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Kelsey House Wood Lane End Hemel Hempstead Herts HP2 4RQ Telephone. Hemel Hempstead 61291 Telex 826437 Kelsey

Registered Number 478564 England *Registered Office Kelsey House Wood Lane End Hemel Hempstead Herts HP2 4RQ*

Our Ref: KRL/WR/PMC

26th June, 1978.

Mr. N.D.McKee,
Development Department,
Du Pont (U.K.) Limited,
Operations Division,
Maydown Works,
P.O.Box 15,
Londonderry,
N.Ireland, BT47 1TU.

Dear Mr. McKee,

From the time that we introduced our asbestos identification service we have had the pleasure of assisting you in reporting our findings on samples which you have forwarded.

We have recently read an article by R.J.Barrot published in 'Plastics and Rubber International' (a copy of which is enclosed) on the health hazards arising from the use of talc where the asbestos present in the laminates of the talc are not identifiable by microscopic examination such as we employ. According to Barrot, the presence of harmful asbestos in the talc can be detected only by a scanning electron microscope or by X-ray diffraction apparatus and we have neither of these instruments which we can use for that purpose.

If there is any further service which we can offer on this topic we will be pleased to assist you.

Yours sincerely,

W.Rubin.

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Talc and professional health hazards

R J Barrot

Talc users are wisely concerned about the health hazards that can occasionally result from its use. However, it is a grave mistake to consider health risks as inevitable. This confusion is supported by a wide lack of knowledge regarding the real nature of talc, as well as by abuse of the word.

Talc and asbestos

The work of Parkes[1] provides valuable evidence on this situation. Table 1 shows the values, in percentages, of different minerals detected in ten different samples of talc analysed by Parkes.

It is necessary to study the mineralogy of talc and asbestos in order to understand their occasional combination.

Talc and asbestos are first cousins. They belong to the magnesium silicates as well as serpentine or ouralite. Their fundamental difference bears essentially on their structure: talc is lamellar and asbestos is fibrous.

This is not the only difference between these two materials: talc is both a rock and a specific mineral, whilst the word 'asbestos' is carried by several minerals having as a common characteristic a fibrous structure and a more or less similar chemical composition. All these minerals, including talc, are metamorphic rocks.

Asbestos is a group of fibrous minerals which belong either to the amphiboles or to the serpentines, as shown by Table 2.[2]

Table 1 Mineralogical composition of ten samples of talc

Samples	1	2	3	4	5	6	7	8	9	10
	%	%	%	%	%	%	%	%	%	%
Tremolite	68	98	17	–	78	38	29	15	88	46
Antophyllite	–	–	20	–	–	–	45	78	4	39
TALC	–	1	63	–	4	–	–	7	1	5
Serpentine	–	1	–	80	18	54	26	–	4	4
Quartz	31	–	–	–	–	–	–	–	2	4
Miscellaneous	1	–	–	20	–	8	–	–	1	2

Table 2 The asbestos family

Asbestos	*Fibrous serpentines*	chrysotile $3MgO\ 2SiO_2\ 2H_2O$
		amosite $5.5FeO\ 1.5MgO\ 8SiO_2\ H_2O$
		tremolite $2\ CaO\ 5MgO\ 8SiO_2\ H_2O$
		antophyllite $7MgO\ 8SiO_2\ H_2O$
	Fibrous amphiboles	actinolite $2CaO\ 4MgO\ FeO\ 8SiO_2\ H_2O$
		crocidolite $Na_2O\ Fe_2O_3\ 3FeO\ 8SiO_2\ H_2O$ (blue asbestos)

The ideal formulation for talc is $(Mg_3Si_4O_{10}(OH)_2)$, from which one can calculate in weight: SiO_2 63.5% MgO 31.7% H_2O 4.8%

Talc is a product of the alteration of
certain amphiboles (chlorite, tremolite, antophyllite)
certain pyroxenes (diopside)
certain serpentines (real serpentine, chrysotile) and
certain carbonates (dolomite, calcite and magnesite, associated with quartz or quartzite).

Fig 1 Pure talc (× 32 200)

Fig 2 Pure talc (× 260 000)

Barrot is a French citizen born in 1926. He entered the paint and plastics industry in 1947 and worked for Tréfileries Laminoirs du Havre, one of the major French cable makers. In 1960 he joined Francolor SA in Paris as an assistant to the director of the Pigment Division.

In July 1965 he was appointed Managing Director of Sierra Corp (which in the meantime has changed its name to Cyprus Industrial Minerals Corporation), Ghent, Belgium.

Barrot is a specialist in mineralogy and has carried extensive work on the advanced applications of talc in the rubber industry. He is Vice-President of the Scientific Association of the European Talc Industry.

