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KENTILE FLOORS, INC.
Brooklyn, New York

Dust Measurements - Interim Report

Asbestos Fibre Dust Determinations

Submitted by
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Sr. Industrial Hygienist

KENTILE FLOORS, INC.
Brooklyn, New York

Dust Measurements - Interim Report

Asbestos Fibre Dust Determinations

Several months ago, as part of our endeavor to provide information on the degree of asbestos dust exposures related to handling of mixed dust at several locations in the Brooklyn plant, 12 membrane filter dust samples were collected and sent to our Hopkinton laboratory for analysis. This work was initiated in December 1969.

Several months have elapsed since this study was initiated. Although preliminary findings were obtained and discussed with Mr. Gentile, no formal reporting of these results was made since it was felt at the time that the information obtained was not sufficiently definitive to allow sound scientific judgment to be made with respect to the exact nature of the exposure as far as the present TLV or proposed TLV for asbestos fibres was concerned. Nor did we believe that the data was sufficiently sound to permit reaching conclusions concerned with the establishing of a standard for Kentile operations.

So that you might have the benefit of these preliminary findings, it can be reported that out of 12 membrane filter paper samples collected, concentrations of asbestos fibres ranged from 4 to 8 fibres greater than 5 microns in length per milliliter of air. These concentrations were arrived at by counting sections of the filter papers at 430 diameter magnification without the benefit of phase contrast illumination.

We intend to re-evaluate these samples with the phase contrast microscope and phase contrast lighting to determine if these preliminary findings are above or below the suggested TLV of 12 fibres/ml greater than 5 microns in length. Our laboratory at the present time has this equipment on order; and as soon as it is operative, these determinations will be completed. In the meantime, we are investigating the possibility of other methods to assist us with these determinations.

We hope in the next several weeks to be in a better position to offer comment on the results of this sampling.

Retest - air stations
Phase contrast - results
down to 1/10 m

Continued -

On the basis of what we have learned thus far, we are still of the opinion that the exposure at all operations involving mixed dusts should be controlled by meeting the currently established TLV for asbestos. It is significant to note in this regard the information contained in the Supplemental Documentation of Threshold Limit Values for Asbestos (copy enclosed), as well as the new recommended change listed in the Notice of Intended Changes for 1970 (copy also enclosed). In this new listing, the TLV for asbestos is lower yet, i.e., "5 fibres/ml greater than 5 microns in length with 10 fibres/ml ceiling of stipulated duration and frequency and as measured by specified procedure."

We trust that this brief reporting will bring you up to date with respect to our efforts aimed at determining the asbestos content of the mixed dust exposure in your operations. We intend to complete this work just as soon as practically possible; and when sufficient information is available, our recommendations for control practices will be made.

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Loss Prevention Department

dl - 6/15/70
Encs.

NOTICE OF INTENDED CHANGES

TO APPEAR IN

ACGIH THRESHOLD LIMIT VALUES OF AIRBORNE CONTAMINANTS

FOR 1970

The following changes and additions to the TLV Booklet for 1969 were recommended for adoption by the Conference at the Committee's plenary meeting April 1 and 2, 1970. Each proposal will remain in the above section for a period of at least two years before transferral to the Recommended List.

RECOMMENDED CHANGES

ITEM	FROM	TO
Ammonia	C 50 ppm	25 ppm
Ammonium chloride	1 mg/m^3	10 mg/m^3
Allyl glycidyl ether	10 ppm	5 ppm
Asbestos	12 fibers/ml > 5μ in length or 2 mppcf	5 fibers/ml > 5μ in length, with 10 fibers/ml ceiling of stipulated duration and frequency and as measured by specified procedure
Camphor	2 mg/m^3	12 mg/m^3 or 2 ppm
Diethylene triamine	10 ppm	1 ppm
Formaldehyde	C 5 ppm	C 2 ppm
"Inert" or Nuisance Aerosols	15 mg/m^3	10 mg/m^3*
Mercury	Organic compounds	Alkyl compounds
Methyl chloride	C 100 ppm	100 ppm
Quartz, mppcf	$\frac{250}{\% \text{ Quartz} + 5}$	$\frac{300}{\% \text{ Quartz} + 10}$
Respirable Mass Sampling Limits for Total Dust	$\frac{30 \text{ mg/m}^3}{\% \text{ Quartz} + 2}$	$\frac{30 \text{ mg/m}^3}{\% \text{ Quartz} + 3}$
Vinyl chloride	C 500 ppm	200 ppm
Wood dust (nonallergenic)	10 mg/m^3	5 mg/m^3

*This revision automatically reduces all other substances listed as 15 mg/m^3 in the 1969 TLV Booklet to 10 mg/m^3.

