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Internal Correspondence

To: E. M. Fenner, 1-06

Date: February 18, 1977

From: R. S. Lamar, 3-05

Copies: J. H. Swensen, J. P. Leineweber, W. C. Streib, D, C

Subject: Paper by C. S. Thompson
"Asbestos in Your Future".

Dr. Leineweber's comments on this paper, given in his memo to you dated February 17, 1977, are in my opinion correct but perhaps too mild.

One of the few technically correct statements made by Dr. Thompson appears on page three. I agree that chrysotile is not a member of the pyroxene group, but disagree with almost everything else said by Thompson.

I object strongly to an earlier statement on page three regarding "misinformation" supplied by a competitor. Furthermore, in all of Thompson's gobbledegook regarding the mineralogy of Vanderbilt's "talc" at no point does he admit to the fact that their "talcs" contain not only fibrous tremolite but chrysotile and anthophyllite as well. This we have proved by every available technique. These findings are well documented in numerous R&D reports.

I'm afraid that Dr. Thompson long ago gave up any professional ethics he might have had and is now persisting with a program that is not only technically false but even more tragic morally and ethically wrong. He totally ignores the medical consequences of his immorality.

R. S. Lamar

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Attachments all copies

Asbestos in Your Future

by C. S. THOMPSON

Manager, Minerals, Ceramics and Paper R&D, R. T. Vanderbilt Co.

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Asbestos in Your Future

by C. S. THOMPSON

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To many, the title of these comments might infer a major discovery of new asbestos deposits, an increase in production, or new areas of application. However, others might suspect a more serious and sinister meaning; and, unfortunately, they are correct.

Relative to world asbestos production and reserves (with the exception of the huge ore body of short fiber in the New Idria serpentine in California), the United States has always been a small contributor, involving a very limited number of mining companies. This situation appears likely to remain the case since nature, apparently, saw fit to distribute the majority of this unique and highly useful material elsewhere in the world.

"Asbestos" minerals created by regulations

However, in the last few years, since excessive exposure to asbestos has been shown to be a serious health hazard, the United States government, through various regulatory agencies, has promulgated and proposed numerous regulations that have created "asbestos" minerals where they have never existed before, and thereby caused essentially every mining company in this country to be an "asbestos" miner and "asbestos" miller. In most cases, this also makes them guilty of contaminating the environment with "asbestos" by dumping their tailings so that the natural weathering processes redistribute these newly invented "asbestos" minerals into the air, surface runoff and ground water. In the case of many miners and producers of industrial minerals, these new "asbestos" materials are distributed into a wide variety of manufacturing operations as mineral fillers in paints, plastics, rubber, or as basic ingredients in cements, spackling compounds and ceramic products.

To understand how this startling situation has come about, let us examine the chronology of the chain of events which has occurred over the past few years.

Issuance of standard in 1972 starts chain of events

It all began with the issuance of the Occupational Safety and Health Administration (OSHA) Asbestos Standard in July 1972, based on the National Institute for Occupational Safety and Health (NIOSH) criteria document, with the purpose of controlling human exposure to asbestos. Without the benefit of readily available mineralogical ex-

pertise (USBM, USGS, etc.), "asbestos" was defined as any one of six minerals.

Table 1 lists these six minerals showing the correct terminology for describing the asbestiform varieties of anthophyllite, tremolite and actinolite.

The first three minerals listed in the OSHA document—chrysotile, crocidolite and amosite—designate specifically the fibrous or asbestiform varieties of their vastly more abundant non-fibrous counterparts. In contrast, the latter three amphiboles—anthophyllite, tremolite and actinolite—assisted erroneously, include all forms of these very common rock-forming minerals which rarely occur in fibrous or asbestiform habit.

Table 1. "Asbestos" minerals as listed in Federal Register (Listed minerals are italicized).

