FILE NAME: DuPont (DUP)

DATE: 1969 Nov 1

DOC#: DUP202

DOCUMENT DESCRIPTION: Report - Old Hickory Textile Fibers - Asbestos Dust Control

PLAINTIFF'S
EXHIBIT
DUP-1769

ASBESTOS DUST CONTROL

DUP 1012406

ASBESTOS DUST CONTROL

Old Hickory Textile Fibers
Old Hickory, Tennessee

November 1, 1969

ASBESTOS DUST CONTROL

This summary report is a compilation of work done by:

Analytical Research Laboratory
Chemical Control Laboratory
and Works Engineering Section
Old Hickory Textile Fibers
Old Hickory, Tennessee

By: R. E. Tyree, Area Engineer
Maintenance Engineering

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I. Introduction

A. Objectives

Reference: Letter J. H. Sigman-L. Cox to R. J. Blair, 8/8/68; Letter R. J. Blair to O. W. Hess, 8/16/68. (See Appendix A)

1. Study jobs where asbestos dust is present, take dust samples for analysis and determine when respiratory protection is required.

2. Provide information to the Textile Fibers Department that could be used as a guide for a uniform safety standard.

3. Recommend minimum equipment requirements for adequate dust control.

B. Premise

1. Asbestos dust control is the prevention of high concentrations of asbestos dust entering the lung of asbestos workers, insulators, and any other person exposed to, handling, or working with asbestos.

2. Asbestosis is a fibrogenic (scar producing) pneumoconiosis (dust disease of the lung) due to inhalation of asbestos fiber dust. In its more advanced stages it can impair respiratory function with production of emphysema. Total disability and death can result. Especially in smokers there is a marked increase in incidence of several varieties of cancer.

   There is no known cure for asbestosis; therefore, every reasonable effort must be made from a humane standpoint to control the dust and prevent it from entering the lung.

II. Development of Old Hickory's Asbestos Dust Exposure Limits (Threshold Limit Values)

In April 1968, the Engineering Department's Construction Division established procedures for monitoring air using personnel air sampling instruments (see Appendix B). Samples were then sent to the University of Pittsburgh for microscopy analysis by qualified experts.

The Construction Division's established Threshold Limit Value (TLV) for total dust count at this time was set at 500,000 particles per cubic foot of air. This was 1/10 the TLV set for industry.

Old Hickory's Asbestos Committee has researched the subject of asbestos dust and control and has concluded from their studies:

- Asbestos dust consisted of grains and fibers[1]. The fibers are the major recognized health hazard.
- Large dust grains cannot enter the lungs but medical studies show that long fibers (as long as 200 microns[2]) do enter the lung and cause asbestosis.
- Prior to 1960, exposure measurements were based on particle counting methods which were not efficient for fiber count. Therefore, by necessity, the asbestos TLV had been set for dust concentrations which were measured primarily by grain count.
- In the late 1950's, new sample and count techniques were developed which provided much improvement in the accuracy and efficiency of counting asbestos dust grains and fibers. This method was particularly effective in the fiber sizes of most concern; i.e., 5 microns and greater.

[1] Fiber is defined as any particle having a length to diameter size ratio of 3 to 1 or greater.

[2] 1 micron = approximately .00004 inches.

- Studies since that time led the American Conference of Governmental Industrial Hygienists in 1968 to adopt, as an "intent to change[1]," a TLV of 12 fibers greater than 5 microns in length per milliliter of air (12 fibers/ml $>$ 5 μ) or 2 million particles per cubic foot of air (2 MPPCF), instead of the present TLV of 5 MPPCF (see Appendix C). The 12 fibers/ml $>$ 5 μ TLV is based on the new membrane filter sample method; whereas, the 2 MPPCF TLV is based on the older, less effective impinger sample method.

- Both the ACGIH and the Division of Occupational Health, Department of Health, Education, and Welfare, agree the fiber count method will, in all probability, replace particulate measurement for exposure to asbestos dust and will be in the TLV "Recommended" category in 1970.

- The Construction Division's TLV and the Departmental goal of 500,000 PPCF actually applies to overall dustiness as measured by the impinger method and is not meaningful when the sample is taken by the membrane filter method. The membrane filter remains the best method of measurement to date and justifies its continued use.

