



Health Hazards Caused by Filter Sheets Containing Asbestos



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The front picture shows:
5 μm asbestos fibres on a 3 μm filter membrane quantity 0.1 mg/cm².
Magnified 10 000 times.

On the basis of some examinations in the U.S.A., in particular, news reporters of daily papers have, through sensational articles roused uncertainty and reservation with users of filter sheets containing asbestos, both in the beverage industry and, of late, also in the pharmaceutical industry.

Since reports of this description have lately been adversely exploited in a propagandist and unilateral manner by certain manufacturers of filter membranes we are forced to strongly protest against these occurrences.

Before going into details, the following can be said: In some cases rumour have been spread to the effect that »filter sheets containing asbestos will shortly be banned for applications in the food and pharmaceutical industries«. This is totally unfounded and is intended to cause panic only.

In this connection we quote the answer of the WHO given at a meeting on the subject »Risk of cancer through asbestos« when the question was raised »Are there any indications of an increased risk of cancer by the presence of asbestos fibres in water, beverages, food stuffs or pharmaceutical preparations?«: »Such evidence as there is does not indicate any risks«.

Since it is quite feasible that you, being our representative will be approached by clients querying these problems, exaggerated in a propagandist way, we endeavour to clarify the present situation by an impartial report so as to help reducing the psychosis and to prevent any possible erroneous decisions being made.

As inventors of cellulose-asbestos-sheets and as responsible, largest producer in the world we have, of course, thoroughly studied all available papers about asbestos and asbestos hazards including the basic literature.

What is »asbestos« and what is its effect in SEITZ filter sheets?

Nature provides 5 different minerals which are known under the collective term »asbestos« because of their similar, fibrous, crystalline structure. All of them are utilized technically due to their fine fibres, some of which can be spun (brake linings, asbestos-cement materials, fire protection, acid-resistant filter cloths and others). Only one of these mineral fibres is used in the manufacture of »filter sheets«, namely »Serpentine asbestos«, designated as »Chrysotil« in mineralogy.

Chrysotil is a magnesium silicate consisting of pliable fibres. For the manufacture of sheets they are partially split down to individual fibres of approx. 30 nm in dia-

meter, thus they are so fine that 30.000 of them placed side by side would cover a distance of 1 mm only. 1 gramme of Chrysotil asbestos has a total fibre length of 1 1/2 times the distance from the earth to the moon.

In SEITZ filter sheets the proportion of asbestos has a bearing on permeability and filtering effect. The tiny asbestos fibres serve to increase the fineness of the relatively large pores of the cellulose structure. Not only the reduction of the pore size, also the enormous »surface area« of the fibres (approx. 1 m² per 1 gramme of asbestos) as well as their chemical/physical behaviour (surface potential, ion exchange, adsorption) contribute to their outstanding retention capability for micro-organisms and colloidal particles.

So far no material has been found which could replace this type of Chrysotil with its favourable properties relative to filtration.

What has been reported in daily news papers and some trade journals regarding the presence of asbestos in beverages and drugs and health hazards related to this?

Asbestos in beverage:

On July 16th, 1972 the »New York Times on Sunday« reported on the occurrence of minute quantities of asbestos fibres in beverages and in mains water, predominantly of Canadian or U.S. origin. The report was evidently based on a publication by H. M. Cunningham and R. Pontefract in »Nature« Vol 232 from July 30th, 1971.

They found $1 - 12 \cdot 10^{-6}$ g of fibres per litre in beverages and $2 - 173 \cdot 10^{-6}$ g of fibres in mains water samples taken in Canadian cities.

The origin of the fibres found in beer and soft drinks was not investigated. It was assumed that they had passed through the filtration plants of the municipal mains water system, originally coming from the Canadian asbestos mines and being distributed by the atmosphere. Furthermore, the authors admit that there is virtually no knowledge about any possible harmful effects of such asbestos particles in the human body.

In the cited paper no mention is made of filter sheet containing asbestos as a possible source for these impurities.

Asbestos in pharmaceutical preparations:

In July 1972 Nicholson, Maggiorre and Selikoff of Mount Sinai Medical School, New York reported in

the journal »Science« about asbestos impurities in injection preparations from the U.S. drug industry. 6 out of a total of 17 antibiotic preparations examined and which were produced between 1969 and 1971 contained asbestos in quantities of 12 — 100 fibres per gramme.