Asbestiform Variety	Chemical Composition	Non-Asbestiform Variety
SERPENTINE GROUP		
<i>Chrysotile</i>	$Mg_3(Si_2O_5)(OH)_4$	Antigorite, lizardite
AMPHIBOLE GROUP		
<i>Crocidolite</i>	$Na_2Fe_2Fe_3(Si_3O_{10})(OH,F)_2$	Riebeckite
<i>Amosite</i>	$(Mg,Fe)_7(Si_8O_{22})(OH)_2$	Cummingtonite-grunerite
Anthophyllite	$(Mg,Fe)_7(Si_8O_{22})(OH,F)_2$	Anthophyllite
Tremolite	$Ca_2Mg_5(Si_8O_{22})(OH,F)_2$	Tremolite
Actinolite	$Ca_2(Mg,Fe)_5(Si_8O_{22})(OH,F)_2$	Actinolite

Simple error has created confused situation

It was this simple error which has been perpetuated by other agencies and is now being expanded through proposed regulations by both OSHA and the Mining Enforcement and Safety Administration (MESA) that has created the confused situation that exists today. This error was further complicated by defining a "fiber" as any mineral particle three times longer than it is wide (3:1 aspect ratio) through reference to the NIOSH criteria document.

These simplistic definitions of "asbestos" and "fiber" were eagerly and immediately accepted by essentially all other agencies as illustrated by the proposed and/or prom-

ulgated regulations listed in table 2. It is obvious from these documents that the majority of standard producing

Table 2. Initial Reaction. (Primary definitions covering asbestos exposures)

Agency	Date	Definitions
Osha	July 7, 1972 (Revised Oct. 18, 1972)	6 Minerals (See table 1) Fiber = 3:1 Length: width ratio = >5 Micrometers in length
USBM (Coal)	Nov. 7, 1972	Same as Osha
EPA (Air)	Apr. 6, 1973	Same as Osha Asbestos material = Asbestos or any material containing asbestos Asbestos tailings = Any solid waste product of asbestos mining or milling operations which contains asbestos

agencies are reluctant to develop definitions of their own and are perfectly satisfied to incorporate those promulgated by others even to the perpetuation and expansion of erroneous ones.

Bureau of Mines tried to clarify issue with symposium

The first major breakthrough in correcting the errors in the original asbestos definitions came as the result of a concerted effort by the Bureau of Mines to clarify the situation by holding a Symposium on Talc on May 8, 1973 in

Table 3. Turn about or Sidestep. (Secondary reactions concerning asbestos definitions)

Agency	Date	Definitions
EPA (Air)	May 3, 1974	Same as Osha Standard revised to include only "commercial asbestos," not operations where asbestos was a contaminant
USBM (Metal-nonmetal)	July 1, 1974	Only includes asbestiform varieties of six minerals; Recognizes existence of non-fibrous forms. Based decision on data presented at symposium on talc ³
Osha	Oct. 9, 1974 Nov. 21, 1974	Agreement with talc producer ⁷ Issued field memorandum ⁸ using five criteria for fiber identification (see table 4)
EPA (Air)	Oct. 25, 1974	Set exclusion level of one percent asbestos content ⁹
Mesa	Dec. 13, 1974	Issued memorandum requiring use of criteria similar to Osha for counting fibers

Washington, D.C.³ Numerous speakers presented data on the medical effects of talc and associated minerals on both humans and animals. Also, methods for the identification and classification of these minerals were discussed in detail.

Subsequent evaluation of all the presentations resulted in the Bureau of Mines publishing in the "Federal Register" of July 1, 1974 Amendments to the "Asbestos" Standard⁴. Included were minor changes in the definitions for asbestos and the recognized asbestos minerals (see table 3). This document stands today as the turning point and landmark in government regulation of minerals by

the realization that materials to be regulated must be correctly defined and described by the field of science to which they belong if meaningful standards are to be developed. To quote Professor Tibor Zoltai of the Department of Geology and Geophysics, University of Minnesota; in comments to the Minnesota Pollution Control Agency⁵ regarding the distinction between fibers of natural asbestos and of cleavage fragments:

Unfortunately, the misuse of some relevant mineralogical concepts and terms are becoming so widespread that it may be extremely difficult to correct them. However, if that is not done, some mineralogical concepts and expressions will have double definitions: one for mineralogists and physical scientists, and one for use in environmental public health sciences and practices.

The continuing use of these double definitions would be most unfortunate as it will undoubtedly lead to additional misunderstanding and conflict between mineralogists and geologists, on one side, and environmental and public health personnel on the other. As the concepts and expressions are mineralogical, the logical solution to this problem would be for the personnel in the second category to restrict themselves to the proper use of mineralogical terms.