Based on these findings and the fact that membrane filter sampling was being used at Old Hickory, the committee agreed to change from the Departmental TLV goal of 500,000 PPCF to 12 fibers/ml $>$ 5 μ in length for instantaneous or short term exposure (one hour or less). A TLV of 6 fibers/ml $>$ 5 μ in length was established for eight hour exposure. This is 1/2 the ACGIH proposed TLV.[2] We feel that TLV goals of 12 and 6 offer as much or more protection than the original TLV expressed in particles. Additionally, we are aligning ourselves in the direction which the asbestos industry and those in the field of study are taking. We shall continue to take additional dust samples and follow the industry studies.

[1] The ACGIH leaves their recommendation in a "Notice of Intended Change" category for two years. If no evidence comes to light in two years questioning the values (TLV's) they are then placed in the "Recommended" list.

[2] The ACGIH TLV of 12 fibers/ml $>$ 5 μ is a time weighted average based on an 8-hour day.

In the following sample data, Old Hickory used the TLV's for long and short term exposure defined above for specifying when respiratory protection is required.

III. Sampling Procedure

Sampling at Old Hickory was done with an MSA portable pump No. 92814, with Millipore Filter Assembly No. MAWG037A0 and Aerosol Adaptor No. XX6200004. All samples were sent to:

Dr. Morton Corn
Attention: Felix Stein
Department of Occupational Health
University of Pittsburgh
Pittsburgh, Pennsylvania, 15213

Dr. Corn is a qualified expert in the field for microscopy analysis. See Appendix D for actual procedures.

IV. Sample Data

In a period, May through August, 43 samples were taken and analyzed (See Appendix E). Of the 43, 36 were jobs; 7 were sampled at vents. Fifteen of the 36 were out of limits.

Four of the 15 "out of limits" were taken while machine sawing "Unibestos." There were three short term samples and one long term.

Of the 11 remaining samples, 6 were less than one hour and 5 were greater than six hours.

Following are data of the 15 samples that exceeded TLV's.

DUST SAMPLING EXCEEDING TLV's

Instantaneous or short term (~~one hour~~ or less) - ~~12~~ fibers/ML, > 5 μ length. Long term (eight hour average) - ~~6~~ fibers/ML, > 5 μ length.

Sample No.	Location and Activity	Duration of Sample	Fiber/ ML > 5 μ	Remarks
Group 1				
25	Central Shops - Sawing "Unibestos"	20 min.	477	Sawing of "Unibestos": All samples produced fiber counts greatly exceeding TLV's.
28	Central Shops - Sawing "Unibestos"	5 min.	99	
30	Central Shops - Sawing "Unibestos"	10 min.	759	
32	Reemay® Shop - Sawing "Unibestos" and "Kaylo"	1 hr. 4 min.	249	
Group 2				
24	Central Shops - Sawing	10 min.	38	Sawing of Insulation: Specific brands of insulation not known.
4	Dacron® Shops - Sample B - Sawing Ruberoid-LK	15 min.	27	All short term fiber counts exceed TLV by considerable amount.
5	Dacron® Shops - Sawing & Pouring Ground Asbestos	13 min.	38	The long term sample #42 only slightly exceeds TLV.
42	Dacron® Shops - Sawing "Kaylo"	7 hr. 30 min.	8	
19	DMT Shop - Sawing	15 min.	925	
25	DMT Shop - Sawing Asbestos Without Bag Over Exhaust	10 min.	773	
15	PRL Shop - Sawing With Vacuum on Saw	16 min.	106	

DUST SAMPLING EXCEEDING TLV's (Cont'd)

Sample No.	Location and Activity	Duration of Sample	Fiber/ ML > 5 μ	Remarks
Group 3				
39	Central Shops - Routine Work	7 hr.	7	Routine (Long Term): Work includes all types of jobs from sawing to cleaning. Some readings are slightly greater than two times the TLV but do not approach the levels of the short term jobs.
40	Dacron® Shops - Routine Work	6 hr. 4 min.	13	
41	Dacron® Shop - Routine Work	6 hr. 10 min.	8	
42	Power Maintenance Routine Work	6 hr. 50 min.	13	

V. Recommendations

Based on Old Hickory's study of the asbestos dust problem and analysis of the sample data, the following recommendations are made:

1. The Engineering Standards should specify the exclusion of insulation materials containing Crocidolite type asbestos. OK

2. Use of Unibestos be discontinued and removed from the Engineering Department Standards. OK

3. Samples should be taken using membrane filters (instead of impinger type samplers) at several plant locations.(1) OK

4. Torit Dust Collector, Series 19 (or equal) should be specified for use on all power saws used for asbestos. (Consider including in Engineering Standards.) NO

5. All existing vacuum systems used for asbestos dust removal should be upgraded to highest effectiveness attainable against air leakage. Special attention should be given to bandsaws. (Consider including in Engineering Standards.) OK yes

(1) Analyze data to establish relationship to the TLV. This may indicate relaxing or tightening of requirements. Routine sampling should be done so that dust level control can be maintained.

6. Torit Down Draft Benches (or equal) should be specified for use in production type insulation shops where severe dusting occurs from shaping, cutting or handsawing asbestos. (OME $1.5M-$2M). (Consider including in Engineering Standards.)

7. Approved vacuum cleaners shall be used for floors, equipment, etc., whenever practical. (Investigation is continuing to find vacuum cleaners that will entrap particle sizes 5 microns and greater efficiently.) Goal is to reduce fiber content of the exhaust air.

8. Minimum Safety Rules

   a. Mineral dust respirators approved under U. S. Bureau of Mines Schedule 21B (see Appendix F) shall be worn for the following jobs[1]:

      (1) All sawing of "Unibestos" until this product is discontinued.

      (2) Pouring of ground asbestos in all cases. Examples: filling storage bins, dumping into mix pails, etc.

      (3) Tearing off asbestos insulation from pipelines, equipment, vessels, etc.

      (4) Any operation involving cleaning or removing of asbestos dust or residue in which an approved vacuum cleaner is not used.

      (5) Cleaning vacuum systems and vacuum cleaners handling asbestos dust.

   b. An approved vacuum cleaner shall be used to remove asbestos dust when cleaning floors, equipment and parts wherever practical. Where impractical, an approved dust mask shall be worn.

   c. On power equipment provided with dust removal systems, turn systems on before working on asbestos materials. Turn systems off only after completing work.

[1] Old Hickory has chosen the MSA Dustfoe #77 (with catalog number 96042 filter) approved under 21B, as a plant standard. The Insulation Industry Hygiene Research Program and Johns-Manville Research and Engineering Center are developing and testing disposable masks with the cooperation of members of the International Association of Heat and Frost Insulators and Asbestos Workers. Old Hickory will keep Textile Fibers informed on this development.

9. Procedures

All insulation shops must be properly ventilated and saws equipped with high efficiency cyclone type or fabric filter type dust collectors. In order to assure expedient and efficient dust removal, the following shall be in effect:

a. Specific Safety Rules shall apply.

b. Equipment and shops shall be inspected once per month to assure systems are being maintained and are operating properly. (This inspection shall be on the IBM monthly reminder.) Specific items to be checked are:

(1) Dust collector fans operating.

(2) Seals around ducts are tight to assure adequate velocity and volume of air.

(3) All duct joints are tight.

(4) Dust collection containers shall have plastic bags inserted to eliminate need for shoveling, sweeping, dumping, etc. Bags should not be allowed to fill more than 1/2 to 2/3 full to allow for tying the tops of bags upon removal to prevent dusting condition.

(5) Under normal use of saws (average one hour sawing per day), the cloth exhaust filter bags should be agitated (shaken and beaten) each week and cleaned each six months.

(6) To clean exhaust filter bags, a large plastic bag should be placed over the filter bag and tied at the top. Then, with the fan <u>off</u>, agitate the filter bag vigorously by beating and shaking to loosen the dust particles from inside and outside the filter bag. Plastic bag must then be removed, tied and disposed of. Dust inside the filter bag will settle to the bottom. These bags can be used indefinitely by properly cleaning but it is recommended they be replaced after three years normal use.

(7) Ducts shall be checked by use of flashlight or other means to assure they are not plugged.

(8) Room exhausts and wall fans shall be checked for proper rotation of fan and to assure guards or grids are not blocked with trash.