Mineral and chemical compositions of talc can vary in accordance with the age of the deposit (and therefore with the metamorphic advancement), with its homogeneity and the identity of the 'mother rock'. The common qualities (50 to 70% pure talc) are generally found in Silurian grounds (400 million years old).

The purest qualities (97 to 99% pure talc) are found in a few mines located in infra-Cambrian sites (600 million years) such as Western Australia or the Belt layers (Montana, USA). The talc ore is therefore composed in variable amounts of

Talc

Non-altered vestiges of the 'mother rock' such as chlorite or dolomite

Substitute products such as:

a) aluminium, iron and titanium, which substitute for silicon

b) iron, manganese, aluminium, which subsistute for magnesium

Impurities: mica, vermiculite, graphite, quartz, etc

All this is extremely important because, in the very particular case where (a) the mother rock is tremolite, antophyllite or chrysotile, or (b) these ones are not entirely altered, this actual talc will exhibit asbestos-shaped fibres within its plate-like particles. Figs 1, 2, 3, 4, 5 and 6 (scanning electron microscope) show the difference between talc and asbestos.

Fig 3 Antophyllite (× 2600 @ 32°)

Fig 4 Tremolite (x900 @ 40°)

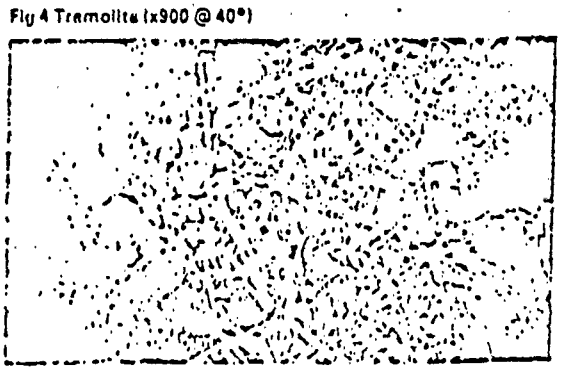


Fig 5 Talc containing 56% tremolite (x650 @ 30°)

Fig 6 Talc containing 1% chrysotile 0,5% tremolite (x1800 @ 32°)

The lack of semantic accuracy in the word 'talc' leads to confusion. Actually, the word is used to mean variously:

a the rock, known also as talcschist, steatite, soapstone;

b the mineral itself, which, as already stated, is found in various purities and which is often called rather pejoratively 'industrial' talc, by cosmetic talc people;

c the powder sold under the name of talc, called sometimes 'commercial' talc, which, actually, refers more to the particular characteristics of talc than to the mineral composition of the product itself. This can apply to fragrance-sprayed talc or to certain blends in which talc is just a mere element used in variable proportions and, as proved by Parkes,[1] being often absent from the composition named talc.

What percentage of pure talc content can be considered as acceptable and justifying describing the material as talc? That is the question!

A positive answer is given by the Cosmetic, Toiletry, and Fragrance Association which defines talc as follows in its last specification[2]:

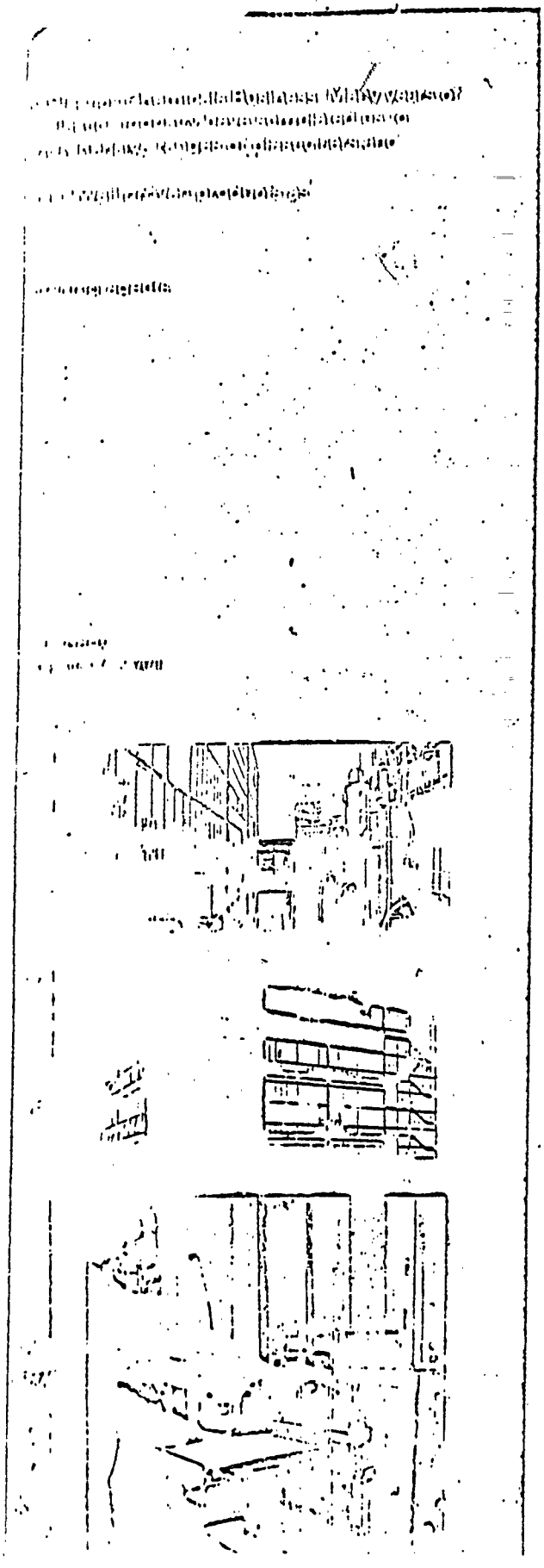
'Cosmetic talc is essentially a white, odourless, fine powder, ground from naturally occurring rock ore. It consists typically of 90% hydrated magnesium silicate, having the ideal formula $Mg_6Si_8O_{20}(OH)_4$ with the remainder consisting of naturally associated minerals such as calcite, chlorite, dolomite, kaolin and magnesite, and containing no detectable fibrous asbestos minerals.'