NEW ADDITIONS

ITEM	PROPOSED LIMIT
Butyl lactate	1 ppm
Coal (bituminous)	2 mg/m^3
Diazinon	0.5 mg/m^3
2-N Dibutylaminoethanol	2 ppm
Iron pentacarbonyl	0.01 ppm
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	0.1 ppm
Rosin fumes	0.1 mg/m^3 (as aldehyde)
Subtilisins (Proteolytic enzymes)	0.0005 mg/m^3 (as crystalline enzyme activity)

For the TLV Committee

Herbert E. Stokinger

H. E. Stokinger, Chairman
May 1970

1968

SUPPLEMENTAL DOCUMENTATION OF THRESHOLD LIMIT VALUES

ASBESTOS - ALL FORMS

C 5 mppcf (2 mppcf, time-weighted average),
or 12 fibers/ml > 5 μ in length

Asbestos is a generic term that applies to a number of mineral silicates, incombustible in air and separable into filaments. The most widely used in industry is chrysotile, a magnesium silicate from serpentine. Other types include amosite (an iron magnesium silicate) crocidolite (a sodium iron silicate), tremolite (a calcium magnesium silicate) and anthophyllite (also an iron magnesium silicate).

That exposure to asbestos is associated with development of a potentially disabling pneumoconiosis in man has been amply demonstrated by industrial experience[1, 2, 3, 4, 5, 6, 7, 8, 9]. A threshold limit of 5 mppcf was recommended by Dreessen et al.[6], in 1938 after studying 541 employees in 4 asbestos textile plants where massive exposures to chrysotile occurred. Only 3 doubtful cases of pneumoconiosis were found at the time of the study in those exposed to dust concentrations under 5 mppcf, whereas numerous well-marked cases were found above 5 mppcf. Counts were from impinger-collected samples in ethyl alcohol and distilled water. Both fibrous and nonfibrous particles were counted, but the latter greatly predominated. Although chemical analyses of collected samples of airborne dust corresponded to those of settled dust, it is believed that dust counts of particulates by impinger can be expected to give only an indirect measure of the risk of asbestosis because impinger sampling collects particulates other than asbestos.

A conference on the biologic effects of asbestos[10] in 1965 called attention to the very real probability that the 5 mppcf limit recommended by Dreessen is inadequate to give complete working-lift-time protection against all forms of asbestos. Medical data on which the limits had been based were inadequate; more than half of the asbestos workers studied were under 30 years of age and thus provided an insufficient exposure time for asbestosis to develop. Of the 105 workers exposed to < 5 mppcf, 82 had worked < 5 years; 101, < 10 years; only 4 had > 10 years exposure. Seven of 36 workers exposed to 5 - 9.9 years had asbestosis; 3 of 50 workers exposed to 10 - 19.9 mppcf for < 5 years had asbestosis[6]. Moreover it was a "point-in-time" study; many of the ill were missing and the dead uncounted, hence not considered in the over-all evaluation of the limit.

The asbestos conference[10] further called attention to the rising worldwide rate of increase in lung cancer among asbestos workers, particularly bronchial cancers, and also noted with alarm a widespread incidence of pleural and diffuse mesotheliomas, tumors heretofore overlooked and only recently (1959) associated with exposure to asbestos. The epidemiology of the early cases was especially revealing in pointing out the scope of asbestos exposures; many of the mesothelioma cases had no industrial association, but were "neighborhood" cases or cases traced to users of asbestos. Exposures to asbestos extend far beyond those of miners

and millers of asbestos or textile weavers, and include carpenters (sawing asbestos board) insulators and pipe laggers, dockers handling asbestos cargo, brake-lining workers, rubbe compounders and several others.

