations, they are intermittent, short-durational operations. For the purpose of calculating 8-hour TWA's, a conservative calculation was made by assuming employees would work at a given operation 1 hour per day. Further, assuming that during the remaining 7 hours of the day they were not exposed, the following 8-hour TWA's would be expected (excluding the two operations not recommended).

Table VIII

Computed Time-Weighted Average Exposures During Operations Involving A/C Pipe (fibers/cc)

Operation		A/C Sewer Pipe		A/C Pressure Pipe	
		Operator	Helper	Operator	Helper
1.	Unloading Pipe	ND			
2.	Laying the Pipe in Trench	ND			
3.	Cutting Operations	<0.10	<0.10		
3a.	Hack Saw	<0.10	<0.10	ND	<0.10
3b.	Snap Cutting	<0.10	<0.10	ND	ND
3c.	Chisel, Hammer and Rasp	<0.10	<0.10	0.25	0.11
4a.	Manual Lathe	<0.10	<0.10	<0.10	<0.10
4b.	Power Lathe	<0.10	<0.10	<0.10	<0.10
4c.	Cutting and Machining with Doty Tool				
	Dry, Shroud	<0.10	<0.10	0.16	<0.10
	Wet, Shroud	<0.10	ND	<0.10	<0.10

DUP 0948292

Table VIII Continued

Operation		A/C Sewer Pipe		A/C Pressure Pipe	
		Operator	Helper	Operator	Helper
4d.	Tapering Tool with Airduct Pipe	0.10	ND		
4e.	Manual Lathe				
	4-inch pipe			ND	ND
	8-inch pipe			ND	< 0.10
	16-inch pipe			ND	< 0.10
5a.	Power Hole Cutter	< 0.10	< 0.10	0.21	< 0.10
6a.	Dry Tap with Mueller J Tool	< 0.10	ND	< 0.10	< 0.10
6b.	Tapping Operations with Mueller B-100	< 0.10	ND	< 0.10	< 0.10
7a.	Removal of Coupling with Hammer and Chisel	< 0.10	< 0.10	< 0.10	< 0.10

In addition to the analysis performed above, Table IX below was constructed to illustrate the theoretical TWA range of exposures which might be anticipated when working with A/C pipe during pipeline installation. The theoretical TWA exposure range is calculated by assuming the duration of the operation ranged from 15 minutes to 2 hours, with the remaining time calculated at zero exposure.

DUP 0948293

Table IX

Ranges of Eight-hour Time-weighted Average Concentrations Derived From Equitable Environmental Health, Inc. Data

Operation		A/C Sewer Pipe		A/C Pressure Pipe	
		Operator	Helper	Operator	Helper
1.	Unloading Pipe	ND			
2.	Laying the Pipe In Trench	ND			
3.	Cutting Operations				
3a.	Hack Saw	*<0.10	ND-<0.10	ND	ND-<0.10
3b.	Snap Cutting	ND-<0.10	ND-<0.10	ND	ND
3c.	Chisel, Hammer and Rasp	<0.10	<0.10	<0.10-.50	<0.10-.22
4a.	Manual Lathe	<0.10	<0.10	<0.10-.12	<0.10
4b.	Power Lathe	ND-<0.10	ND-<0.10	<0.10	<0.10-.14
4c.	Cutting and Machining with Doty Tool				
	Dry, Shroud	<0.10	ND-<0.10	<0.10-.32	<0.10
	Wet, Shroud	<0.10	ND	<0.10	<0.10
4d.	Tapering Tool with Airduct Pipe	<0.10			
4e.	Manual Lathe				
	4-inch pipe			ND	ND
	8-inch pipe			ND	<0.10
	16-inch pipe			ND	ND-<0.10
5a.	Power Hole Cutter	<0.10-.12	<0.10	0.10	<0.10-.10

*/ No range is reported when both values were < 0.10 f/cc.

DUP 0948294

Table IX Continued

Operation	A/C Sewer Pipe		A/C Pressure Pipe	
	Operator	Helper	Operator	Helper
6a. Dry Tap with Mueller J Tool	ND- 0.10	ND	ND-0.10	ND- 0.10
6b. Tapping Operations with Mueller B-100	ND- 0.10	ND	ND-0.10	0.10
7a. Removal Coupling with Hammer and Chisel	ND- 0.10	ND- 0.10	0.10	ND- 0.10

As shown in Tables VI, VII, VIII, and IX, the use of certain work practices for A/C pipe will provide effective worker protection that can be feasibly and practically implemented in the construction industry.

Following the completion of the EEH study, AACPP published and distributed nearly 85,000 copies of its field manual, "Recommended Work Practices for A/C Pipe." The recommendations set forth in the manual are based on the data developed by EEH and experience gained in the field. Based on the wide-spread acceptance of the manual, the American Water Works Association (AWWA) adopted these same work practice recommendations and included them in their manual M-16 1 "Work Practices for Asbestos-Cement Pipe."

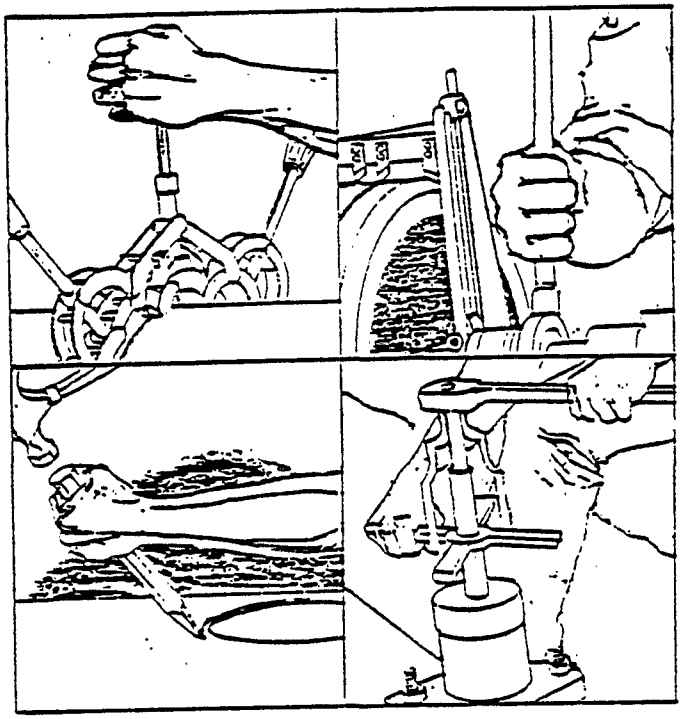
AACPP is convinced that when recommended work practices are followed, no adverse health effects will be realized during normal employment in a construction environment where A/C pipe is used. It is the position of the asbestos

DUP 0948295

industry that similarly safe and effective work practices can be developed to assure employee protection during the use of all asbestos-containing products in the construction industry.

The following publication sets forth recommended work practices for A/C Pipe.

DUP 0948296



Recommended Work Practices for A/C Pipe

DUP 0948297

Products and Operations

Types of A/C Pipe Products covered by these work practices include:

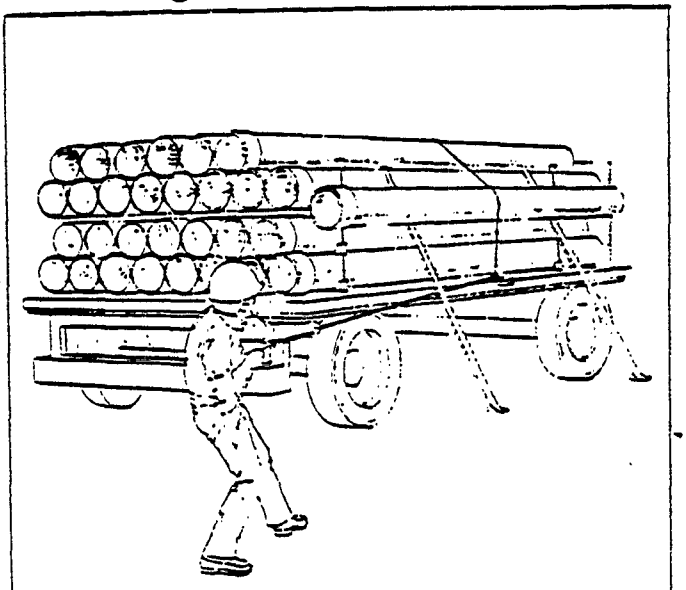
"Class" Pressure Pipe
"Transmission" Pressure Pipe
Pressure Sewer Pipe
Gravity Sewer Pipe
Building Sewer Pipe
Storm Drain Pipe
Perforated Underdrain Pipe
Electrical Conduit
Telephone Duct
Air Duct

Operations to which these work practices apply include:

Shipping, Receiving and Handling
Cutting
Machining
Hole Cutting
Tapping
Coupling Removal
Housekeeping and Waste Disposal

DUP 0948298

Shipping, Receiving, Handling and Assembly*



A/C pipe is shipped clean from the factory and carefully loaded using methods acceptable to the carrier. Loading, unloading, stringing out and assembling A/C pipe are essentially dust-free operations. Even in enclosed spaces, airborne asbestos fiber levels from pipe handling operations are far below existing and proposed occupational standards.

All hand and mechanical unloading operations should be carried out in accordance with the manufacturer's installation manuals.

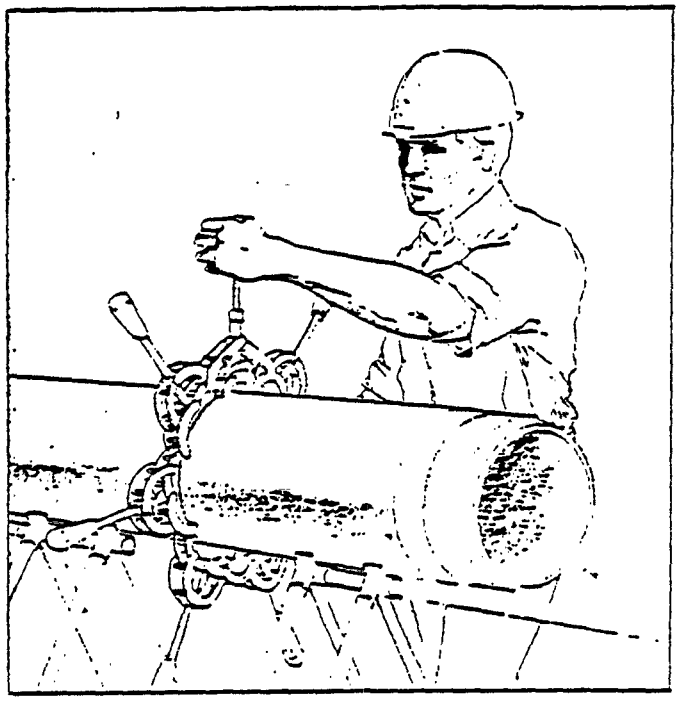
A/C Pipe Products: All
Size Range: All

*Exposure data not currently available. Recommendation based on exposure data for operations believed to be comparable.

DUP 0948299

- 22b -

Cutting Carbide Blade Equipment

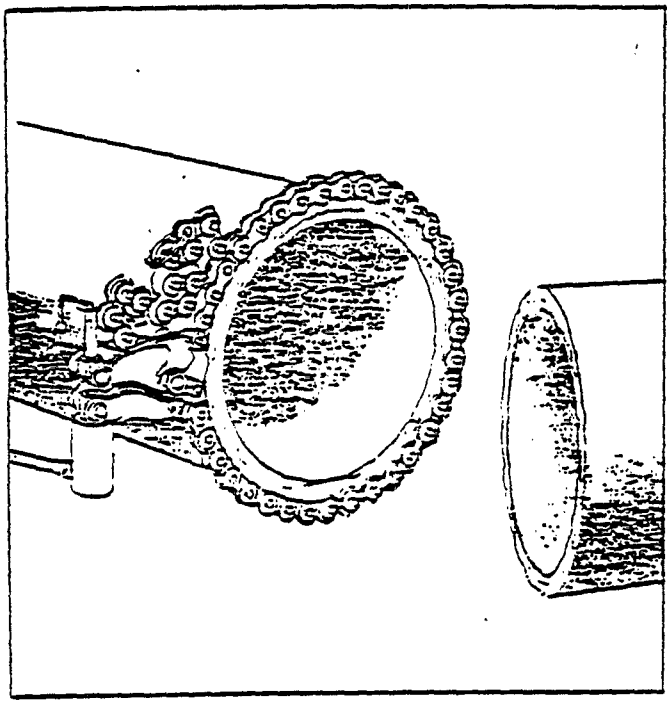


Blade cutters consist of a frame adjustable to the circumference of the pipe and a number of outboard, self-tracking rollers that align one or more carbide-dipped cutting blades. Blade cutters are typically hand-operated. Due to the relatively low mechanical input and clean cutting action, significant amounts of airborne asbestos dust are not produced.