(9) Exhausts and vents shall be checked periodically to assure they are exhausting into unoccupied areas.

c. Approved dust masks shall be used as specified in Safety Rules and inspected monthly.

d. Personnel should be thoroughly trained in how to properly fit the masks or respirators to the face as per the manufacturer's recommendations.

Responsibility - It is the responsibility of the area supervisor in whose area dust collection systems are located to see that they are inspected and recorded on IBM cards according to this procedure.

SUMMARY

Old Hickory has attempted to pool present knowledge of the asbestos dust problem with the information obtained from on-plant sampling to do the following: (1) clarify the differences between level identification - MPPCF and fibers/ML; (2) determine realistic TLV; (3) identify jobs and materials exceeding TLV; (4) reduce exposure by specifying equipment modifications or additions, changes in job procedures and use of suitable respirators where levels cannot be lowered sufficiently.

The recommendations contained in this report are based on analysis of the problems imposed on the only groups of people on the Old Hickory plant site routinely exposed to asbestos dust - the pipe insulators. Other job classes and other plant sites may have particular problems which go beyond Old Hickory's considerations.

Asbestos dust hazards can obviously be greatly minimized by controlling exposure concentrations to safe levels. Old Hickory's selection of a safe level is equivalent to 20% of the present recognized industry standard. Further, it is believed that the best way to obtain this level is to control it at the source, thereby reducing the instances where respirators are needed.

ACKNOWLEDGMENTS

The assistance of the following individuals is gratefully acknowledged.

C. D. Crook	Analytical Research Laboratory Old Hickory
D. J. Kloos	Bureau of Mines, U.S. Department of Interior Pittsburgh, Pennsylvania
J. R. Lynch	Bureau of Occupational Safety & Health U.S. Department of H.E.W. Cincinnati, Ohio
H. D. Murray, M.D.	Medical Supervisor Old Hickory
V. E. Rose	Secretary of American Conference of Governmental Industrial Hygienists Cincinnati, Ohio
J. R. Smith	Chemical Control Laboratory Old Hickory
Felix Stein	Department of Occupational Health University of Pittsburgh Pittsburgh, Pennsylvania
P. J. Tracey	Du Pont de Nemours (Deutschland) GMBH Werk Uentrop Hamm, West Germany

APPENDIXES

C O P Y

CC: R. B. Hayden
D. D. Drummond

Wilmington, Delaware
August 8, 1968

TO: R. J. BLAIR

FROM: J. A. SIGMAN - LYMAN COX

CONTROL OF ASBESTOS DUST

The recommended rules and procedures contained in letters: Cockrill to Drummond dated 3/29/68, and Rhodes to Kennedy seem to me to be generally satisfactory but are not complete in certain respects. The additions that I think should be considered are outlined below.

1. A goal level should be stated. The Threshold Limit Value recommended by the American Conference of Governmental Industrial Hygienists is 5 million particles per cu. ft. of air. Construction has set a goal of 5 hundred thousand particles per cu. ft. of air. Both values are average concentrations for an 8-hour working day. I think we should use the same goal as Construction.

2. A procedure for monitoring the level of exposure should be established. Construction does this by having one of their insulators wear a dust sampler for an 8-hour day. One such sample is collected once a month at each construction site. The filter through which the air sample has been drawn is sent to Dr. Morton Corn at the University of Pittsburgh for microscopic examination. (See attached copy of letter Keuper to Queener, dated 5/29/68.) We could do the same thing. However, I suggest that we learn how to do the microscopic work ourselves. This is something the Old Hickory laboratory is trying to do. A method for collecting and examining asbestos dust samples was published in the Journal of Occupational Medicine dated January 1968 by Lynch and Ayer. The title of their paper is: "Measurement of Asbestos Exposure." If this article doesn't provide enough information, it might be advisable to arrange for someone from the Old Hickory Laboratory to visit Dr. Corn for instructions. His address is: Graduate School of Public Health, Department of Occupational Health, University of Pittsburgh, Pittsburgh, Pennsylvania, 15213.

