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10 December 2019 Testimony before Subcommittee on
Economic and Consumer Policy Hearing Examining Asbestos in Talc

Chairman Krisnamoorthi, Ranking Member Cloud, and members of the Subcommittee, thank you for inviting me to appear before the committee today. My name is Dr. Rodney V. Metcalf; I hold B.S. and M.S. degrees in Geology from the University of Kentucky and a PhD in Geology from the University of New Mexico. I have served on the faculty in the Department of Geoscience at the University of Nevada-Las Vegas for nearly 30 years and presently serve as Department Chair. Beginning in 2011 my research has focused primarily on understanding the geologic processes responsible for the genesis of amphibole asbestos and its distribution in geologic materials.

I am here today to discuss the geological controls and processes that form talc and asbestos, the potential for talc and asbestos to coexist in talc ore, and whether or not it is reasonable to expect talc ores to be free of asbestos minerals.

It is my scientific opinion that when geologic processes and scale are taken into account, the probability that talc and amphibole asbestos coexist in talc-rich rocks is very high. Talc and amphibole asbestos minerals can and certainly do co-exist at scales that cannot be mined in such a way as to exclude amphibole minerals from talc. Though not impossible, it is improbable for geologic processes to produce 100% pure talc ore in minable volumes.

Talc and the materials regulated as asbestos are all naturally occurring silicate minerals formed by geologic processes. Asbestos is a commercial and regulatory term that refers to six silicate minerals defined by (1) morphology, specifically fibrous shape and size, and (2) mineral classification which is based on the mineral's name and chemical formula. The six asbestos minerals are: the serpentine mineral chrysotile, and fibrous varieties of five minerals from the amphibole group, tremolite, actinolite, anthophyllite, riebeckite (known commercially as crocidolite), and grunerite-cummingtonite (known commercially as amosite). While chrysotile is always fibrous, amphibole occurs in both fibrous and non-fibrous morphologies.

Talc and the six asbestos minerals form by water-rock interaction during a type of metamorphism called *hydrothermal alteration*. During this process a pre-existing rock called a *protolith* is subjected to changes in temperature, pressure, and the infiltration of hydrothermal fluids (hot water), these changes drive reactions where minerals in the protolith breakdown to form new stable minerals. Hydrothermal fluids can carry dissolved mineral components and have the capacity to alter bulk-chemical composition of the protolith by the addition and/or removal of components as fluids flow through a rock over time. When water-rock interaction produces significant shifts in protolith composition the process is called *metasomatism*; this process is thought to be responsible for production of talc-rich ores.

There are two questions are of particular interest here.

1. Are talc-producing reactions linked to the formation of amphibole and amphibole asbestos? In other words might we expect to find amphibole asbestos in talc? The answer is yes.

   Many talc-forming reactions involve the breakdown of amphibole under geologic conditions that are favorable for the generation of fibrous morphology, i.e. amphiboles asbestos. For these reactions, incomplete reaction progress results in the retention of amphibole asbestos in talc-rich rocks. Talc-anthophyllite "transition particles" found in talc ore are interpreted as relicts of such incomplete reactions.

2. Are there metamorphic processes capable of producing a rock in minable volumes of 100% pure talc rock, a talc-rock free of asbestos minerals?

The answer to this question is yes, but only under a very specific and limited set of conditions. Talc can be produced by reactions involving the breakdown of carbonate minerals (dolomite or magnesite), a reaction pathway that does not pass through amphibole asbestos. Extreme metamosmatism of a carbonate-rich protolith at a specific temperature could produce asbestos-free talc. However, if this process started at slightly higher temperature, amphibole and amphibole asbestos would form and would become reactants in subsequent talc-producing reactions. Talc ores containing amphibole asbestos are known from deposits formed by alteration of carbonate protoliths.

Asbestos in cosmetic talc is considered a health hazard to consumers even at levels labeled as "non-detect" by the industry J4-1 method. We should not be surprised when more sensitive testing methods find asbestos present in talc ores and talc products given that the formation of asbestos and talc are linked by common geologic processes. Although we often refer to asbestos as a "contaminant" in talc, as though it is an introduced foreign substance, asbestos can occur as a relict component of the natural talc-forming geologic processes and its presence should be anticipated.

Thank you for your time today, I am available for questions.

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My testimony today is based on a review of published, peer-reviewed scientific literature, publically available Government documents, widely used university-level metamorphic petrology textbooks, and other relevant information.

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