A/C Pipe Products: All
Size Range: 3" through 24"

DUP 0948300

Cutting
Snap Cutting Equipment

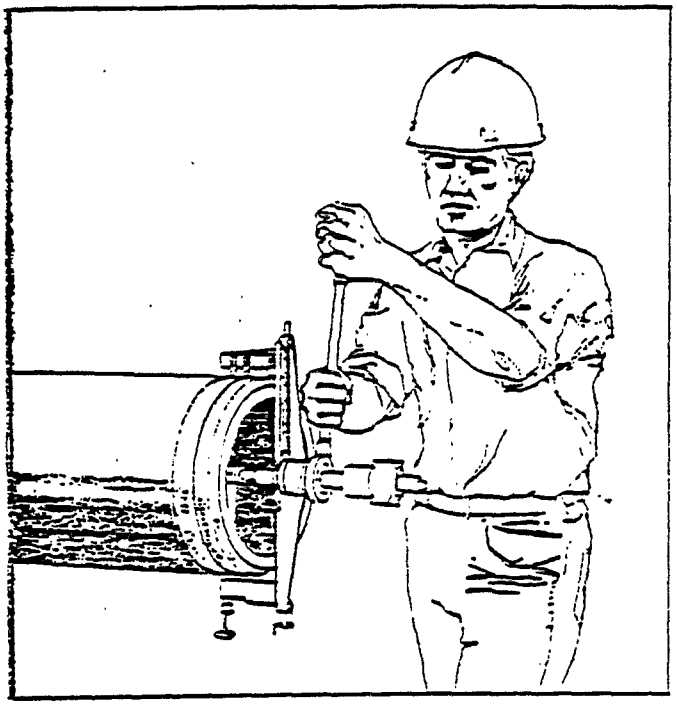


Snap cutters or "squeeze and pop" equipment operates by means of cutting wheels mounted in a chain wrapped around the pipe barrel. Hydraulic pressure, applied by means of a remote electric or manually-operated pump, simultaneously squeezes the cutting wheels into the pipe wall until the cut is made.

AMC Pipe Products: All
Size Range: Pressure Pipe—3" through 24"
Pressure, Gravity and Building Sewer; Storm Drain; Air, Electrical and Telephone Duct—3" through 36"

DUP 0948301

Machining
Field Lathe–Manual

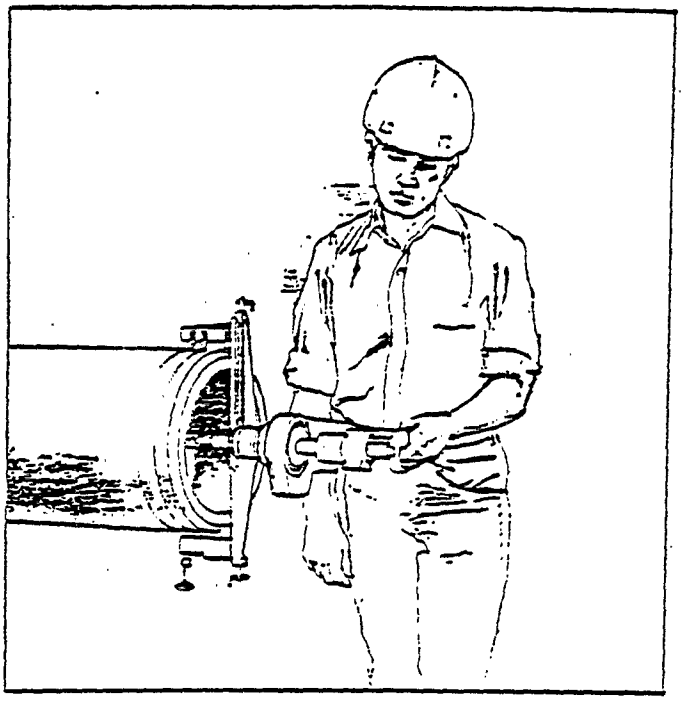


Manual field lathes are designed to end-trim and re-machine rough pipe barrels to factory-machined end profiles. The lathe consists of an adjustable, self-aligning arbor inserted into the pipe bore (which acts as a mandrel upon which the turning handle operates), a screw-fed turning frame, carbide machining blades and manual (hand or ratchet) turning handles.

A/C Pipe Products: All
Size Range: All

DUP 0948302

Machining
Field Lathe–Power

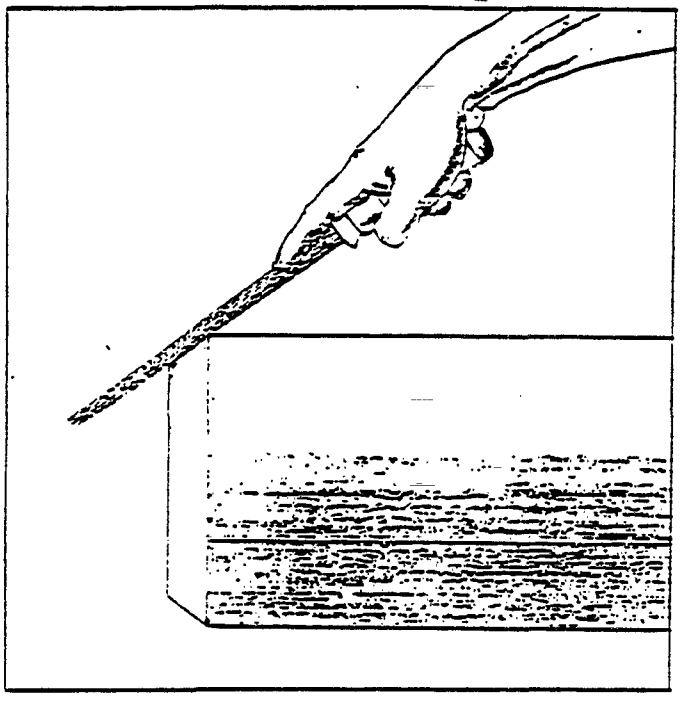


Power field lathes, like manual lathes, are designed to end trim and re-machine rough pipe barrels to factory-machined end profiles. The lathe consists of an adjustable, self-aligning arbor inserted into the pipe bore (which acts as a mandrel upon which the turning handle operates), a screw-fed turning frame, carbide machining blades and electric or pneumatic power drive.

A/C Pipe Products: All
Size Range: All

DUP 0948303

Machining Rasp--Manual*



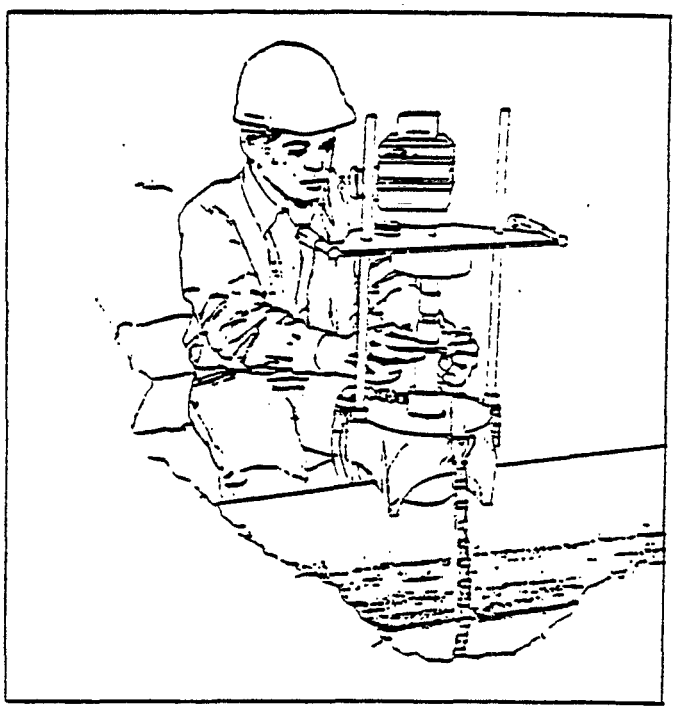
Short lengths of A/C pipe (MEE's & MOA's) can be cut for pipe closures, repairs and to locate fittings exactly. Field cut ends may be rebeveled with a coarse wood rasp to form a taper approximating the same profile as the factory-beveled end.

A/C Pipe Products: All
Size Range: All

*Exposure data not currently available. Recommendation based on exposure data for operations believed to be comparable.

DUP 0948304

Hole Cutting Shell Cutters



For field connections into A/C pipe, clean, even entry cuts may be accomplished by means of shell cutting equipment. Shell cutters consist of a hole cutter housing mounted on the pipe, a carbide or diamond-tipped hole cutter and a manual ratchet, pneumatic, electric or gasoline drive to power the cutting head.

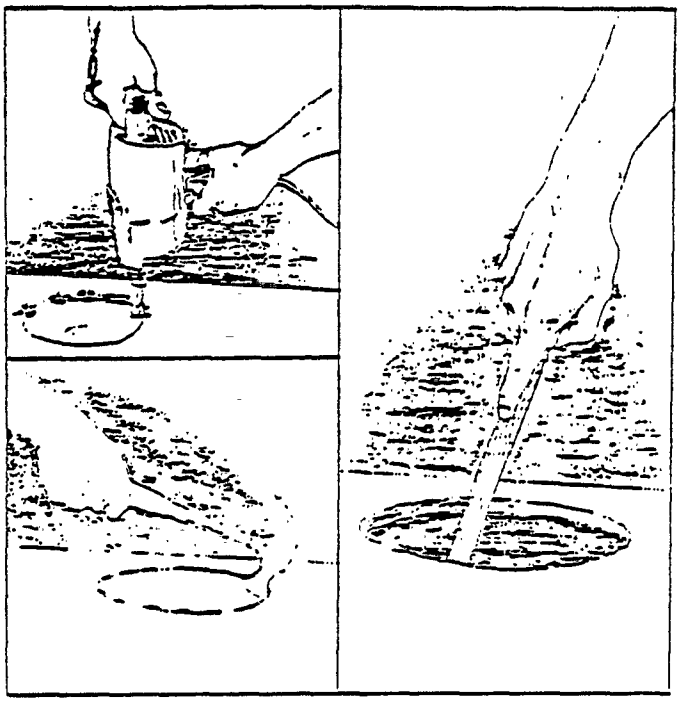
When cutting holes in A/C pipe products, all dust and cuttings should be removed from the pipe or duct interior after the cutting operation. Removal may be accomplished by flushing with water, wet mopping or vacuuming prior to placing in service. DO NOT BLOW OUT WITH COMPRESSED AIR OR DRY SWEEP.

A/C Pipe Products: Pressure, Gravity and Building Sewer
Air Duct

Size Range: All

DUP 0948305

Hole Cutting
Drill and Rasp*



Field connections may be made with a heavy duty electric drill and rasp. Using a carbide-tipped drill, a series of closely-spaced holes are first drilled around the hole outline. The disc is knocked free with a hammer and the edges of the hole are dressed with a coarse wood rasp.

When cutting holes in A/C pipe products, all dust and cuttings should be removed from the pipe or duct interior after the cutting operation. Removal may be accomplished by flushing with water, wet mopping or vacuuming prior to placing in service. DO NOT BLOW OUT WITH COMPRESSED AIR OR DRY SWEEP.

