Comments on Asbestos; Reporting and Recordkeeping Requirements Under the Toxic Substances Control Act (TSCA) Proposed Rule

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Submitted by the National Stone, Sand & Gravel Scientific Advisory Board

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Abbreviations

EMP	Elongate Mineral Particle
LAA	Libby Amphibole
MSHA	Mine Safety and Health Administration
PCM	Phase Contrast Microscopy
PLM	Polarized Light Microscopy
TSCA	Toxic Substances Control Act
US EPA	United States Environmental Protection Agency

1 Overview

We have been asked by the National Stone Sand & Gravel Association to comment on the "Asbestos; Reporting and Recordkeeping Requirements Under the Toxic Substances Control Act (TSCA) Proposed Rule [EPA-HQ-OPPT-2021-0357; FRL-8632-02-OCSPP]," as it relates to the construction aggregate industry. The Proposed Rule "require[s] certain persons that manufactured (including imported) or processed asbestos and asbestos-containing articles (including as an impurity) in the four years prior to the date of publication of the final rule to electronically report certain exposure-related information." It appears that the ultimate goal of the Proposed Rule is to prevent future adverse health effects from asbestos. However, as written, the Proposed Rule will not accomplish this goal, particularly in respect to construction aggregates, for two primary reasons:

Asbestos is not defined consistently as the asbestiform varieties of minerals.

> A precise definition of asbestos is needed that includes only asbestiform minerals that are known to be mesotheliomagenic. This should not include non-asbestiform particles, even if elongated, as these do not confer the same exposure-related human health risks as asbestos.

Other terms must be defined.

> Other terms are used in the Proposed Rule that must be precisely defined (*e.g.*, impurity, contaminant, and mixture).

Measuring asbestos in bulk samples is not informative with respect to human health risks.

> Human health risks are associated with the inhalation of airborne asbestos of certain dimensions, and the dimensions and concentrations of airborne asbestos cannot be determined from the quantity of asbestos in a bulk sample.

Precautions can be taken to mitigate exposures and risks from asbestos in a quarried rock or deposit.

> The Proposed Rule should acknowledge that asbestos is a naturally formed group of minerals that have grown with an asbestiform mineral habit. Consequently, asbestos may occur as an impurity in certain geological formations, although usually naturally occurring asbestos exists as a trace component. If there are trace amounts of asbestos in a quarried rock or deposit, precautions can be taken to mitigate exposures and risks.

The Proposed Rule focuses on measurements of bulk samples that will almost certainly contain non-asbestiform mineral particles identical in composition (*i.e.*, chemistry) to those that are asbestiform and comprise asbestos. Because the Proposed Rule does not exclude non-asbestiform mineral particles, the reporting and recordkeeping requirements will result in misleading information relative to public health. As such, the Proposed Rule should not be finalized and promulgated as proposed, as it pertains to impurities and the unintentional trace presence of naturally occurring asbestos. If it is to be promulgated, US EPA should establish a reporting 'threshold' for asbestos content that is measurable and scientifically valid.

Furthermore, reporting requirements should be based on results from analytical methods that distinguish asbestos fibers of the relevant dimensions from non-asbestiform mineral particles.

2 Asbestos Definition

The United States Environmental Protection Agency (US EPA) should strictly adhere to the definition of "asbestos" in TSCA, Title II, Section 202, as the "asbestiform varieties of six mineral types – chrysotile (serpentine), crocidolite (riebeckite), amosite (cummingtonite-grunerite), anthophyllite, tremolite or actinolite" (US EPA, 2021a, p. 9). This does not include the non-asbestiform varieties of these mineral types. If the definition is expanded to include other amphiboles or erionite, they must be asbestiform and mesotheliomagenic.

Asbestos is a natural-forming group of minerals that have grown with an asbestiform mineral habit. It is not human made. Consequently, it may occur as an impurity in certain geological formations (Figure 1). Typically, naturally occurring asbestos, if it exists in an active mine, will likely be present as a trace contaminant.

The Proposed Rule references the TSCA, Title II, Section 202 definition mentioned above, but under Subpart B – Chemical-Specific Reporting and Recordkeeping Rules, the Proposed Rule states: "Asbestos is a collective term meaning any of the substances listed in Table 1 of this paragraph." Table 1 lists asbestos, chrysotile, crocidolite, amosite, anthophyllite, tremolite, actinolite, and Libby Amphibole (LAA, which we note should be referred to as asbestiform winchite, richterite, and tremolite). This definition does not, but MUST, indicate that only asbestiform varieties of these minerals constitute asbestos, and that LAA itself is not defined as asbestos.

