

ABSTRACT

The physical properties of different types of asbestos may strongly affect health outcomes in exposed individuals. This study was designed to provide understanding of the comparative toxicity of naturally occurring asbestos (NOA) fibers including Libby amphibole (LA), Sumas Mountain chrysotile (SM), El Dorado tremolite (ED) and Ontario ferroactinolite cleavage fragments (ON). Rat-respirable fractions ($PM_{2.5}$) were prepared by water elutriation. Surface area was greater for SM ($64.1 \text{ m}^2/\text{g}$) than all other samples (range: $14.1\text{-}16.2 \text{ m}^2/\text{g}$), while mean lengths and aspect ratios for LA and SM were comparable and greater than ED and ON. Samples were delivered via a single intratracheal (IT) instillation at doses of 0.5 and 1.5 mg/rat. One day post-IT, low-dose NOA exposure resulted in a 3-4 fold increase in bronchoalveolar lavage fluid (BALF) cellularity compared to dispersion media (DM) controls, whereas high-dose exposure had a more severe effect on lung inflammation which varied by source. Although inducing less neutrophilic inflammation than ON and ED, exposure to either LA or SM resulted in a greater degree of acute lung injury. Three month post-IT, most BALF parameters had returned to control levels, while the development of fibrosis persisted and was greatest in SM-exposed rats (SM>LA>ON>ED). These data demonstrate that fiber length and higher aspect ratio are directly correlated with the severity of fibrosis and that, in the rat, exposure to SM is more fibrogenic than LA which suggests that there may be cause for concern for people at risk of being exposed to NOA from the Sumas Mountain landslide.

Key Words: Libby Amphibole, El Dorado, Sumas Mountain, cleavage fragments, fibrosis

Sumas Mountain chrysotile induces greater lung fibrosis in Fischer 344 rats than Libby amphibole, El Dorado tremolite, and Ontario ferroactinolite

JM Cyphert^{*†}, A Nyska[‡], RK Mahoney[§], MC Schladweiler[†], UP Kodavanti[†], and SH Gavett[†]

^{*}Curriculum in Toxicology, UNC School of Medicine, Chapel Hill, NC 27599

[†]EPHD, NHEERL, U.S. EPA, Research Triangle Park, NC 27711

[‡]Consultant in Toxicologic Pathology and Sackler School of Medicine, Tel Aviv University, Israel, Timrat 36576, Israel

[§]EMSL Analytical, Inc, Libby, MT 59923

Corresponding Author:

Stephen Gavett, PhD, U.S. EPA, Mail Drop B105-02, 109 T.W. Alexander Drive, Research Triangle Park, NC 27711. (e-mail: Gavett.stephen@epa.gov; Telephone: (919) 541-2555; Fax: (919) 541-0026)

Running Title: Toxicological responses to NOA

Disclaimer

The research described in this article has been reviewed by the National Health and Environmental Effects Research Laboratory, U.S. Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the agency, nor does the mention of trade names of commercial products constitute endorsement or recommendation for use.