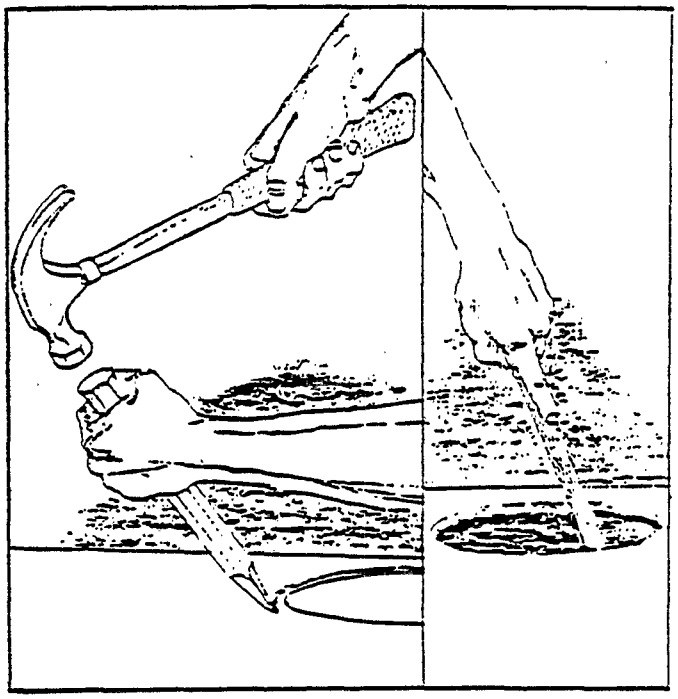
A/C Pipe Products: Pressure, Gravity and Building Sewer; Air Duct

Size Range: All

*Exposure data not currently available. Recommendation based on exposure data for operations believed to be comparable.

DUP 0948306

Hole Cutting
Chisel and Rasp



Holes may be cut into A/C pipe with a hammer and chisel. The edge of a plumber's wood chisel is used to cut completely around the hole outline, about a ¼" from the prescribed line. The operation is repeated and the cut deepened until through. The edges of the hole are then dressed with a coarse wood rasp.

When cutting holes in A/C pipe products, all dust and cuttings should be removed from the pipe or duct interior after the cutting operation. Removal may be accomplished by flushing with water, wet mopping or vacuuming prior to placing in service. DO NOT BLOW OUT WITH COMPRESSED AIR OR DRY SWEEP.

A/C Pipe Products: Pressure, Gravity and Building Sewer; Air Duct

Size Range: All

DUP 0948307

Tapping Non-Pressure*

Non-pressure or "dry" tapping for service connections may be performed in or above the trench. The equipment is affixed to the pipe by means of a chain yoke. Separate drills and taps or a combination tool drills and taps the pipe wall. Corporation stops or other connections may then be affixed to the pipe.

To minimize (a) the fouling of valves, regulators, meters, etc. with chips and (b) unnecessary addition of asbestos to drinking water, all dust and cuttings should be removed from the pipe interior by flushing with water, wet mopping or vacuuming prior to placing in service. DO NOT BLOW OUT WITH COMPRESSED AIR OR DRY SWEEP.

A/C Pipe Products: Pressure Pipe
Size Range: All

*Exposure data not currently available. Recommendation based on exposure data for operations believed to be comparable.

DUP 0948308

Tapping Pressure*

Pressure or "wet" tapping for service connections is performed in the trench while the pipe is under pressure. The equipment (manual or power driven) is affixed to the pipe by means of a chain yoke. A combination boring and inserting bar drills and taps the pipe wall and inserts a corporation stop or pipe plug. The pressure chamber, which protects against water leakage, also catches the asbestos-cement chips, so this is essentially a dust-free operation.

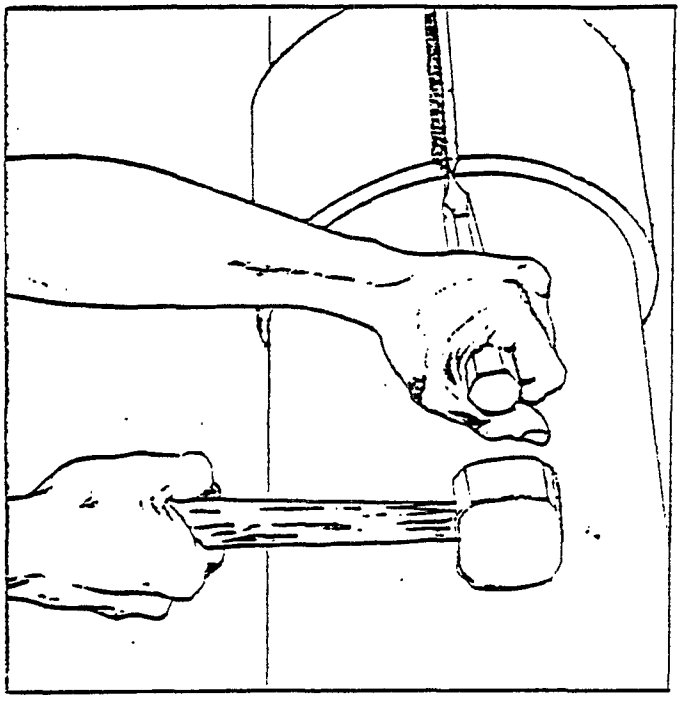
To minimize (a) the fouling of valves, regulators, meters, etc. with chips and (b) unnecessary addition of asbestos to drinking water, provisions should be made for downstream flushing or use of tapping equipment with positive purge or "blow-off" features.

A/C Pipe Products: Pressure Pipe
Size Range: All

*Exposure data not currently available. Recommendation based on exposure data for operations believed to be comparable.

DUP 0948309

Coupling Removal Hammer and Chisel*



Replacement of damaged pipe necessitates excavation, exposure and removal. Coupling removal may be accomplished by gradually splitting the coupling lengthwise, using a chisel and ball-peen hammer. After the top of the coupling has been split, a crowbar or similar tool is used as a lever to split the bottom of the coupling.

A/C Pipe Products: All pipe with A/C couplings
Size Range: All

*Exposure data not currently available. Recommendation based on exposure data for operations believed to be comparable.

DUP 0948310

Housekeeping and Waste Disposal

Housekeeping is an important part of any safe construction operation. It is even more essential when airborne dust created by the *lack* of good housekeeping has the potential for harm to employees or others.

EQUIPMENT: All external surfaces of equipment should be maintained free of dust accumulations that might, if dispersed, create asbestos fiber concentrations above permissible exposure limits.

WASTE DISPOSAL: Asbestos-cement chips and cuttings from the field operations described in this booklet should be disposed of in a manner that will not contribute airborne asbestos dust to the atmosphere. Where cutting and machining operations are performed at the construction site, the chips should be placed in the trench and buried with the pipeline.

Where operations are performed at a central location such as a contractor's or distributor's yard on a more or less continuing basis, the chips and cuttings may be collected and mixed wet with cement and made into non-friable forms. These forms may be used in the trench as supports for cast iron fittings and valves, as appropriate.

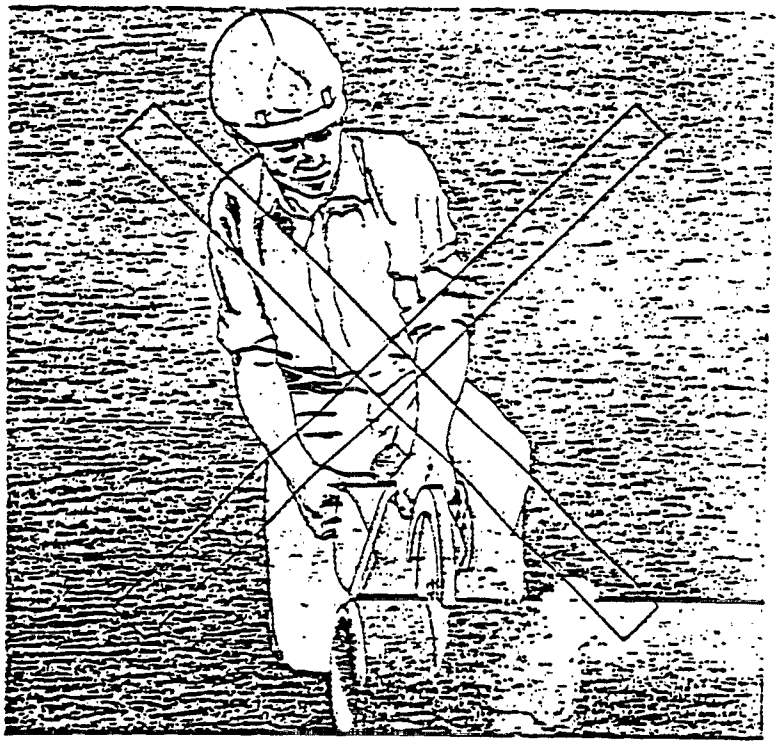
Otherwise, chips and cuttings should be collected in sealed bags or closed containers impermeable to asbestos dust. *Loose material should never be dry swept.* When vacuum equipment is available, it should be used. Water or other dust suppressants should be applied in those circumstances where sweeping is unavoidable. DO NOT BLOW WASTE MATERIAL WITH COMPRESSED AIR.

No visible emissions to the atmosphere may result from the collection, processing, packaging, transporting or deposition of any asbestos-containing material. Wastes should be disposed at a site operated in accordance with the requirements or applicable national, state or local laws.

DUP 0948311

Section 2
Non-Recommended Work Practices *

Cutting Any A-C Pipe Using Abrasive Disc-Dry Tools.



Power-driven saws with abrasive discs (masonry blades) should not be used for dry cutting or beveling A-C pipe. Abrasive disc cutters produce concentrations of airborne dust that exceed OSHA permissible levels. *This work practice is therefore specifically not recommended.*

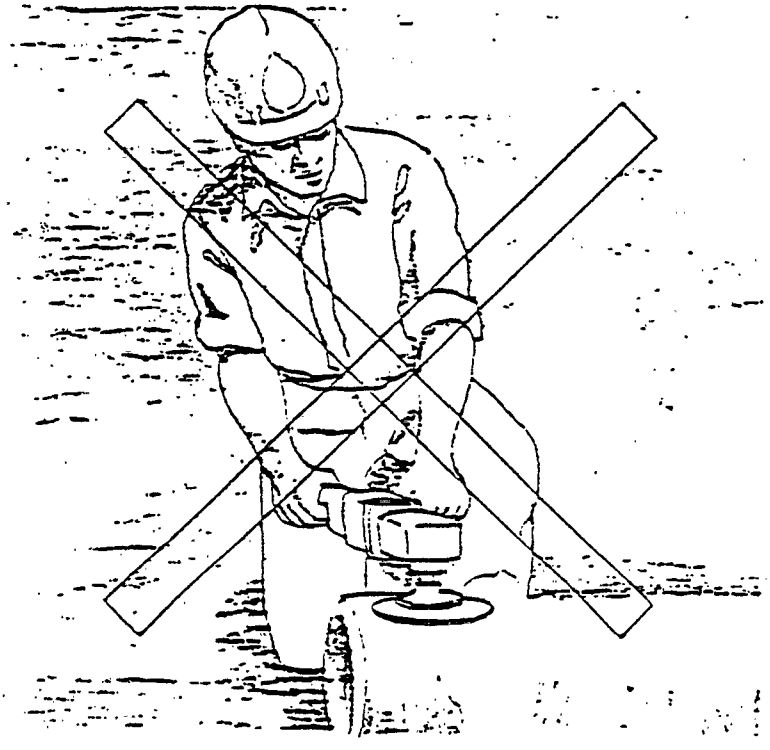
* This recommendation was excerpted from the work practices manual prepared by the American Water Works Association.

DUP 0948312

DU 039239

WORK PRACTICES FOR ASBESTOS-CEMENT PIPE *

Machining Any A-C Pipe Using Right-Angle Sanders or Other Dry High-Speed Abrasive Tools.



Power-driven abrasive-disc sanders should not be used for shaping or beveling A-C pipe. Abrasive discs produce concentrations of airborne dust that exceed OSHA permissible levels. *This work practice is therefore specifically not recommended.*

* This recommendation was excerpted from the work practices manual prepared by the American Water Works Association.

DUP 0948313

Sampling Methodology
and
Operations Sampled
for Asbestos-Cement Pipe

DUP 0948314

METHODS

Air samples were collected on 37-millimeter diameter, 0.8 micron pore size Millipore cellulose ester membrane filters in accordance with OSHA and NIOSH recommendations. They were all "open-face" (with the cover of the filter cassette removed) samples. Personal sampling pumps were operated at flow rates ranging from 1.6 to 2 liters per minute. The pumps were calibrated by the soap bubble technique before use. Both area and personal (breathing-zone) samples were taken. In the latter, the pump was attached to the worker's belt and the filter clipped to his lapel near his face.