It is highly desirable that every talc-using industry should adopt this definition and settle its own specifications accordingly.

Professional health hazards

Asbestos and free silica, if present in talc, can cause asbestosis and silicosis respectively, which are sclerogenic, cytotoxical and fibrogenical evolutive pneumoconiosis. Is asbestos-free and silica-free talc dangerous?

As with *any* kind of dust, talc is easily inhaled. In normal working conditions, under adequate ventilation, the inhaled talc dust is either rejected or neutralized by the muco-ciliary system, which is the self-defence of the human body against dust. According to Leophonte *et al*,[4] Fabre, Pous, Albarede and Delaude[4], Rubino *et al*,[5] and Leophonte,[6] excessive inhalation of talc as well as extensive exposure can overwhelm the efficiency of the muco-ciliary system and lead to a non-evolutive residual pneumoconiosis, in which talc dust piles up at the bottom of the lungs in an inert and non-aggressive form, but which reduces the respiratorial capacity and shows easily under X-rays.



Talc users' protection

The first elementary safeguard to be observed is taking care of the cleanliness and the ventilation of the working premises in order to keep under the dust threshold limit values. The second safeguard, by far the most effective, consists in paying attention to the type of talc one is buying.

The talc industry is in full evolution. Fifteen years ago talc was still a commodity product, used as a carrier or as a cheap filler in traditional applications. This did not require either a great deal of technical knowledge from the producer or a sophisticated laboratory installation. For rather more than twenty years, demand for talc has been growing, owing to the efforts of one of the world's major talc producers, who led the way for other American and European producers. New milling techniques were developed as well as new applications requiring tight specifications, severe quality control, modern equipment and 'application-minded' technical staff. The talc consumer can totally rely on a supplier who exercises severe quality control on a daily basis, from supervision of mining operations up to final bagging, with the help of sophisticated laboratory equipment. It is not so certain with a small producer who has to call for outside services in order to exercise the same type of control.

It becomes still more hazardous to go through a broker who has no control at all on his sources of supply which are, most of the time, located in countries where the customer cannot visit the mine, either for political reasons or because it is too far away. People, equipment, techniques and policies can be improved, but no one can change the structure of a talc deposit.

The size and uniformity of talc deposits are extremely important. Most of them, whether they are open-pit or underground, are heterogeneous. This explains the variations in quality which can be detected only by a scanning electron microscope or X-ray diffraction apparatus.

The confusion about talc is more detrimental for the talc users than for the producers. It is therefore imperative that each talc-using industry should build up a talc specification according to its own requirements. The situation would be less confusing if each talc producer were summoned to issue his technical data sheets according to a standard pattern, using the same method of measures and showing clearly the pure talc content in percentage, as well as the nature and the quantity of non-talc components and impurities, and, more particularly, asbestos-like products, free silica, iron oxides, heavy metals and acid-soluble components. The mineralogical analysis is more important than the chemical analysis as far as the purity of talc is concerned; that is why a very few talc producers dare to include it in their information.

References

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5 Rubino, G F, Scansotti, G, Piolato, G, Rocchino, C A 'Mortality study of talc miners and millers' *J Occ Med* 0 (1976) 186

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