COPY

3. The procedure discussed above in item 2 should be used to determine whether or not our control methods, as outlined in Rhodes' letter of May 22, are good enough to hold dust levels at values such that the 8-hour goal-value is not likely to be exceeded. This is something else that Old Hickory is working at. The values obtained in this way will show whether there are specific operations or activities that cause enough dust to require additional control or the use of protective equipment (air masks or respirators). I would think we would devise control measures in preference to specifying protective equipment. If we find that we can't do this, we will have established a basis for "supervisory judgment" for saying what dust conditions are sufficiently "severe or irritating" to require protective equipment. In my opinion if we find that we want to adopt a safety rule requiring the wearing of dust masks or respirators, it should apply to any dust that is "severe or irritating" not just "insulation dust." This might be coal dust, soda ash, activated carbon or other dusty materials that are handled on the plant.

4. The procedure should outlaw materials containing crocidolite type asbestos. In this connection, the Purchasing Department says we haven't been buying any products containing crocidolite.

5. The procedure should outlaw pressure spraying of materials that contain asbestos.

6. A record should be compiled to show dates on which improved control measures were instituted: e.g., when specific saws were equipped with exhaust systems, when protective equipment was provided, when specific instructions on mixing asbestos cement were established, etc.

7. Medical records that Dr. Murray has compiled on personnel who work as insulators should be continued.

The interest which Old Hickory is showing in the subject is commendable. When they gain skill in taking dust samples and measuring concentrations, accumulate meaningful data on the amount of dust produced by identifiable operations or activities, and devise improved control methods, they should be assigned the responsibility for taking the lead in applying findings to other Textile Fibers plants and if it seems appropriate, suggesting additions to the present Engineering Standard S2T which is on "Threshold Limit Values of Air Contaminants."

LC'rbl
Att.
Copied/10-17-69/ekl

C O P Y

CC: Lyman Cox

Wilmington, Delaware
August 16, 1968

O. W. HESS® MANAGER
OLD HICKORY PLANT

ASBESTOS EXPOSURE HAZARDS

Ref: Letter B. F. Kennedy to R. J. Blair of 5/27/68

The reference letter pointed out Old Hickory's concern on the adequacy of present safety standards for employees exposed to insulation dust. Old Hickory suggested that a departmental standard be set up requiring respiratory protection for employees working with insulation.

I have reviewed this proposal with the Division Engineer's Office, who in turn have counseled with the Engineering Department, Haskell Laboratory and other locations. We conclude the following:

1. Basically, there is little technical knowledge today on level of exposure that is tolerable. Accordingly, there is considerable debate on what standards should apply to dust exposure.

2. There have been many recent changes in the direction of minimizing personnel exposure. For example, preformed insulation, outlawing of crocidolite, insulation dust exhaust systems, etc. The effect of these improvements are not quantitatively known.

Accordingly, before adopting a standard requiring respiratory protection across the board (a significant administrative problem), we should obtain some quantitative facts of where we stand today. I would like for Old Hickory to take the lead in making this analysis and, in turn, give guidance to the department.

C O P Y

Specifically, Old Hickory should first assure itself that it is in conformity with all the latest operating and procedural standards, and then under these conditions, measure dust concentration at the various identifiable operations, including not only insulation dust, but coal, carbon and other dust sources. This will require developing techniques for sampling and measuring dust concentration. Some thoughts along this line are contained in the attached letter from Lyman Cox. Then, let's judge our actual position of dust concentration in various operations against a standard of 500,000 particles per cubic foot of air. This is the standard recently adopted by Construction and is one-tenth of the official Governmental standards. From these data, identify the problem areas of dust concentration exceeding the standard. These findings should be made known to the department and used as criteria for adopting respiratory protection at Old Hickory and other plant locations.

Also, your medical section should continue its follow-up with insulators so that a continuing medical history is available for correlation with procedural equipment changes.

Old Hickory's concern in this area is justifiable and I believe with the above approach, we can more realistically establish protective equipment standards. Please advise if you have any questions.

DACRON® MANUFACTURING DIVISION

/s/R. J. BLAIR
PRODUCTION MANAGER

RJB/bhs
Attach.

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C O P Y

CC: J. S. Queener, Employee Rel., Nemours
G. J. Stopps, M.D., Employee Rel., Haskell
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F. H. Mackie, Engg. Constr., Louviers
B. B. Lewis, " " "
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W. H. Zane, Engg. Design, Louviers
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Site Safety Supervisor, Constr.