All samples were analyzed by a laboratory accredited by the American Industrial Hygiene Association, following OSHA and NIOSH methods. Briefly, the analytic procedure consisted of rendering the filter transparent with a high viscosity solution of membrane filter material in a mixture of diethyl oxalate and dimethyl phthalate. The asbestos fibers which lie on the surface of the filter are counted with a phase contrast microscope at 400x magnification. The count area was delineated with a Porton graticule. Only fibers exceeding 5 micrometers in length were counted. The laboratory examined 100 microscopic fields or counted 100 fibers, whichever came first. Fiber identification depended upon a particle having an aspect ratio of at least 3:1 and having approximately parallel sides.

DUP 0948315

It should be emphasized that estimates of fiber concentrations below 2 fibers/cc are becoming increasingly less precise, and those below 0.5 fibers/cc have a fairly wide margin of error, often being based on the observation of relatively few fibers. Thus, although counts are reported as calculated to two decimal places, differences in counts in these ranges should not be overinterpreted.

OPERATIONS SAMPLED

(1) Unloading. This operation was performed with a palletized or "unitized" load, the standard packing/shipping method for A/C pipe using a forklift. The 8 inch pipe was arranged on 4 foot pallets, 8 per bed, plus miscellaneous short lengths and couplings. Using a fork lift, it took approximately 15 minutes to unload a two-bed truck. For this operation, a single 24-minute personal sample was taken on the fork-lift operator while pressure pipe was being unloaded.

(2) Laying the pipe in trench. The operation which was studied involved trenching, laying pipe, and back-filling simultaneously. One worker remained in the trench at the forward end of the pipe. The second worker worked both topside and in the trench. He attached a lowering clamp to the pipe, lubricated the pipe end, then entered the trench to help guide it into place for coupling. Two 1 1/2

DUP 0948316

hour samples were collected in addition to personal samplers taken from the two workers.

(3a) Cutting with hack saw. A standard hack saw with a hardened steel blade was used for this operation. The blade was changed before each run. Sampling times ranged from 12 to 15 minutes, during which time it was possible to cut about one-half way through the 8" pressure pipe. This tool was not used with sewer pipe.

(3b) Cutting with snap cutting equipment. For this portion of the study, a Wheeler Chain Cutter (Model 2990) was used. It has cutting discs mounted on a chain which is wrapped around the pipe. The action is controlled hydraulically by an operator who can stand as far as 10 to 15 feet from the pipe being cut. The set-up between cuts took about two minutes. Pumping to build up pressure required about 15 seconds. Five to 8 cuts were made during each sampling period; the average ranged from 14 to 16 minutes for sewer pipe and 13 to 16 minutes for pressure pipe.

(3c) Cutting with abrasive disc, wet. A gasoline-powered abrasive disc saw (Stihl) with a 10-inch carbide blade was used. Four 1/4 inch diameter plastic hoses were mounted on the housing of the saw, two on a side. These were connected to a manifold to which was attached a hose delivering water at a rate of 2 to 3 gallons per minute.

DUP 0948317

A preliminary run was made with a saw that proved to be underpowered, requiring 18 minutes for two cuts. With a more powerful saw (1 1/2 hp motor) a cut would be completed in approximately 1 1/2 minutes. Two to 3 cuts were taken per sample, the sampling periods having been reduced to 3 to 6 minutes after an initial test sampling period of 17 minutes had led to overloading of the filter with dust. This test was run on pressure pipe only.

(3d) Cutting with abrasive disc, dry. A gasoline-powered abrasive disc saw (Stihl) with a 10" diameter carbide blade was used in this test. When cutting with the saw, the operator held the saw while the helper rolled the pipe along the ground toward or away from him. No machining of the ends was performed with this method of cutting. On both sewer and pressure pipe, one cut would be made in 30 to 45 seconds. Each peak sample included four cuts.

(3e) Cutting with hammer, chisel, and rasp. The pipe was cut with a hammer and chisel, and the edges then smoothed with a course file. The helper rotated the pipe as the operator worked. Two cuts of sewer pipe, each taking 4 to 6 minutes, were made during the short-term or peak sampling period. Cutting the pressure pipe lasted 11 minutes, and only one cut was made per sample.

(4a) Machining with a manual field lathe. The equipment (Pilot Ratchet Field Lathe, Model B-12R) was attached to the

DUP 0948318

end of an 8-inch pipe supported 2 to 3 feet from the ground. The lathe had two sets of blades, one for the actual cut and the other to machine and profile the pipe end. The depth of cut could be adjusted manually with screws. A ratchet allowed the operator to turn the lathe by pumping a handle. The helper adjusted the depth of cut as the lathe rotated about the pipe and also assisted in lathe turning. For sewer pipe, one complete cycle took about 8 minutes, i.e., 2 minutes to cut and 6 to 7 minutes for set-up and machining. Each short-term peak sample represented two cycles. Cutting pressure pipe took longer, 4 minutes for cutting and 8 to 9 minutes for set-up and profiling. Each short-term sample covered a single cut.

(4b) Machining with a power-driven lathe. The electric-powered lathe (Pilot Powered Field Lathe, Model B-12P) worked on the same principle as the manual lathe. Due to the ease of operation, a helper was unnecessary. Sewer pipe took 1/2 to 1 minutes to cut and 4 1/2 to 5 1/2 minutes to profile. Two cycles were completed for each short-term ("peak") sample. Again, cutting pressure pipe took longer, 1 1/2 minutes to cut and 5 to 6 minutes to profile; two cycles were used per sample.

(4c) Cutting and machining with Doty machine. The Doty machine is custom-manufactured equipment which has two

DUP 0948319

operating stations, one for cutting, and one for machining. It has three operating modes: dry, dry with shroud, and wet with shroud. The last two modifications were designed to reduce dust generation and dispersion. During tests of the tool in the dry mode with shroud and wet mode with shroud, a plastic bag was placed over the blade to reduce dust.

All cuts were made wet, because a diamond blade was used. A fine spray of water was directed across the blade during operations. A single cut requires one-half minute.

Machining was performed dry with no shroud, dry with shroud, and wet with shroud. Again for the wet mode, a fine spray was used. The operation took about 1 minute with most of the sampling time used for moving pipe. The Doty tool was essentially a one-man operation, a helper was needed only to move large diameter pipe.

Two to four cuts and two to four machining operations were completed per sample cycle. Because visible dust was raised by the dry mode, sampling time was reduced from approximately 51 minutes to approximately 10 minutes. Observers also noted that visible dust was released during bevelling on the dry mode with shroud tests. It was suggested that a gasket or some other seal would be helpful in preventing this.

Sampling times recorded during use of the Doty tool, wet, for pressure pipe were 10 to 11 minutes and for sewer

DUP 0948320

pipe 9 to 15 minutes. In operations involving the Doty tool with shroud the sampling times for pressure pipe were 13 to 17 minutes, and for sewer pipe, 12 to 14 minutes. For usage of the Doty Tool, wet with shroud, 13 to 18 minute sampling times were employed for pressure pipe, 12 to 16 minutes for sewer pipe.

(4d) Use of tapering tool with A/C air duct.

Testing of the tapering tool was limited to 10-inch A/C air duct pipe, which has a wall thickness of approximately 1/4 inch. Its operating principle is similar to that of the manual field lathe. Sampling times ranged from 14 to 22 minutes which included one cut and one tapering operation.

(4e) Machining with manual lathe on differing sizes of pipe. In order to determine whether pipe size had a detectable influence on dust production, a manual lathing operation was carried out on pressure pipe with 4-inch, 8-inch, and 16-inch diameters. For the 4-inch pipe, there was one cut and one machining operation for each sample. The set-up required about 3 minutes, the cut about 3 minutes; the second set-up about 4 minutes, and machining about 8 minutes. The replicate samples ranged 13 to 21 minutes.

For 8-inch pipe, one cut and one machining operation were performed for each sample. The set-up required about 3-1/2 minutes, the cut about 2 minutes; the second set-up took about 2 minutes and machining about 10 minutes. The replicate samples ranged from 19 to 21 minutes.

DUP 0948321

For the 16-inch pipe there was one partial cut per sample including some machining and some cutting. The set-up required 3 minutes, the cutting about 12 minutes, the second set-up about 2 minutes, and machining about 20 minutes.

(5a) Hole cutting with power-operated equipment. The tool used for this operation (Pilot Hole Cutter, Model HC-38E) is available with either an electric or gasoline engine. In this test, a gasoline powered engine was used to cut a 4 1/2" diameter hole with a small center plug. The cutter was secured to the pipe with a chain. The engine rotated the blade while the operator continuously adjusted the height of the blade. The helper aided in equipment set-up. It took about 1 minute to cut a hole in sewer pipe and 1 1/2 to 2 minutes for pressure pipe. A two minute set-up time was required between hole cutting operations. Four holes were cut for each peak sample.

(5b) Hole cutting with drill, hammer and rasp. For this operation, 5/8 inch holes were drilled on the pipe in a circular pattern about 6 inches in diameter, after which the central portion was knocked out with a hammer and the rough edges smoothed with a rasp. The operator used the exhaust air from the drill to blow off excess dust. The drilling took a long time to complete, so that only about 3/4 of the circumference was finished in one sampling period. Therefore, some samples did not include the hammer and file

DUP 0948322

steps. Sampling times for pressure pipe ranged from 16 to 24 minutes, for sewer pipe, from 17 to 21 minutes.

(6a) Dry tapping with Mueller J tool. The Mueller J tool is used for tapping pipe for customer service connections. In field operations, the operation may be done at the trench tap, or in the trench. A manually operated tool, which cuts a hole and threads it, was used. Two one-inch holes were cut per sampling period. Sampling periods for pressure pipe were 14 to 29 minutes, for sewer pipe 15 to 18 minutes.

(6b) Tapping operations with Mueller B-100 tool. The Mueller B-100 tool is used for tapping pipes already in place and containing water. In the field, a hole is dug to expose the pipe; for the test, an uninstalled pipe was used. It has a pressure chamber to keep the water from flowing out. For the tests, this chamber was filled with water to simulate "wet" tapping conditions. There were two holes cut per sampling period. For pressure pipe, the sampling times were 14 to 19 minutes, for sewer pipe 14 to 19 minutes.

(7a) Removal of coupling with hammer and chisel. A hammer and chisel were used to make a longitudinal trough in the coupling. When this was completed, a crowbar was used to separate the coupling. For pressure pipe, this operation took about 22 minutes with one coupling being removed per sample. For sewer pipe, the same procedure

DUP 0948323

took about 10 minutes per sample. It was soon found that by placing the chisel midline on the coupling, one or two sharp hits would split the coupling, a procedure which took only 10-30 seconds per coupling. For sewer pipe, 3 to 4 couplings were cut per sample, with the major portion of the sampling time used while the pipe was moved and secured to supports.

DUP 0948324

DUP 0948325

DU 039252

Recommended Work Practice Procedures
for
Asbestos-Cement Sheet

DUP 0948326

Shortly after the promulgation of the original asbestos standard in 1972, the Johns-Manville (J-M) Corporation actively began pursuing the development of local exhaust systems for use with portable power tools used in the field fabrication of A/C sheets. Initial attempts to interest tool manufacturers to market a product that was equipped with a hood and suitable for attachment to a vacuum source met with little success. This setback was partially due to the fact that the demand for such specialized equipment had not evolved as rapidly as the development of the exposure standard. Additionally, portable vacuum systems, meeting the efficiency necessary to filter asbestos dust, were also not available.

During the period between 1973 and 1975, two new vacuum systems were introduced. One was a semi-portable, high efficiency system developed by the Hoffman Company; the other, a much smaller but equally efficient unit, was developed by the Niefisk Company of Sweden. With these advances, J-M undertook an in-house tool development program. Several prototypes were examined and tested, ranging from retrofitted enclosures to systems designed specifically for individual tools. A suitable system was eventually developed in 1975. J-M approached tool manufacturers with their new designs and again, was told there was no interest in marketing such a product line.

DUP 0948327

The tool designs, as well as the vacuum specifications necessary for efficient operation, were first made available by J-M in 1975. AIA/NA subsequently released a pamphlet on A/C sheet illustrating the use of these systems a year later.