Asbestiform is a term used for a mineral that is like asbestos, *i.e.*, crystallized with the habit of asbestos. The characteristics of minerals with an asbestiform habit are generally recognized to include fibers having mean aspect ratios[1] ranging from 20:1 or 100:1 or higher for fibers longer than 5 μm; very thin fibrils (usually <0.5 μm in width); and two of more of the following: parallel fibers occurring in bundles, fiber bundles displaying splayed ends, matted masses of individual fibers, and fibers showing curvature (US EPA, 1993). Not all asbestiform fibers are asbestos, but all asbestos fibers are asbestiform (Steel and Wylie, 1981; Gunter, 2018; ASTM, 2018).

Non-asbestiform minerals, including some that meet analytical dimensional criteria for an asbestos fiber, occur as needle-like (acicular) or prismatic particles and do not possess the characteristics of asbestiform fibers (NIOSH, 2011). According to US EPA (1993), "If a sample contains a fibrous component of which most of the fibers have aspect ratios of <20:1 and that do not display the additional asbestiform characteristics, by definition the component should not be considered asbestos." Cleavage fragments are non-asbestiform and non-fibrous particles are created when non-fibrous mineral fragments are broken into smaller particles, *i.e.*, when a rock is crushed and undergoes further comminution. Importantly, each of the six asbestos fiber types have non-asbestiform analogs that are not asbestos and are very common in rock in many areas of the US (Figure 1) some of them over large areas.

The distinction between asbestiform and non-asbestiform varieties of amphiboles and serpentines is important because there is no evidence that exposure to non-asbestiform particles, including cleavage fragments, increases the risk of asbestos-related disease. This has been widely recognized in the scientific literature (*e.g.*, Williams *et al*., 2013; Mossman, 2008; Addison and McConnell, 2008; Gamble and Gibbs,

[1] The aspect ratio is the ratio of the length to the diameter of a fiber.

2008; Wylie, 2016; Wylie *et al*., 2020) and by US EPA and other federal agencies (*e.g*., US EPA, 1993; OSHA, 1992; NIOSH, 2011; Crane, 2018).

In summary, the Proposed Rule should be limited to asbestos as defined in TSCA. Only asbestos minerals in their asbestiform habit should be considered.