The Committee on Hygienic Standards of the British Occupational Hygiene Society from an evaluation of medical evidence from Great Britain and data from the U. S. Public Health Service Study[6] has recommended the following criteria for limiting exposure to chrysotile asbestos assuming a 1% risk of contracting asbestos disease during a 50-year working exposure[11].

Dust Category	Chrysotile Concentration[a] Fibers/ml[b]
Negligible	< 0.5
Low	0.5 - 2.0
Medium	> 2 - 10
High	> 10

a) Averaged during a 3-month period
b) Greater than 5 μ in length

From these criteria, a limit of 100 fibers/ml-years was proposed, hence a limit of 2 fibers/ml averaged over a 50-year period.

In arriving at an asbestos limit based on American experience and considerations applicable to the American industrial scene, the following predominated. Recent evaluation of the health experience in asbestos plants indicated that the 5 mppcf limit was not sufficiently low to protect workers exposed for 30 years, a period rarely exceeded in America. Balzer and Cooper[12] supported this view in a report of asbestos is occurring among insulati n worker from levels that were deemed highly unlikely to have exceeded a time-weighted average of 5 mppcf. A retrospective investigation of the association between lung cancer in asbestos workers and smoking by Selikoff et al.[13] revealed that asbestos neoplasias were strongly associated with smokers.

In accordance with these findings, the 5 mppcf limit was made a ceiling value below which a concentrations should fluctuate. This is equivalent to a time-weighted average value of slightly less than 2 mppcf, as shown by Ayer[14] from the following determined for asbestos where 5% of the samples only exceed the 5 mppcf limit:

% Samples Exceeding 5 mppcf	Average Concentration mppcf
1	1.3
2	1.5
5	1.9
10	2.4
25	4.5

Inasmuch as the count by impinger procedure often consists primarily of extraneous particulates (textile plants) an alternate fiber-count may be made by the membrane filter method using phase-contrast illumination at 430 X magnification[15]. For the purpose of determining significant asbestos exposure, the membrane-filter method in which only fibers greater than 5 micra (μ) in length are counted, is recommended. On this basis, 6 fibers/milliliter greater than 5 μ had been found to be equivalent to 1 mppcf. Hence for a time-weighted average limit by count of asbestos particles of 2 mppcf, the corresponding limit based on fibers of specified size is 12 fibers/ml. This limit is intended to reduce to an insignificant risk, the occurrence of asbestos disease among those exposed for 30 years to all forms of asbestos.

There is still asbestos disease appearing in industry. It is not known to what extent this represents a reservoir effect of past exposures, or if the 5 mppcf level is still contributing to the disease incidence. For this reason the 5 mppcf is recommended as a ceiling value (2 mppcf as a time-weighted average)until a more definite value can be established based on medical findings.

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CRISTOBALITE*

* Use one-half the value obtained from either the count or mass formula for quartz.

Cristobalite, one of the three major crystalline forms of silicon dioxide is stable at high temperatures and is formed when quartz or amorphous silica is heated, as in the calcining of diatomaceous earth or in the silica brick industry.

Gardner[1] reported on experiments in which rabbits were injected intravenously and guinea pigs intraperitoneally with various mineral dusts. Responses to cristobalite were more severe than from quartz, and the fibrosis that followed was diffuse rather than nodular. King, Mohanty, Harrison, and Nagelschmidt[2] had similar results in rats given intratracheal injections of cristobalite, fused silica, quartz and tridymite.

The present recommended threshold limit is based on studies in the diatomite industry[3,4] and by analogy with the threshold limit for quartz. Recent experimental studies[5] in animals with diatomaceous earth of 61% cristobalite content at levels of 2, 5 and 50 mppcf have presented strong evidence for the need to review the present limit. Although no frank fibrosis of the lung developed from any level of exposure in 2.5 years, the lifetime of one of the exposed species (rat), there was considerable cellular infiltration in the lung and hyalinized fibrotic nodules developed in the pulmonary lymph nodes in 1 animal species (dog) at the 5 mppcf level with scattered nodules at the 2 mppcf level.

Long industrial medical experience indicates that the limit of 5 mppcf does not possess the requisite safety factor; occasional cases of pneomoconiosis continue to occur after cristobalite exposures had been reduced to levels approximating 5 mppcf[6].

Accordingly, a limit approximating one-half that for quartz of the corresponding percentage in the dust is recommended as calculated either from the count or mass formula.

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