Although considered effective, the exhaust system designed for the circular saw was somewhat awkward, i.e., a separate vacuum box collected dust from the bottom of the sheet during cutting operations. In 1977, J-M began development of an improved system. This continued through 1978 and eventually led to the development of a new hood design; one that enclosed the entire saw and eliminated the need for a vacuum box. This design was further refined in early 1979. The Pilot Tool Manufacturing Company (manufacturers of A/C pipe tools) was approached by J-M in early 1979 and agreed to purchase portable tools and equip them with the hoods designed by J-M. Subsequently, the J-M designs were further improved under Pilot's direction.

Through the diligent and persistent effort of J-M, portable power tools equipped with a high velocity/low volume exhaust system are now available for use with A/C sheet.

Air monitoring tests were conducted by J-M on operations involving the use of a circular saw and drill equipped with the newly designed system. The results of these tests are reported in Table XV below.

DUP 0948328

Table XV

Air Monitoring Test Results Using Circular Saw and Drill

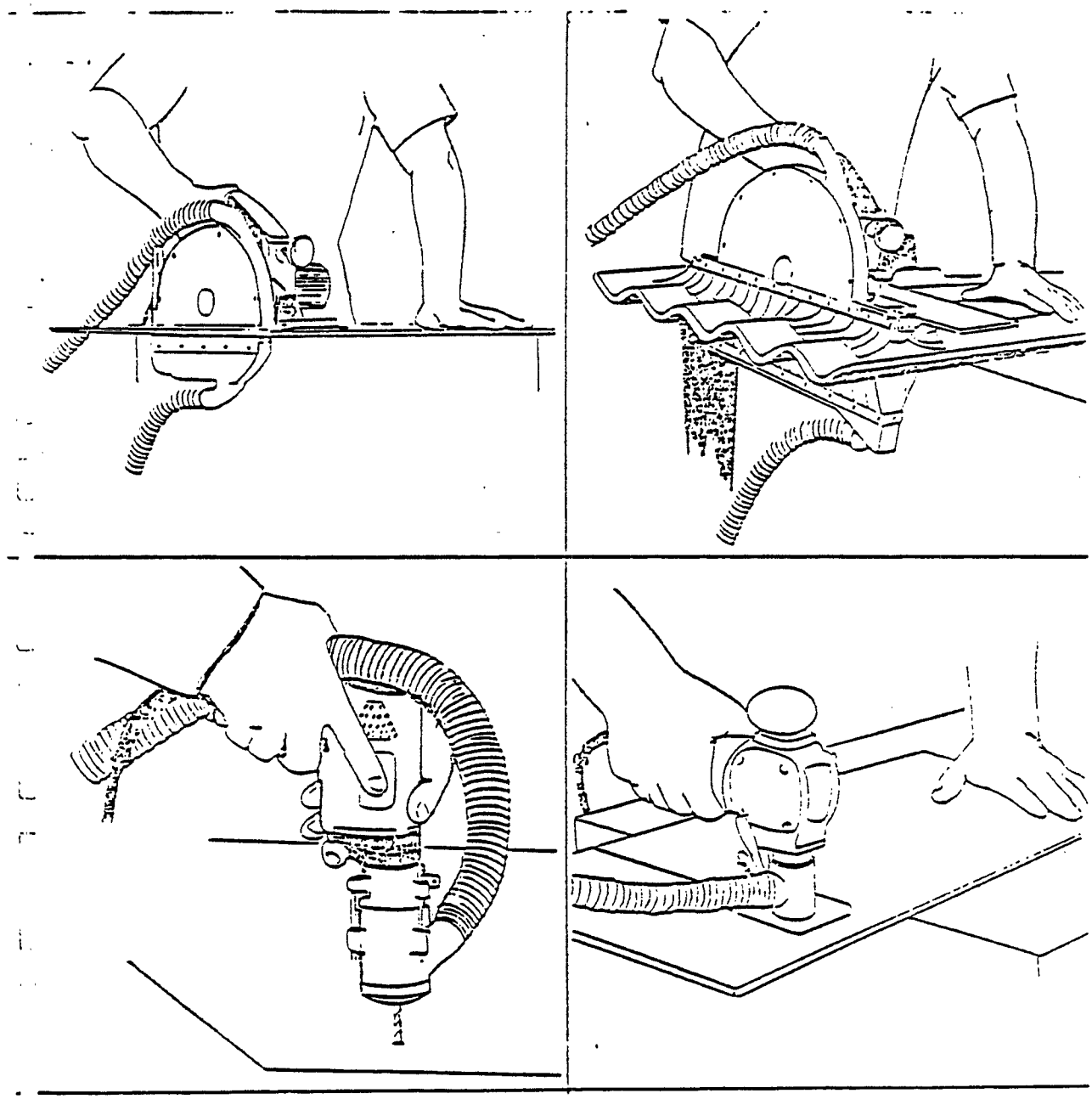
Equipment	Test Conditions*	Test Duration	Material Fabricated			Dust Concentration
			Type	Quantity	Quantity/ Minute	(personal)
Drill with dust pickup shroud	1/4 inch masonary bit, operated at full speed. Drilled downward through horizontal board	40 min	1/4 inch flat A/C sheet	163 holes	4.08 holes	< 0.1
Circular saw with dust pick-up shroud	Totally enclosed shroud masonary blade	40 min	1/4 inch flat A/C sheet	720 inch	18 inch	0.0

Based on these results, as well as the results from other testing (e.g., saber saws), a work practice manual was developed. Its primary purpose is to inform the users of A/C sheet products of the proper tool selection and work practices which would permit the field fabrication of asbestos-cement sheets in an acceptably dust-free manner. Excerpts from this manual, entitled "Recommended Work Practices for A/C Sheet," are reproduced below.

* All tests conducted in an open room.

Source: Johns-Manville Corporation

DUP 0948329



RECOMMENDED WORK PRACTICES
FOR
FIELD FABRICATION
OF
ASBESTOS-CEMENT SHEET

DUP 0948330

DU 039257

Products and Operations

The following work practices are applicable to flat and corrugated A/C sheet products.

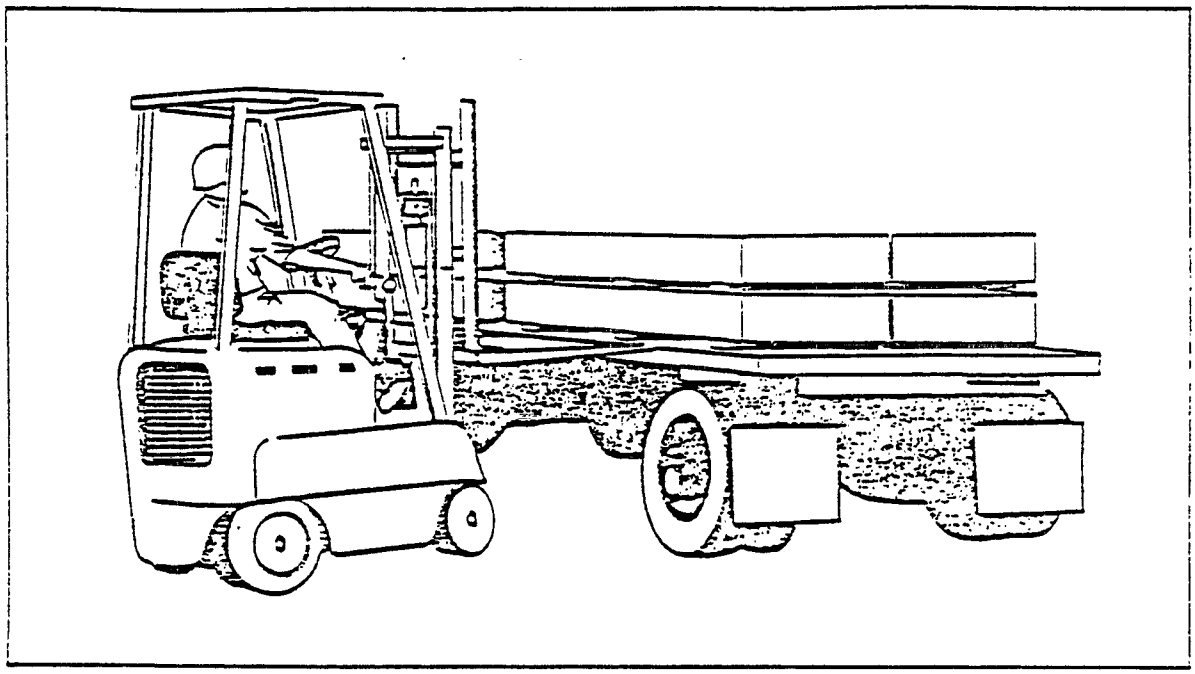
Operations to which these work practices apply include:

Shipping, Receiving and Handling
Cutting
Drilling
Hole Cutting and Cutouts
Housekeeping and Waste Disposal

Equipment used with these work practices is available from the sources shown in the equipment list.

DUP 0948331

Shipping, Receiving and Handling

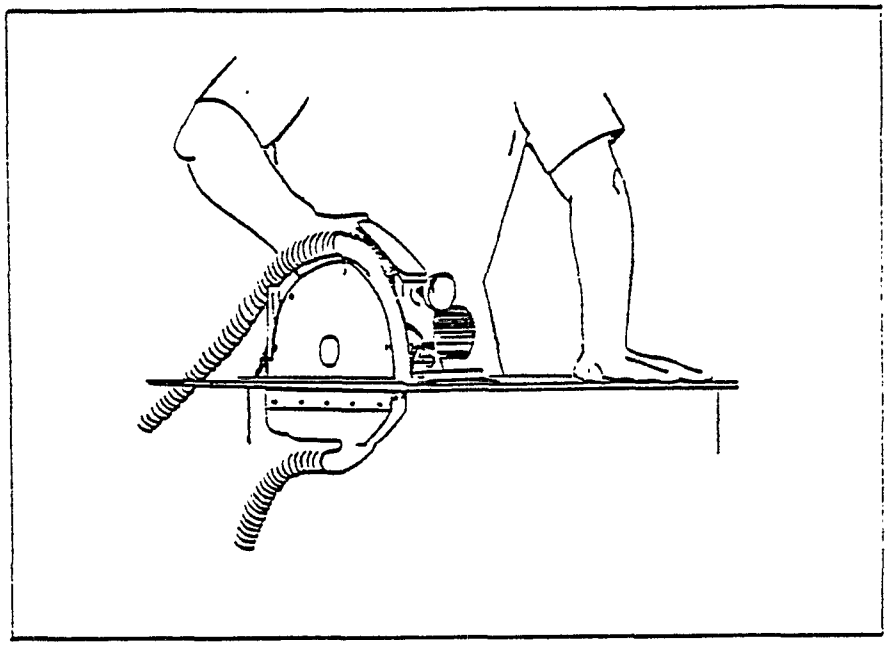


A/C sheet is shipped from the factory with clean surfaces, generally in pallet loads, using shipping methods acceptable to the producer and the customer.

All unloading operations should be carefully performed to avoid sheet damage. Pallet loads are normally unloaded by fork truck. Small shipments may require manual unloading.

DUP 0948332

Cutting - Flat Sheets
Circular Saw



Circular Saw With Dust Collection Hood

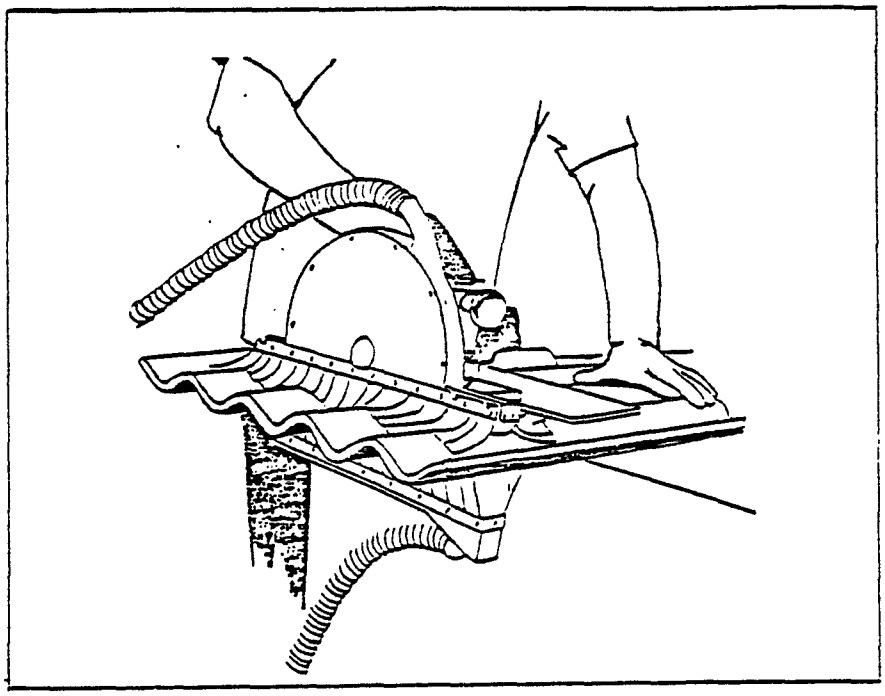
Circular saws for cutting flat sheets should be used only when equipped with the specific dust collection hoods pictured above. Exhaust ventilation and dust collection is provided by a vacuum cleaner as described in the specifications (page 15).