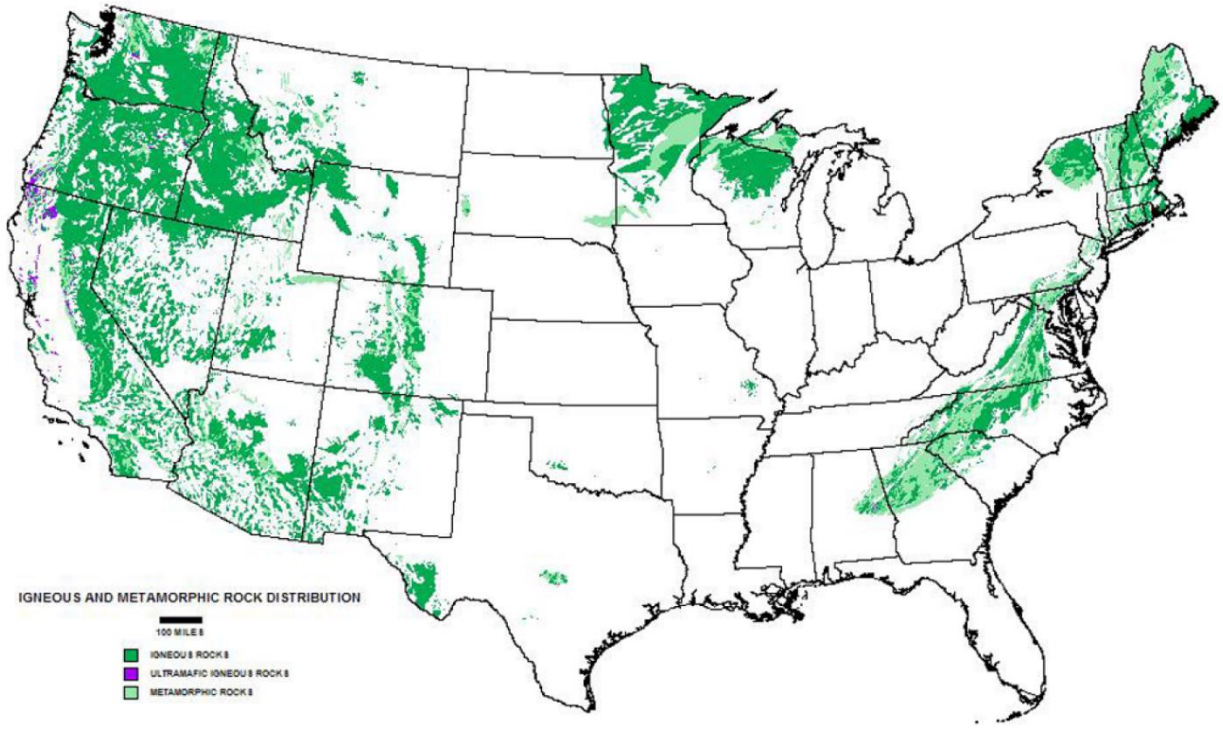

Figure 1 Igneous and Metamorphic Rock Distribution in the Contiguous United States. Rocks and soils in the areas shown in green have a higher probability of containing amphibole and serpentine minerals, some of which are minerals defined as asbestos. Derived from US EPA (1974). Note that the resolution is limited at this scale.

3 Other Definitions

The Proposed Rule states:

> Under TSCA section 3(10) (15 U.S.C. 2602(10)), the term "mixture" means any combination of two or more chemical substances if the combination **does not occur in nature** and is not, in whole or in part, the result of a chemical reaction; except that such term does include any combination which occurs, in whole or in part, as a result of a chemical reaction if none of the chemical substances comprising the combination is a new chemical substance and if the combination could have been manufactured (including imported) for commercial purposes without a chemical reaction at the time the chemical substances comprising the combination were combined. [Emphasis added]

Because asbestos only occurs in nature, this definition precludes any material with asbestos to be defined as a mixture.

The terms impurity and contaminant are used several times throughout the document but are never defined. The Proposed Rule further states, "Bulk materials containing asbestos means bulk materials in which asbestos is being mined or milled as a contaminant or an impurity, such as in vermiculite or talc." Without a precise definition of impurity or contaminant, bulk materials containing asbestos cannot be defined.

4 Thresholds

The Proposed Rule states, "Because asbestos can be included in small quantities in some products, having a threshold concentration for reporting would be expected to eliminate much of the information that may be useful to support US EPA's TSCA risk evaluation and risk management efforts. Therefore, US EPA is proposing that reporting would be required whenever the presence of asbestos is known or reasonably ascertainable."

Asbestos is a natural-forming group of asbestiform minerals that may be found in large areas of the US (see Figure 1). It may occur in igneous, metamorphic, mafic, and ultramafic rocks as a trace component in these types of geological formations (Wylie and Candela, 2015). Reporting on trace levels of natural occurrences of asbestos is extremely complicated and not practical due to its heterogeneity within a geological formation or deposit. Collecting a truly representative sample of a mining deposit to accurately reflect the quantity of heterogeneously distributed, naturally occurring asbestos at trace levels is not possible or practical.

Furthermore, measuring the amount of asbestos in bulk samples is not informative with respect to human health risks, which are associated with airborne asbestos. As such, there should be no reporting requirements under TSCA for asbestos in naturally occurring rock formations. Rather, as discussed below, if the presence of asbestos is expected based on local geology, the Mine Safety and Health Administration (MSHA) will conduct sampling as part of their bi-annual inspections. US EPA should consult with MSHA on all matters regarding trace levels of asbestos in mining.

5 Reporting

Fiber type, habit, dimensions (*i.e*., length, width, and aspect ratio), elemental composition, and surface properties (*i.e*., iron oxidation state, surface area) are thought to influence asbestos's carcinogenic potency. However, some federally designated analytical protocols do not distinguish different asbestos fiber types or distinguish asbestos from other fibers or fragments, including those from non-asbestiform minerals. Furthermore, analytical methods differ in their rules for counting asbestos fibers and their dimensions, especially between airborne and bulk methods. Thus, a key consideration in asbestos exposure studies is the method of analysis of asbestos fibers (or structures), including both analytical capabilities and counting rules.

Analytical methods used to analyze bulk samples should be able to distinguish specific asbestos fiber types, asbestos *vs*. other types of particles and fibers, and asbestiform *vs*. non-asbestiform habits. They should also be able to characterize fiber dimensions. Several different analytical methods are available for fiber analysis that differ in these abilities, as well as in the counting rules they employ. If bulk samples are being analyzed, the relevant metric is based on content (*e.g*., µg/g or parts per million), as numbers of fibers (or structures) are altered during sample preparation and cannot be replicated or empirically validated.

Polarized light microscopy (PLM) is commonly used to determine the percent asbestos in bulk building materials, as well as other bulk materials such as mineral powders. With proper training, PLM can be used to identify asbestos fiber type with reasonable certainty by employing several techniques to determine fiber refractive index and other crystalline properties (NIOSH, 2017; US EPA, 1993).