These alarming findings were seized by daily news papers, for example the »International Herald Tribune« (22nd July, 1972) and »Le Monde« (July 1972), and held against asbestos-cellulose-filter sheets presumably used in the manufacture of these preparations.

Which health hazards caused by asbestos are known?

The effects of asbestos dust on respiratory organs have been known for many decades. They can lead to the dreaded asbestosis (asbestos lung) or also, in some cases, to lung cancer (mesothelioma). Nowadays these maladies rarely occur because of preventative measures and supervision by authorized associations and trade unions.

This hazard is known to many a layman and it is very likely that the uncriticized generalization of the risks caused by »asbestos of any kind« stems from this.

In the literature we had access to, we found no indication whatsoever about any effects of ingested asbestos (e.g. from beverages). Neither is there any indication of risks from injections of infusions. It would appear that only one point has reliably been established, namely that cancer cannot be induced by subcutaneous injection of fairly large quantities of asbestos.

In this context it should also be mentioned that, from a mineralogical point of view there are different kinds of asbestos. Of these, the Amphibol asbestos types — they cannot be used in the manufacture of filter sheets — are the most dangerous for the respiratory organs. The Chrysotil asbestos (Serpentine asbestos) used by us is, in comparison, harmless or, at least, presents a much lesser risk.

With certainty this also applies to effects which might be suspected in the digestive system (although such effects have not yet been proved) because Serpentine asbestos is attacked by the gastric juices.

Objections can be raised with regard to a direct injection of solutions containing asbestos fibres, at least for intravenous applications. A. J. Vorwald proved that symptoms resembling cancer could only be observed after direct injection of very large quantities of asbestos (1 million times the quantities found in drugs) into the peritoneal area of rats. Injections into liver and spleen or subcutaneous applications showed no effects.

Are there any bans or limitation with regard to the use of asbestos?

Bans: there are no limitations with the exception that in atmospheric hygiene MAK figures have been established for air which is breathed by humans.

The FDA (Food and Drug Administration) of the U.S.A., which has in the last few years banned a number of drugs and, amongst others cyclamate and »Baycovin« (DEPC), has thoroughly investigated the subject »Health hazards through asbestos«. This led to vehement discussions pro and contra. Since there was no proof of a correlation between the incorporation of minute quantities of asbestos and a cancerous effect the FDA was understandably very reserved in banning technical aids containing asbestos, such as for instance filter sheets.

A decision banning the use of asbestos filter sheets has, to our knowledge, neither been made during the last FDA hearing on this problem in May, 1973.

Which quantities of asbestos have been determined in water, beverages and drugs?

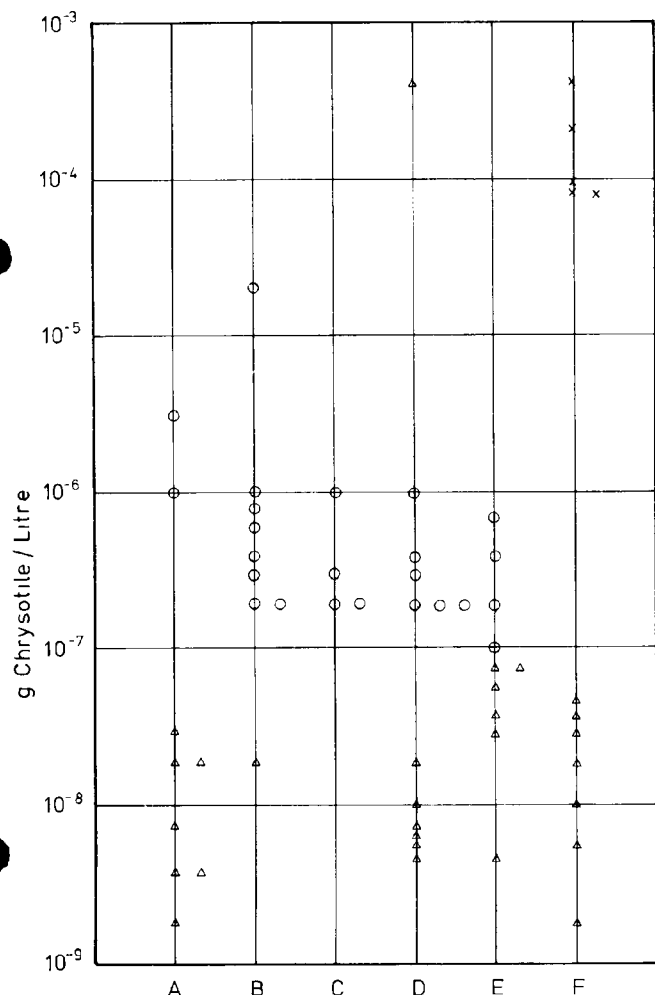
Removal of turbid matter and solids from liquids can only be effected in steps. Liquids, perfectly clear to the naked eye, may still contain fairly large quantities of suspended solids which can be determined by visual/optical means (microscope, Tyndall cone) and analyzed without major difficulty down to quantities of about 10^{-4} g/l. Such particles, down to diameters of $0.1 \mu\text{m}$ can be trapped in modern, fine filtration systems (sheet filters, membrane filters).