A circular saw cuts by a "pulverizing" action which releases asbestos fibers and fine particulate. The combination of hood and vacuum source is highly effective in capturing and collecting these particles and fibers. Saw operating techniques are those normally employed. No special procedures are required except adjustment of the lower hood section to suit thickness of sheet being cut. Saw design requires the use of blades recommended by the tool supplier (abrasive disc or diamond).

For additional information on saw operation, refer to the supplier's instructions in Appendix A.

DUP 0948333

Cutting - Corrugated Sheets
Circular Saw



Circular Saw With Dust Collection Hood

Circular saws for cutting corrugated sheets should be used only when equipped with the specific dust collection hood pictured above. Exhaust ventilation and dust collection is provided by a vacuum cleaner as described in the specifications (page 15).

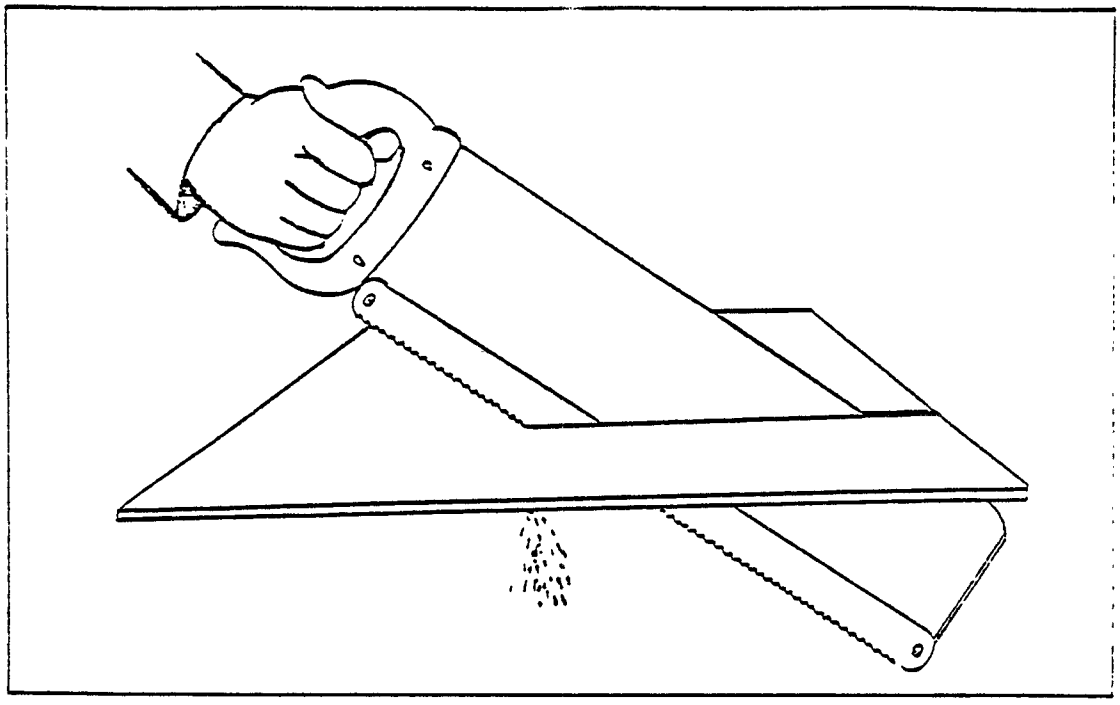
A circular saw cuts by a "pulverizing" action which releases asbestos fibers and fine particulate. The combination of hood and vacuum source is highly effective in capturing and collecting these particles and fibers. Saw operating techniques are those normally employed. Saw design requires the use of blades recommended by the tool supplier (abrasive disc or diamond).

This tool depends on pliable "fingers" to seal the cutting zone and is designed for use on sheets with 1 1/2" deep corrugations. For cutting sheets with deeper or irregular corrugations, consult the tool supplier.

For additional information on saw operation, refer to the supplier's instructions in Appendix A.

DUP 0948334

Cutting - Handsaw



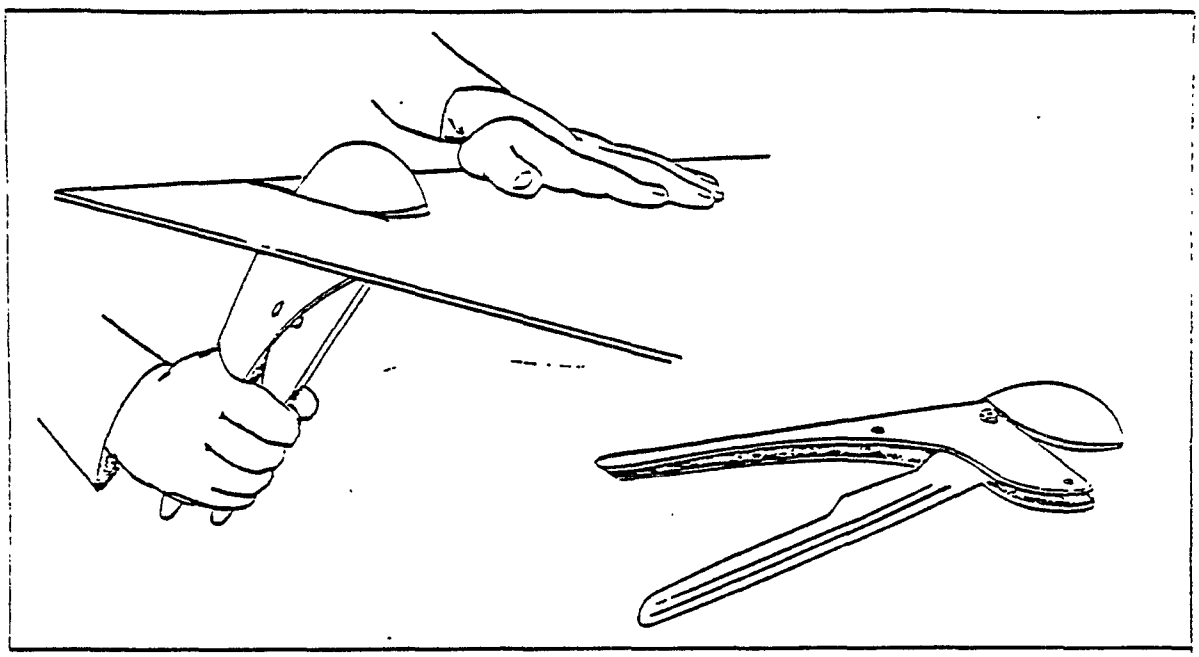
Handtools
Handsaw

This is a handsaw equipped with a carbide blade designed for cutting asbestos-cement sheet. Practical use of this saw is limited by its slow cutting speed. It is most useful in operations where cutting is infrequent and of short duration.

Because of the slow cutting speed, saw operation generates coarse particles of asbestos-cement with few airborne fibers. Its use does not require dust collection equipment for compliance with present exposure limits.

DUP 0948335

Cutting - Flat Sheets
Hand Clippers



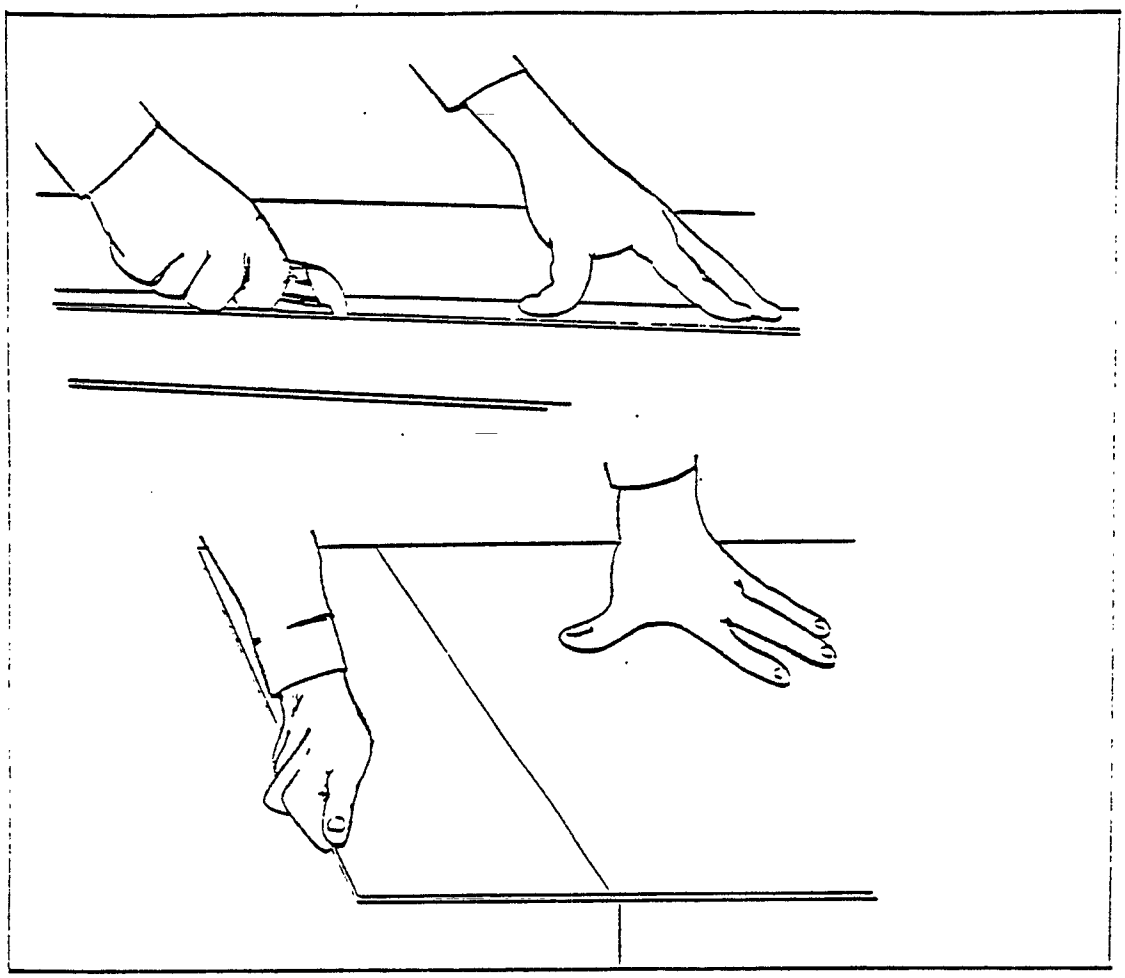
Handtools
Hand Clippers

These hand clippers are designed for cutting sheet material up to 1/4" in thickness. Practical use is limited by slow cutting speed. It is most useful in operations where cutting is infrequent and of short duration.

The clipper cutting action generates coarse particles of asbestos-cement with few airborne fibers. Its use does not require dust collection equipment for compliance with present exposure limits.