On May 3, 1974 the Environmental Protection Agency (EPA) issued its "Revised National Standard for Asbestos Air Pollutant"⁶ in which the asbestos definition was side-stepped by stating that the standard was meant to deal only with "commercial asbestos" and that materials "containing asbestos as a contaminant only are not covered." They specifically mention talc mines and manufacturing operations and the "releases of asbestos from taconite milling operations" as being excluded from coverage.

Effort was made to correct error

In the meantime, through the diligent and consistent efforts of a small group of interested parties, Osha became aware of the errors in definition and the Department of Labor issued an agreement on Oct. 9, 1974⁷ with one industrial talc producer stating that "non-fibrous or non-asbestiform minerals such as non-asbestiform tremolite are not within the scope of the standard . . ." Soon thereafter, on Nov. 21, 1974 Osha issued a Field Information Memorandum⁸ recognizing the two forms of the amphibole minerals and listing five criteria to be used in deter-

Table 4. Criteria to be used by Osha in counting fibers

- Particles must appear to be fibrous rather than as crystals or slivers.
- The maximum diameter of a fiber to be counted is 3 microns.
- The maximum length of a fiber to be counted is 30 microns.
- The length to width ratio must be 5 or more to 1, that is, . . . times or more longer than wide.
- The separate or individual fibers must contain fibrils or the "bundle of sticks" effect unless they are at a nondivisible stage. A fibril cannot be subdivided and would be counted if it meets the other criteria. The electron microscope may be used to prove the fibrous nature of the particles. The length to width ratio of 5 or more to 1 is not meant to imply that other particles are not hazardous.

mining whether a mineral particle could be considered as fibrous or asbestiform. These are tabulated in table 4.

Osha's recognition of the problem as evidenced by these two documents and its repeated verbal assurances that correct mineralogical terminology and identification method would be incorporated into the asbestos amendment appeared to signal a real and welcome change in this agency's attitude toward the scientific correctness of its standards.

Very soon thereafter, on Dec. 13, 1974, Mesa issued "Health Division Instruction Memorandum No. 8—Definition of Asbestos Fiber for Tremolite Occurring in Talc," which listed criteria for fiber determination similar to those outlined in the Osha document. The year 1974 ended with a feeling of optimism that science had won out and that future regulatory documents dealing with "asbestos" would contain definitions and terminology that would limit their application to the true asbestos minerals upon which all medical data concerning human health hazards has been obtained.

Plan to rescind Labor Dept. agreement revealed

The first indication that all was not well was a thinly veiled threat early in 1975 that Osha was considering the rescinding of the Department of Labor agreement with the before mentioned talc producer and the withdrawal of Osha Field Information Memorandum #74-92. This maneuver was based on misinformation supplied by a competitor concerning the mineralogy of the talc products in question and on continuing pressure from NIOSH which, to this day, insists on using only the simplistic 3:1 (length:width) criterion to define a fiber. A meeting was held with the then Assistant Secretary of Labor, John Stender, with all principals represented, at which Stender stated that as long as he held office both the agreement and Field Information Memorandum would remain in force. Stender left the Department of Labor soon thereafter.

Another document was brought to our attention late in the summer of 1975 by Bureau of Mines personnel. This was a study, commissioned by EPA, published by Battelle, Columbus Laboratories entitled "Identification and Assessment of Asbestos Emissions from Incidental Sources of Asbestos."¹⁰ This publication deals primarily with the occurrences of amphiboles, all lumped together under the subtitle of "Asbestiform Minerals of Interest." All amphiboles are grouped, regardless of crystalline form, because the authors state, "the excellent prismatic cleavage characteristic of all members of this mineral series (some 27 individual species) causes the mineral to fragment into fibers." This statement is directly contrary to the principle, in general acceptance among mineralogists, that mineral fibers grow as fibers and that fibers are not generated from non-fibrous crystalline material by fragmentation. This paper goes on to discuss, essentially, all the major mining districts in the United States, state by state, with the consistent inference that the presence of amphiboles in any rock makes that rock a potential "incidental source of asbestos."