»Impurities« will also be found in liquids below the microscopic visibility range because »nature does not make leaps« in this respect either.

Size-wise the asbestos fibres, found by the authors cited, are in the submicroscopic range (electron microscope) and their quantity is of such minute concentration that they can only be determined by sophisticated and laborious methods under complete elimination of the general environmental asbestos pollution.

Following the development of an extremely sensitive analysis method by Badami and Rickards of TBA Rochdale — down to 10^{-13} g of asbestos per ml can still be determined — at least the analysis results of Nicholson and others have to be doubted. Provided that 10^{-6} to 10^{-7} g of asbestos per ml of infusion solution were present it must be assumed that the solutions were prepared with the aid of inadequate filter systems.

Analytical data of asbestos remnants in water, beverages and pharmaceutical preparations.



- A: River water, Melted snow, Well water
 B: Tap water
 C: Soft drinks
 D: Wines
 E: Beers
 F: Parenteral drugs

- X Analysis of Cunningham and Pontefract, in Nature 232, 332
 O Analyse of Nicholson and others, in Science 177 171 1972
 Δ Analyse of Badami and Rickards, TBA Rochdale 1972-73

The graph shows a compilation of the asbestos quantities found in various liquids by different authors.

If the figures of TBA are looked upon as correct, a general asbestos level between 10^{-7} and 10^{-9} g/l is present in all liquids. These quantities are of such extraordinary minuteness that, for example, a human being would have to consume 10 to 12 bottles of beer per day for 50 years to take in a total of 1/1000 g of asbestos.

To trace the origin of the asbestos present in beverages and parenteral solutions it is of particular interest to establish whether or not this is a function of the filtering process employed. Initially one might be inclined to assume that filtrates from filter sheets containing asbestos show a markedly higher asbestos content than for instance membrane filtrates.

This cannot be proved with certainty. However, it is possible to determine that, after proper use of the different filtering systems with various filter media the same quantities of asbestos micro-fibres can be found in all filtrates, i.e., the asbestos level is not a function of the filter medium.

In this context we quote some measuring results of TBA:

Relatively large quantities of wine were filtered in practice, i.e. with large filters, according to 3 different methods. During the filtration run small sample volumes were taken and 0.5l mixtures of these analysed:

Table 1

	Chrysotil content in g/ml
a) Filtration via surface hardened SEITZ EK sheets followed by a fibre catcher cartridge with a 15-30 μ m ceramic filter candle	$< 2 \cdot 10^{-12}$
b) Filtration via surface hardened SEITZ EK sheet followed by a 0.45 μ m mem- brane filter	$< 2 \cdot 10^{-12}$
c) Filtration via surface hardened SEITZ EK sheet without additional fibre catcher device	$2 \cdot 10^{-12}$
(Limit of detection $\sim 10^{-13}$ g/l)	

Corresponding tests results have been carried out in the pharmaceutical field with 5 % human albumin solutions:

Table 2

Determination of Chrysotil in Human Albumin solutions filtered differently

a) Post EKS sheets 40 × 40 cm	1.	$< 6 \cdot 10^{-12}$ g/ml
	2.	$3 \cdot 10^{-10}$ g/ml
	3.	$3 \cdot 10^{-11}$ g/ml
b) Post »Lifeguard« pleated membrane	1.	$4 \cdot 10^{-11}$ g/ml
	2.	$2 \cdot 10^{-11}$ g/ml
	3.	$< 6 \cdot 10^{-12}$ g/ml
c) Post 20 Cox filter sheets, circular	1.	$6 \cdot 10^{-11}$ g/ml
	2.	$6 \cdot 10^{-11}$ g/ml
	3.	$3 \cdot 10^{-11}$ g/ml
d) Post Millipore filter 0,22 µm	1.	$5 \cdot 10^{-11}$ g/ml
	2.	$< 1 \cdot 10^{-11}$ g/ml

Fractional sampling during filtration in the listed order.