DUP 0948336

Cutting - Flat Sheets
Score & Snap Knife

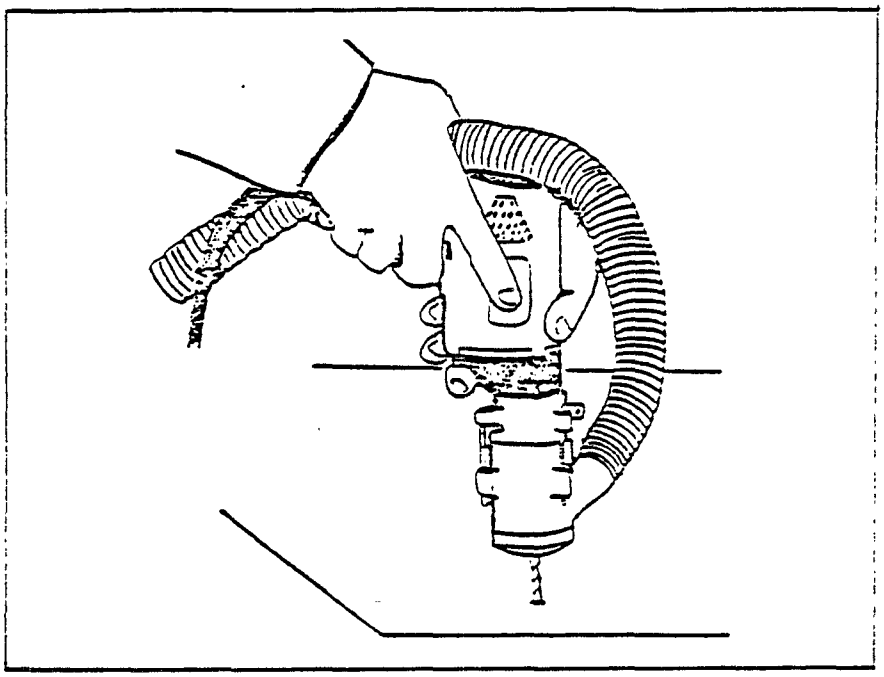


Handtools
Scoring Knife

The scoring knife can be used with sheets up to 1/4" in thickness. However, it performs best with sheets 1/8" and 3/16" thick. The sheet is placed on a worktable or saw horses. A suitable guide bar is placed or clamped along the cut line and the sheet scored repeatedly. After scoring, the sheet is hand snapped along the score line. This cutting procedure generates little dust and few airborne fibers. Its use does not require dust collection equipment for compliance with present exposure limits.

DUP 0948337

Drilling - Power Drill



Drill With Dust Collection Hood

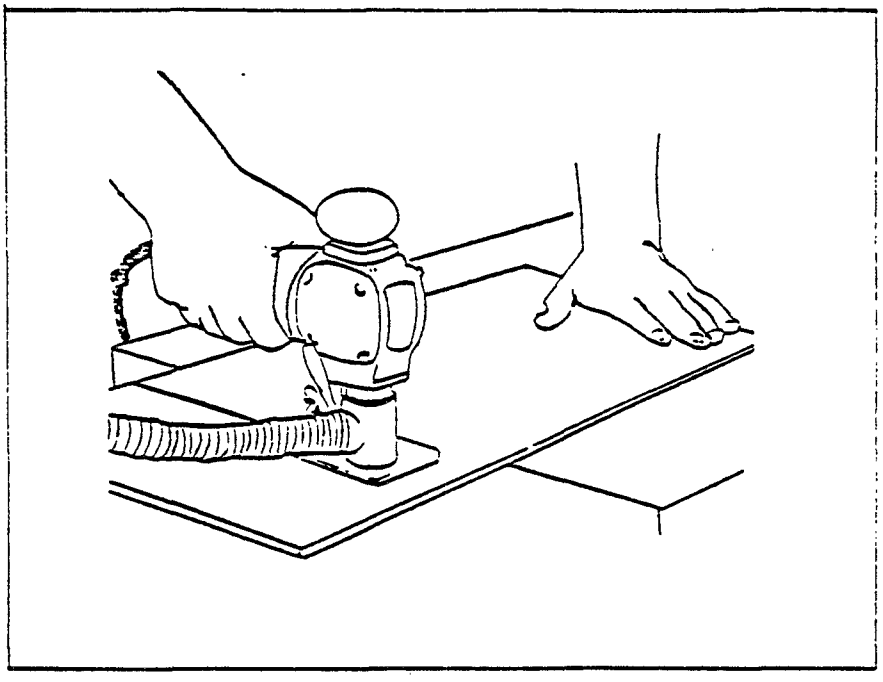
Drilling of small holes (1/4" or less) on vertical surfaces, or downward usually can be done without dust collection equipment and in compliance with present exposure limits.

Drilling of larger holes, and drilling overhead, requires dust collection equipment on the drill in order to achieve compliance. Equipment includes a hood (Cape Universal Building Products, Ltd.) and vacuum cleaner to provide exhaust ventilation and dust collection. Vacuum cleaner should be as described in specifications (page 15).

Drilling techniques are those normally employed. No special procedures are required.

DUP 0948338

Hole Cutting and Cutouts - Flat Sheets
Sabre Saw



Sabre Saw With Dust Collection Hood

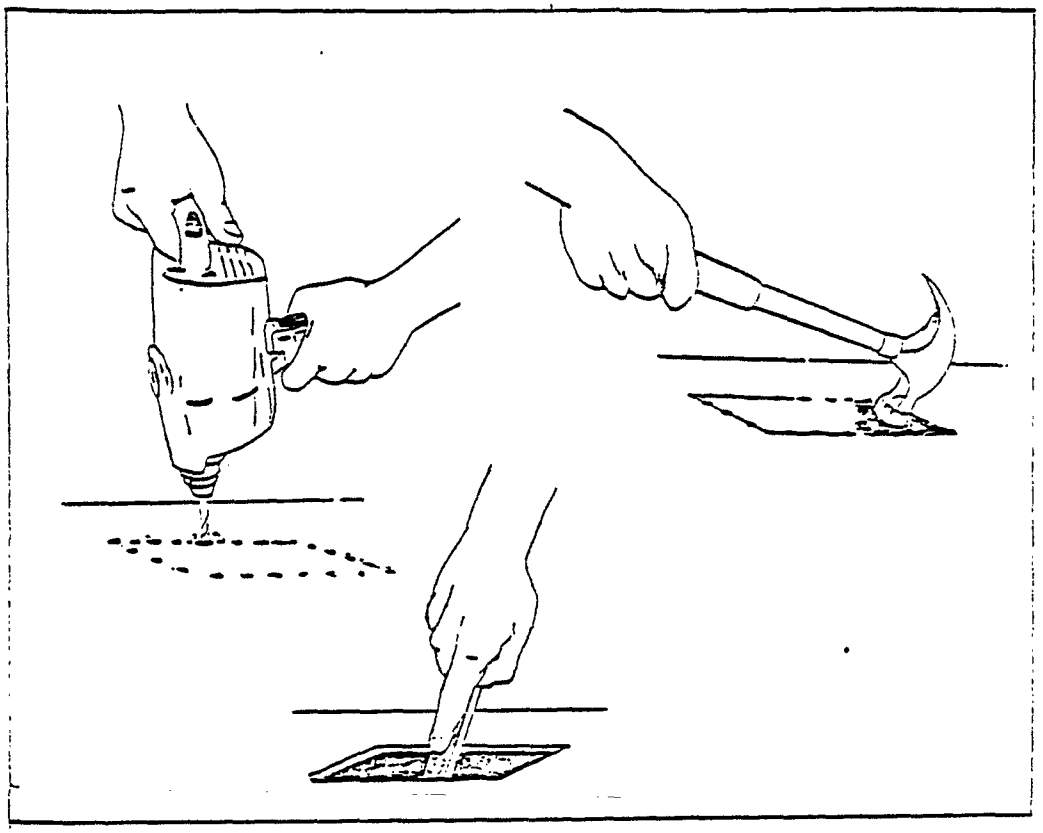
Sabre saws should be used only when equipped with the specific dust collection hood pictured above. Exhaust ventilation and dust collection is provided by a vacuum cleaner as described in the specifications (page 15).

Saw operating techniques are those normally employed. No special procedures are required.

For additional information on saw operation, refer to supplier's instructions in Appendix A.

DUP 0948339

Hole Cutting and Cutouts - Drill and Rasp



A simple method of making cutouts is to drill small holes around the edge of the opening to be cut and knocking out the material to be removed with a hammer. A rasp is used to dress or bevel edges of the cut.

This procedure does not require dust collection equipment for compliance with present exposure limits.

DUP 0948340

Vacuum Cleaner Specifications

(Values shown below are minimum recommended)

Circular Saw - Flat and Corrugated Sheet Cutting

Vacuum (lift):	59" W.G. (water gage)
Airflow:	175 SCFM (standard cubic feet per minute)
Filtration System:	Multi-stage, designed for use with asbestos-containing dusts.
Dust Collection:	Unit must be provided with, or capable of using, a disposable plastic or paper bag for collecting and removing dust.

Sabre Saw and Drill

Vacuum (lift):	59" W.G.
Airflow:	65 SCFM
Filtration System:	See Above
Dust Collection:	See Above

DUP 0948341

DU 039268

Housekeeping and Waste Disposal

Housekeeping is an essential part of any safe construction operation. It is even more essential when airborne dust created by the lack of good housekeeping has the potential for harm to employees and others.

EQUIPMENT: All external surfaces of equipment should be maintained free of dust accumulations that might, if dispersed, create asbestos fiber concentrations above permissible exposure limits.

WASTE DISPOSAL: Asbestos-cement dust chips and cuttings from the field operations described in this booklet must be collected in a manner that will not contribute airborne asbestos dust to the atmosphere. *Loose material should never be dry swept.* When vacuum equipment is available, it should be used. Water or other dust suppressants should be applied in those circumstances where sweeping is unavoidable. DO NOT BLOW WASTE MATERIAL WITH COMPRESSED AIR.

No visible emissions to the atmosphere are permitted from the collection, processing, packaging, transporting or deposition of any asbestos-containing material. Wastes must be collected and disposed in accordance with the requirements of the U.S. Environmental Protection Agency. For full text of EPA waste disposal requirements (40 CFR, Chapter 1, Part 61) refer to Appendix C.

DUP 0948342

Equipment Suppliers

Tools shown in this pamphlet are available from:

Wheeler-Pilot International
P. O. Box 3128
20433 Earl Street
Torrance, CA 90510
(213) 371-1233

Nilfisk of America, Inc.
201 King Manor Drive
King of Prussia, PA 19406
(215) 277-3900

Suppliers claiming to have vacuum cleaning units suitable for use with asbestos-containing dusts are:

American Cleaning Equipment Corp., 111 South Route 53, Addison, IL 60101

Beamco, Inc., 707 Stierlin Road, Mountain View, CA 94040

Breuer Electric Manufacturing Co., 5100 No. Ravenswood Ave., Chicago, IL 60640

Hild Floor Machine Co., Inc., 5339 West Lake St., Chicago, IL 60644

Kari-Vac Inc., 4360 W. 127th St., Alsip, IL 60658

Nilfisk of America, 201 King Manor Drive, King of Prussia, PA 19466

Pullman/Holt Products, 10702 46th Street, Tampa, FL 33617

Vac-U-Max, 227 Main St., Belleville, NJ 07109

Wheeler-Pilot International, 20433 Earl Street, Torrance, CA 90510

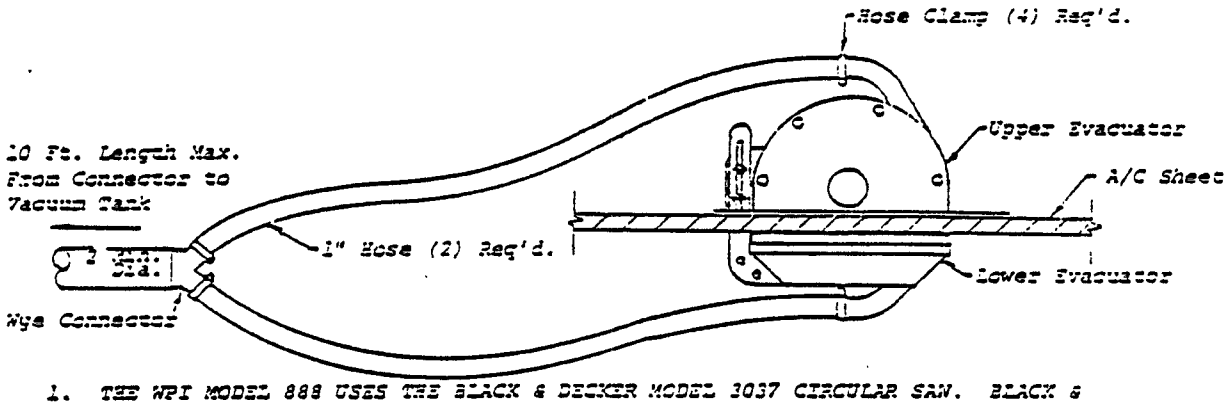
Note:

It is recognized that equipment suppliers other than those listed above may be available. Mention of any company is not to be considered an endorsement by AIA/NA.