Proposed amendment to standard

The shoe dropped on Oct. 9, 1975 (Black Thursday) with the issuance of the Osha proposed amendment to its

Asbestos Standard (see table 5).¹¹ Not only did Osha propose to take the step backward and use the aspect ratio as the sole criterion in defining a fiber but also to lower the threshold limit value (TLV) from 5 fibers/cm³ (this TLV was automatically dropped to 2 fibers/cm³ on July 1, 1976) to 0.5 fiber. In the preamble to this document Osha continues to show its lack of mineralogical expertise by

Table 5. Back to go and worse. (Most recent reactions concerning asbestos definitions)

Agency	Date	Definitions
Osha	Oct. 9, 1975	6 Minerals—No distinction as to crystalline form. Fiber = 3:1 length:width ratio = >5 micrometers in length (negates field memorandum*)
EPA (Air)	Oct. 14, 1975	No change from original—details disposal methods
EPA (Water)	Oct. 16, 1975	No change from original—groups wollastonite with asbestos for required effluent controls
Mesa (Metal-nonmetal)	June 29, 1975	Removes "asbestos" terminology and substitutes "mineral fiber" Mineral fiber = any mineral particle with a 3:1 aspect ratio or more >5 Micrometers in length <5 Micrometers in width

copying an asbestos definition from a New York Academy of Science publication dealing with the biological effects of asbestos rather than consulting a more appropriate mineralogical reference. The definition chosen was in gross error in that it included all pyroxenes, in addition to all amphiboles, and classified chrysotile as an example of the pyroxene group, which it is not. This inclusion of an additional group of minerals never before considered to be asbestos indicates the never ending attempts by some regulatory agencies to expand their jurisdiction indefinitely.

The Osha publication was followed in quick succession by two documents issued by the EPA on Oct. 14 and 16, 1975, dealing with asbestos contamination of air and water, respectively.^{12,13} The former details the method of disposal of asbestos and any material containing more than one percent by weight of asbestos. The latter further modifies the effluent guidelines for mineral mining and processing numerous minerals including a category entitled "Asbestos and Wollastonite." This expansion of the inferred health hazard to a non-asbestos mineral apparently slipped by unnoticed by the industry since no counteracting comment has been discovered to date.

Mesa proposal would expand mining regulation

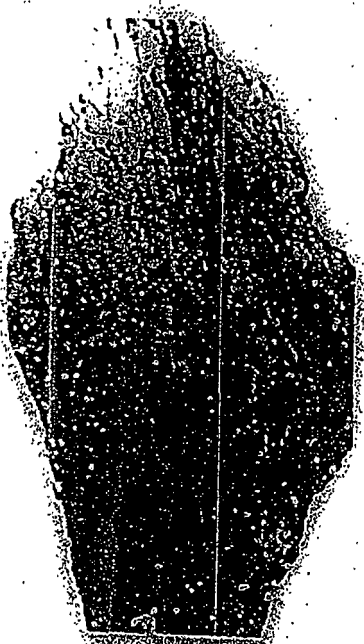
The latest in this long list of regulations ostensibly directed at reducing or eliminating exposure of the worker, consumer and the general public to "asbestos" is aimed directly at the mining industry by its own regulatory agency. The proposed Mesa regulation,¹⁴ presented to the Federal Mine Safety Advisory Committee in Birmingham, Al., June 29, 1976, would expand the asbestos regulations to cover essentially all minerals known to man, regardless of composition.

Mesa would accomplish this very simply by removing the term "asbestos," which everyone has such a difficult

Amorph



Reberite



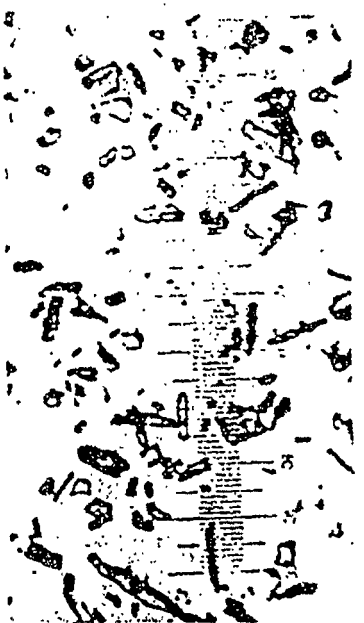
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"ASBESTOS" MINERALS

Anthophyllite Variety



Non Anthophyllite Variety



time defining, from the standard and replacing it with two words, "mineral fiber." The agency would further simplify the regulator's task by defining a "fiber" as any "particle that exceeds 5 microns in length but not 5 microns in width, and shall have a length-to-width ratio of at least 3 to 1." While the terminology and definitions are altered, the requirements for handling these "mineral fibers" remain the same as those promulgated for true asbestos.