Wilmington, Delaware
April 5, 1968

FIELD PROJECT MANAGERS

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SAFETY - DUST CONTROL

Industrial work producing airborne dust particle contamination is recognized as a primary contributor to employee health problems. The ability of the medical profession in identifying the personal respiratory disease of asbestosis, and the establishing of the cause to be due to extended exposure to asbestos dust have created a serious industrial concern. Federal and State legislation is being enacted to place the burden of proof on the employer for continuous conformance with Governmental Industrial Hygienists' established Threshold Limit Values for specific materials. The employer's problem becomes acute when pre-employment medical examinations are not required for the employees.

C O P Y

With the above-mentioned responsibility in mind, and to assure atmospheric conditions which will not contribute to the employees' health problems when working with asbestos fiber containing materials, the Construction Division is initiating the following permanent air quality control program to be effective June 1, 1968.

Air Monitoring

Environmental air monitoring shall be conducted to provide quantitative data for site evaluation of dust control efficiency and document air quality analysis needed to demonstrate conformance with established Threshold Limit Values (TLV).

1. The Threshold Limit Value for total dust count shall be 500,000 particles per cubic foot of air.

2. Personnel monitoring will be conducted in the insulation shops on site locations. One employee will be requested to wear the air sampler one eight-hour day each month.

3. Trained site safety personnel shall be responsible for the control, operation and adjustment of the air sampling instrument, recording required technical data associated with the air sample, mailing of air sample to laboratory for analysis and compiling records of analysis reports.

4. When soliciting participation in the air monitoring program, craft supervision and Safety Engineer should anticipate who will be involved in work which will produce the greatest dust exposure for what day of that month.

5. The personnel air sampling instrument used shall be a Universal Industrial Equipment Company, Millipore filter, Model 440B (qualified for explosion hazard areas) air sampler. The filter used shall be a .8 micron pore size, Millipore Cat. No. MAWG 037 AO, Type AA, in plastic holder. This equipment will be assigned to the sites where air monitoring is required by the Division Safety Office.

C O P Y

6. The filter in plastic holder, upon completion of air sampling, shall be mailed by the site Safety Engineer to Morton Corn; Ph.D., Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania, 15213, attention Felix Stein. A phase microscopy analysis of submitted sample will be made and a report submitted to the site and the Division Safety Office indicating: a) fibers below 5 micron length, b) fibers above 5 micron length, and c) total number of particles. Reports indicating total particle count to be approaching or above the TLV will require determining cause of condition and taking corrective action to reduce particle count. After improvement has been applied, a second eight-hour sample shall be conducted, analyzed and documented.

Atmospheric Dust Control

The application of the following recommendations should demonstrate conformance with the established dust TLV and provide effective dust emission control.

1. Materials containing Crocidolite asbestos fiber shall not be purchased or accepted for use. Materials containing Chrysotile and Amosite asbestos fibers are acceptable for use.

2. The pressure spray application of materials with any per cent of asbestos fiber content shall be eliminated.

3. All power tool and equipment operations shall be isolated from other shop facilities and fabricating operations.

4. All power shop equipment shall, when operated, have installed exhaust ventilation of sufficient capacity to remove dust particles at point of origin. Exhausted dust particles shall be collected by an effective collector system which will not allow vent-off of dust particles to the atmosphere.

5. Present controlled shop cleanliness programs shall be expanded. A vacuum cleaner should be used in lieu of broom sweeping to remove dust particles from shop equipment, work tables, ledges, floors, etc.

6. A controlled materials handling program should be adopted to eliminate the emission of dust; for example, when opening and removing materials from shipping cartons or in the handling and mixing of asbestos cements.

C O P Y

Respiratory Protection

Severe or isolated conditions may require that respiratory protective devices be used. Consideration should be made for adequate protection of people in adjacent areas to the work location producing this condition. A supplied air respirator or a filter respirator manufactured by Mine Safety Appliance Co., Pittsburgh, Pennsylvania, Model Dustfoe 77 with filter number BM 21 B-97 should be used.

Your usual cooperation is anticipated in administering these dust controls.

CONSTRUCTION DIVISION

/s/K. E. KEUPER
DIVISION SAFETY SUPERINTENDENT

KEK/dlm
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