DUP 0948343

7-11-79

OPERATING INSTRUCTIONS
WHEELER-PILOT FLAT SHEET CIRCULAR SAW
MODEL 888



1. THE WPI MODEL 888 USES THE BLACK & DECKER MODEL 3037 CIRCULAR SAW. BLACK & DECKER OPERATING INSTRUCTIONS FOR MODEL 3037 MUST BE READ AND UNDERSTOOD PRIOR TO OPERATION.

2. ONLY VACUUM CLEANERS CERTIFIED BY THE MANUFACTURER FOR USE WITH ASBESTOS DUST AND HAVING A CAPABILITY OF 175 CFM MINIMUM ARE TO BE USED WITH THIS TOOL. A VACUUM HOSE OF NOT LESS THAN 2 INCH DIAMETER AND NOT MORE THAN 10 FEET LONG IS TO BE USED BETWEEN THE WYE CONNECTOR AND VACUUM TANK. THE VACUUM MANUFACTURER'S OPERATING INSTRUCTIONS MUST BE READ AND UNDERSTOOD BEFORE OPERATION.

3. INSPECT ALL SYSTEM ELEMENTS FOR CRACKS, PUNCTURES OR OPENINGS, i.e. HOOD, VACUUM HOSE AND CONNECTORS. REPAIR OR REPLACE ANY FAULTY ITEM OR PART.

4. CONNECT THE VACUUM HOSES AS SHOWN, INSURING ALL CONNECTIONS AND CLAMPS ARE TIGHT.

5. TURN ON VACUUM AND CHECK FOR ANY STOPAGES OR AIR LEAKS IN THE VACUUM LINE OR HOOD AND INSURE ADEQUATE AIR FLOW IN THE OPEN AREA OF THE SAW.

6. IF ANY LEAKS OR STOPAGES ARE LOCATED, CHANGE OR REPAIR FAULTY ITEM.

7. ADJUST LOWER EVACUATOR SO THAT THE RUBBER SKIRT CONTACTS THE UNDERSIDE OF THE SHEET TO BE CUT.

8. CONNECT CIRCULAR SAW TO ELECTRICAL OUTLET AND FEED INTO WORK. THERE SHOULD BE VIRTUALLY NO VISIBLE DUST OR DEBRIS. IF EXCESS DUST IS VISIBLE, (a) CHECK VACUUM CLEANER BAG FOR OVERLOAD-PER MANUFACTURER'S INSTRUCTIONS, (b) CHECK LINES FOR AIR LEAKS AND (c) CHECK PROPER ADJUSTMENT OF LOWER EVACUATOR.

9. AVOID USING EXCESSIVE FORCE FEEDING SAW INTO WORK. IF GREAT FORCE IS REQUIRED, STOP AND CHECK TOOL FOR PROPER OPERATION.

BLADE REPLACEMENT
(IN ADDITION TO BLACK & DECKER OPERATING INSTRUCTIONS)

1. DISCONNECT UNIT FROM ELECTRICAL OUTLET.
2. LOWER OR REMOVE LOWER EVACUATING HOOD.
3. REMOVE (4) SCREWS AND COVER TO EXPOSE BLADE.
4. GRASP THE EXPOSED LOWER PORTION OF THE BLADE AND REMOVE HUB SCREW WITH WRENCH.
5. BLADE CAN BE REMOVED OR REPLACED (CAUTION: SILICON CARBIDE BLADES MUST BE MOUNTED WITH APPROPRIATE SIDE OUT, THE BLADES ARE MARKED ACCORDINGLY).

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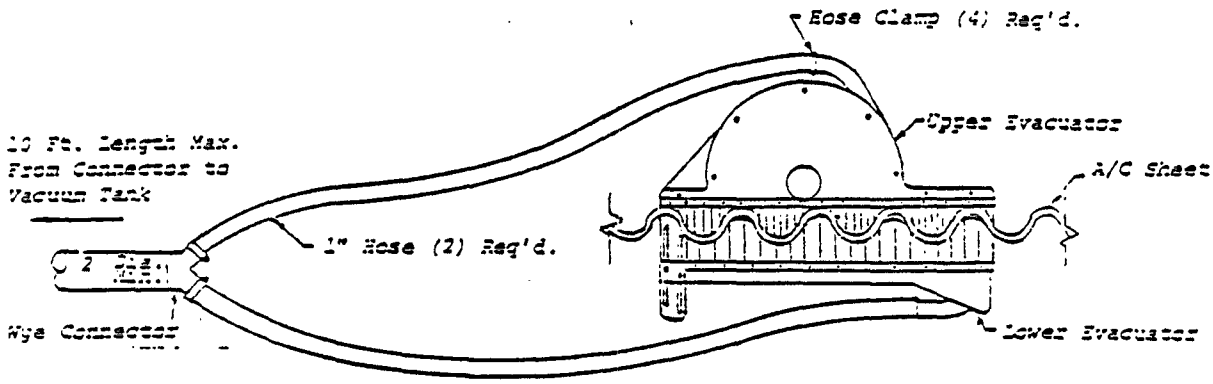
7-11-73

OPERATING INSTRUCTIONS
WHEELER-PILOT CORRUGATED SHEET CIRCULAR SAW
MODEL 998



1. THE WPI MODEL 998 USES THE BLACK & DECKER MODEL 3037 CIRCULAR SAW. BLACK & DECKER OPERATING INSTRUCTIONS FOR MODEL 3037 MUST BE READ AND UNDERSTOOD PRIOR TO OPERATION.

2. ONLY VACUUM CLEANERS CERTIFIED BY THE MANUFACTURER FOR USE WITH ASBESTOS DUST AND HAVING A CAPABILITY OF 175 CFM MINIMUM ARE TO BE USED WITH THIS TOOL. A VACUUM HOSE OF NOT LESS THAN 2 INCH DIAMETER AND NOT MORE THAN 10 FEET LONG IS TO BE USED BETWEEN THE WYE CONNECTOR AND VACUUM TANK. THE VACUUM MANUFACTURER'S OPERATING INSTRUCTIONS MUST BE READ AND UNDERSTOOD BEFORE OPERATION.

3. INSPECT ALL SYSTEM ELEMENTS FOR CRACKS, PUNCTURES OR OPENINGS, i.e., HOOD, VACUUM HOSE AND CONNECTORS. REPAIR OR REPLACE ANY FAULTY ITEM OR PART.

4. CONNECT THE VACUUM HOSES AS SHOWN, INSURING ALL CONNECTIONS AND CLAMPS ARE TIGHT.

5. TURN ON VACUUM AND CHECK FOR ANY STOPAGES OR AIR LEAKS IN THE VACUUM LINE OR HOOD AND INSURE ADEQUATE AIR FLOW IN THE OPEN AREA OF THE SAW.

6. IF ANY LEAKS OR STOPAGES ARE LOCATED, CHANGE OR REPAIR FAULTY ITEM.

7. ADJUST LOWER EVACUATOR SO THAT THE RUNNERS ON THE INSIDE OF THE SKIRT FINGERS ARE APPROXIMATELY 1/4 INCH FROM THE BOTTOM OF THE SHEET.

8. CONNECT CIRCULAR SAW TO ELECTRICAL OUTLET AND FEED INTO WORK. THERE SHOULD BE VIRTUALLY NO VISIBLE DUST OR DEBRIS. IF EXCESS DUST IS VISIBLE, (a) CHECK VACUUM CLEANER BAG FOR OVERLOAD-PER MANUFACTURER'S INSTRUCTIONS, (b) CHECK LINES FOR AIR LEAKS AND (c) CHECK PROPER ADJUSTMENT OF LOWER EVACUATOR.

9. AVOID USING EXCESSIVE FORCE FEEDING SAW INTO WORK. IF GREAT FORCE IS REQUIRED, STOP AND CHECK TOOL FOR PROPER OPERATION.

BLADE REPLACEMENT
(IN ADDITION TO BLACK & DECKER OPERATING INSTRUCTIONS)

1. DISCONNECT UNIT FROM ELECTRICAL OUTLET.
2. LOWER OR REMOVE LOWER EVACUATING HOOD.
3. REMOVE (3) SCREWS AND COVER TO EXPOSE BLADE.
4. GRASP THE EXPOSED LOWER PORTION OF THE BLADE AND REMOVE HUB SCREW WITH WRENCH.
5. BLADE CAN BE REMOVED OR REPLACED (CAUTION: SILICON CARBIDE BLADES MUST BE MOUNTED WITH APPROPRIATE SIDE OUT, THE BLADES ARE MARKED ACCORDINGLY)

DUP 0948345

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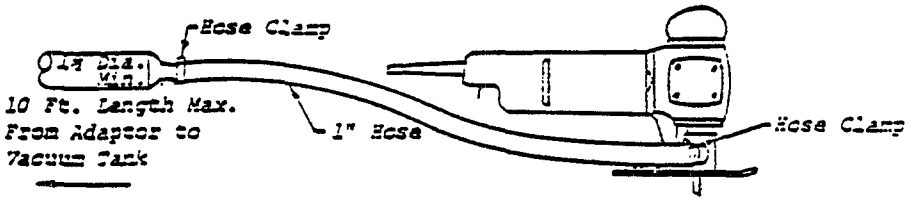
7-11-79

OPERATING INSTRUCTIONS
WEILER-PILOT SABER SAW
MODEL 879



1. THE WPI MODEL 879 USES THE BLACK & DECKER MODEL 3155 SABER (JIG) SAW. BLACK & DECKER OPERATING INSTRUCTIONS FOR MODEL 3155 MUST BE READ AND UNDERSTOOD PRIOR TO OPERATING THIS UNIT.

2. ONLY VACUUM CLEANERS CERTIFIED BY THE MANUFACTURER FOR USE WITH ASBESTOS DUST AND HAVING A CAPABILITY OF 65 CFM MIN. ARE TO BE USED WITH THIS TOOL. A VACUUM HOSE OF NOT LESS THAN 1¼ INCH DIAMETER AND NOT MORE THAN 10 FEET LONG IS TO BE USED. THE VACUUM MANUFACTURER'S OPERATING INSTRUCTIONS MUST BE READ AND UNDERSTOOD BEFORE OPERATION.

3. INSPECT ALL SYSTEM ELEMENTS FOR CRACKS, PUNCTURES OR OPENINGS, i.e. HOOD, VACUUM HOSE AND CONNECTORS. REPAIR OR REPLACE ANY FAULTY ITEM.

4. ASSEMBLE VACUUM HOSE AS SHOWN ABOVE, INSURING ALL CONNECTIONS AND CLAMPS ARE TIGHT.

5. TURN ON VACUUM AND CHECK FOR ANY STOPAGES OR AIR LEAKS IN THE VACUUM LINE OR HOOD AND INSURE ADEQUATE AIR FLOW IN THE OPEN AREA OF THE SAW.

6. IF ANY LEAKS OR STOPAGES ARE LOCATED, CHANGE OR REPAIR FAULTY ITEM.

7. CONNECT SABER SAW TO ELECTRICAL OUTLET AND FEED INTO WORK. THERE SHOULD BE NO VISIBLE DUST OR DEBRIS. IF EXCESS DUST IS VISIBLE, (a) CHECK VACUUM CLEANER BAG FOR OVERLOAD-PER MANUFACTURER'S INSTRUCTIONS,(b) CHECK LINES FOR AIR LEAKS.

TO INSTALL OR REMOVE BLADE
(IN ADDITION TO BLACK & DECKER OPERATING INSTRUCTIONS)

1. DISCONNECT UNIT FROM ELECTRICAL OUTLET.

2. REMOVE THE TWO SCREWS WHICH RETAIN THE SHIELD.

3. PULL SHIELD STRAIGHT DOWN (SHIELD FITS FIRMLY IN POSITION. A SOFT TAP MAY BE NECESSARY)

4. REMOVE BLADE (SEE BLACK & DECKER OPERATING INSTRUCTIONS)

5. REASSEMBLE.

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