To my knowledge, there is no mineral assemblage being mined, milled, processed and either used as such or discarded as tailings that would not contain significant amounts of mineral particles which would be classified as "mineral fibers" using the Mesa definition. The majority of silicates, including those most common in mineral deposits (i.e. amphiboles, pyroxenes and feldspars), and numerous nonsilicates have, by nature, cleavage characteristics that cause them to elongate during comminution. Nature itself forms particles meeting Mesa's criteria through normal weathering processes.

Two points should be made quite clear at this time:

—All of the medical data concerning the nature and extent of health hazards related to asbestos exposure has been gained on:

- truly asbestiform varieties of only four minerals, chrysotile, crocidolite, amosite and anthophyllite
- groups of workers exposed to extremely excessive amounts of these asbestiform minerals, usually as mixtures of at least two types.

—No definitive medical data has been presented to indicate that comparable health hazards exist with respect to the non-asbestiform varieties of the true asbestos minerals. No references at all regarding exposures to tremolite or actinolite, in any form, were included in the list of 70 plus references listed in the Osha Asbestos Standard and the additional 42 containing "new information" in the proposed amendment. The extrapolation of hazard from three or four extremely rare forms of common minerals to the inclusion of cleavage fragments and particles of essentially all other minerals is entirely unwarranted.

Ramifications to mining boggle the mind

There are many ramifications of the present and proposed "asbestos" regulations, which would directly affect the mining industry, that may not be immediately apparent. As mentioned earlier, regulatory agencies show a great reluctance to develop definitions of their own and eagerly adopt those supplied by others. The EPA is using the 3:1 aspect ratio exclusively for the six listed "asbestos" minerals in its extensive study of water contamination by mines, mills and manufacturing facilities. At present, the EPA requires that any material containing one percent or more "asbestos" must be disposed of by covering with "at least 15 cm (ca. 6 in.) of non-asbestos

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containing material . . . at the end of each operating day." Try to imagine the situation the mining industry would be in when the EPA starts to apply the proposed Mesa "mineral fiber" definition to the hundreds of thousands of tons of mine tailings and overburden dumped daily. Even worse, try to dream up a soil or cover of any kind which would not contain any "mineral fibers." Many state agencies try to improve on their federal counterparts by setting more stringent standards. The Illinois EPA, for example, requires that any "asbestos" containing material be disposed of in steel drums.

Every mining company would be affected

All the potential problems need not be elaborated on here. Everyone in the business of mining has been greatly affected by one or more of the multitude of safety and health regulations now on the books, but this latest "mineral fiber" proposal by Mesa is probably the only standard that affects every mining company in this nation. To make it worse, it is based on a lack of medical data, a totally unjustified extrapolation of hazard from fibers to non-fibers and a complete absence of mineralogical understanding and expertise.

In conclusion, I would urge the entire mining industry to support the efforts now being spearheaded by the AMC Noncoal Occupational Health Committee to counteract the ever growing umbrella of the "asbestos-mineral fiber" regulations. An AMC ad hoc subcommittee on "mineral fibers" has already made a presentation to the Federal Mine Safety Advisory Committee in Birmingham, resulting in the assignment of that topic to subcommittee for study. Continued efforts will be made to present any and all data which will aid all regulatory agencies, federal and state, to correct past errors in mineral definitions and to make use of the vast reservoir of mineralogical expertise in the U.S. Bureau of Mines and the U.S. Geological Survey in all future standards dealing with minerals. To accomplish this, the backing of the entire mining industry will be needed.

Almost everyone knows what asbestos is, but there seems to be a great many people in numerous regulatory agencies that do not know what "asbestos" is not. Unless these people are enlightened, most everyone who has not had "asbestos" in his past will find that he has "asbestos" in his future.

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