Analysis by counting and measuring the elemental fibres in the electron-microscope.

Method BADAMI and RICKARDS

Research and Engineering Division of the TBA
Rochdale, England.

The test series a) refers to asbestos based SEITZ EKS sheets and series c) to similar sheets of the brand »Cox«. Absolutely identical asbestos levels were found in the membrane filtrates, obtained from Millipore filters d) and Millipore Cartridges b).

Assuming that filter membranes with a pore size of 0.22 µm will yield »filtrates of maximum purity« it can be said that filter sheets will produce at least the same degree of purity.

What possibilities does the SEITZ Filter System offer to achieve filtrates »free of asbestos«?

The asbestos quantities in sheet filtrates have to be regarded as general, world-wide »impurity level« because utility water and drinking water are equally contaminated. However, it has to be stressed that when using filter sheets these figures can only be obtained if filtration is carried out according to our instructions and if the filters themselves are mechanically in good working order. Neither can it be denied that at the beginning of every filtration run particles, amongst others also asbestos, can enter the filtrate. The quantities may be such that they can be determined with conventional means. These particles largely originate from dust which cannot be eliminated during handling and packaging, inspite of very careful manipulation. When returning the first filtrate quantities as directed this proportion is reduced to a minimum in a short time.

For pharmaceutical applications fibre catcher devices have been available for decades to ensure absolute protection. These proven procedures could be applied without any technical difficulties to all other filtering tasks.

In place of the successful ceramic filter candles, so far recommended for larger liquid volumes, we nowadays prefer the use of membrane filters as fibre catchers. For reliable retention of fibrous particles down to a length of 1 µm, SEITZ membranes with a mean pore diameter of 3 µm are adequate, even if the fibre diameter is only 0.03 µm as in the case of elementary asbestos fibres.

For combination with our smaller sheet filters (Pilot, Orion 40 up to 2—3 m² filter area) we recommend the use of our construction range EFM 14 to EFM 30 (see leaflet P 80435).

Safety filters with larger filter areas are required for higher filter outputs. As described in our Information Sheet B 70268 a change-over plate and SEITZ membrane pads are employed for such applications. Membrane pads comprise a combination of filter membranes with a stable supporting cardboard. They are mechanically insensitive and can be incorporated into our sheet filters without special precautions in the same way as filter sheets. They are supplied by SEITZ-Filter-Werke in 4 porosities up to a size of 60 × 60 cm, designated as »SEITZ-MK«. The grade SEITZ-MK 300 suffices for the retention of fibres.

Own investigations for the determination of minute quantities of asbestos in filtrates.

In our laboratories we have also carried out extensive analytical, submicroscopic tests and examinations by X-ray analysis to determine asbestos traces in filtrates and downstream of fibre catchers.

We have deliberately omitted to quote any results of our experiments in this exposé and have limited ourselves to the data of neutral institutes because, if passed on to third parties we wish to avoid the impression that this report is biased in the interests of our firm.

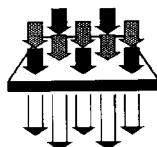
We would also like to mention that the SEITZ-Filter-Werke are in close contact with German universities and

technical colleges to exchange scientific knowledge concerning the above problems. It has thereby repeatedly been expressed that the qualitative and quantitative determination methods applicable for asbestos are well beyond all conventional analytical procedures and that the results have to be viewed with reservations and limitations in spite of utmost diligence and an enormous amount of work involved. This knowledge together with the vast information material in our possession permits the following conclusion:

A number of publications which triggered the »Asbestos Problem« were construed on an inadequate, scientifically unproved basis. From this it can be assumed that specifically aimed and economic-unilateral interests have been followed.



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