The basic fiber counting rules for most current methods of analysis of airborne asbestos fibers are to include those fibers with a length longer than 5 µm and an aspect ratio greater than or equal to 3:1 (NIOSH, 2017). These dimensions are not necessarily indicative of asbestos in environments that could include both asbestos and non-asbestos analogs of the same amphibole species. Therefore, exposure measurements are most reliable when taken in environments with known asbestos sources. Otherwise, additional criteria should be used to help distinguish between asbestos and non-asbestos particles (Chatfield, 2018). In fact, mean aspect ratios for asbestiform fibers >5 µm are much greater than 3:1, ranging from 20:1 to 100:1 (US Dept. of Commerce and NIST, 2003, 2007). US EPA (1993) stated, "If a sample contains a fibrous component of which most of the fibers have aspect ratios of <20:1 and that do not display the additional asbestiform characteristics, by definition the component should not be considered asbestos."

Mined products are heterogeneous mixtures of minerals. Protocols for estimating trace component abundances of an ore body must be based on many assumptions and are potentially subject to large errors. Importantly, precautions can be taken to minimize fugitive emissions when asbestos is known to be present and, hence, risks to workers. All metal and non-metal mines are inspected at least twice a year by MSHA for safety and health hazards. If the presence of asbestos is expected based on local geology, MSHA will conduct sampling. If asbestos is present, potential exposures can be reduced by restricting access to the area or by controlling airborne dust. Dust can be controlled by using natural barriers (e.g., trees) and constructed barriers (e.g., buffer zones), applying water to suppress dust, modifying equipment (e.g., by enclosing dusty operations), mandating low speed limits for vehicles, covering truckloads of material, and using street sweepers for paved roadways.

Health risks are associated with the inhalation of airborne asbestos of certain dimensions, but airborne concentrations cannot be determined from the quantity of asbestos in a bulk sample, regardless of what method is used to measure it.

6 Health Effects

US EPA stated that it intends to evaluate the epidemiology literature to examine the potential for asbestos exposure to cause several cancers and non-cancer effects. This includes mesothelioma and lung, ovarian, and laryngeal cancer.

The Proposed Rule states: "Asbestos is a hazard to human health (Ref. 6). Some of the health effects caused by exposure to asbestos are:

- Lung cancer;
- Ovarian cancer;
- Laryngeal cancer; and
- Mesothelioma, a cancer of the thin lining of the lung, chest and the abdomen and heart."

The only cancers for which a causal relationship with asbestos exposure has been conclusively demonstrated are mesothelioma and lung cancer (US EPA, 2001; ATSDR, 2001). Evidence to support causal associations between asbestos exposure and laryngeal and ovarian cancers is not conclusive, nor has it received consensus agreement (IARC, 2012; Ferster *et al*., 2017; Slomovitz *et al*., 2020).

As stated by US EPA (2008), "If inhaled, asbestos fibers can increase the risk of developing lung cancer, mesothelioma, pleural fibrosis, and asbestosis." On its current webpage, "Learn about asbestos," US EPA lists lung cancer, mesothelioma, and asbestosis as the three major health effects associated with asbestos exposure (US EPA, 2021b). The Proposed Rule should add asbestosis and remove reference to ovarian and laryngeal cancer.

7 Conclusions

The "Asbestos; Reporting and Recordkeeping Requirements Under the Toxic Substances Control Act (TSCA) Proposed Rule" should be updated to reflect the following:

- The Proposed Rule should include only the mesotheliomagenic asbestiform varieties of specific mineral fibers.
- The Proposed Rule should precisely define terms, including asbestos, mixture, impurity, and contaminant.
- Typically, if naturally occurring asbestos exists in an active mine, it will be present as a trace contaminant.
- There is no practical way to collect samples that are representative of a mine's entire mineral deposit.
- Asbestosis, lung cancer, and mesothelioma are the only conditions for which conclusive evidence of a causal relationship with asbestos exposure exists.
- Human health risks are associated with the inhalation of airborne asbestos of certain dimensions, but airborne concentrations cannot be determined from the quantity of asbestos in a bulk sample. Hence, there should be no reporting requirements for trace amounts of asbestos in construction aggregate products.

Because the Proposed Rule is based on measurements of bulk samples that may not exclude non-asbestiform mineral particles, the reporting and recordkeeping requirements in the Proposed Rule will result in misleading information relative to public health. As such, the Proposed Rule should not be finalized and promulgated as it pertains to impurities and the unintentional presence of naturally occurring asbestos. If it is to be promulgated, US EPA should establish a reporting 'threshold' for asbestos content that is measurable and scientifically valid. Furthermore, reporting requirements should be based on results from analytical methods that can distinguish asbestos fibers of the relevant dimensions from non-asbestiform minerals.

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