

REPORT BRIEF • OCTOBER 2009

## A REVIEW OF THE NIOSH ROADMAP FOR RESEARCH ON ASBESTOS FIBERS AND OTHER ELONGATE MINERAL PARTICLES

Prior and ongoing exposures to asbestos continue to contribute to respiratory diseases—including mesothelioma, lung cancer, and asbestosis—despite the fact that asbestos is no longer mined in the United States. Asbestos exposures are estimated to have contributed to 18,068 deaths from mesothelioma from 1999-2005; asbestos-related diseases continue to be diagnosed due to the long latency period for their manifestation.

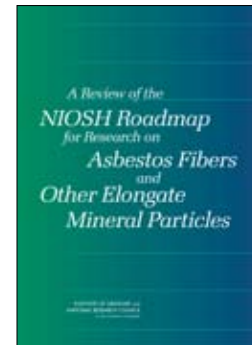
To examine ongoing issues and concerns in this field, the National Institute for Occupational Safety and Health (NIOSH) released a research roadmap in January 2009, *Asbestos Fibers and Other Elongated Mineral Particles: State of the Science and Roadmap for Research*, that provides an overview of the state of the science and a plan for future research in areas including toxicology, mineralogy, epidemiology, and exposure assessment. The proposed research focuses on clarifying the relationship between human health effects and the physical and chemical characteristics of a wide range of elongate mineral particles. In 2008, NIOSH asked the Institute of Medicine (IOM) and the National Research Council (NRC) to form a committee to review the scientific and technical quality of the NIOSH Roadmap. The committee found that NIOSH has put together a comprehensive and broad-based research Roadmap that could be improved through implementing a systematic and interdisciplinary approach to the outlined research.

### TERMINOLOGY

One of the major challenges facing researchers in this field is the terminology. NIOSH recognized the need for a term to encompass a broad class of mineral particles of specific size and dimension that are the primary focus of the proposed research in the Roadmap. The term—elongate mineral particle—is a convenient, neutral, and unified means of describing those mineral particles across different professional disciplines but is neither a rigorous mineralogical classification nor is it of regulatory significance.

### RECOMMENDATIONS

The NIOSH Roadmap brings together a substantial amount of information and a wealth of ideas on future directions for research, and therefore, it is necessary for the document to have a clearly stated vision and rationale. Additionally, the committee hopes that a more systematic and tiered approach to the research agenda will allow research to be conducted in a manner that will answer questions about which physical and chemical characteristics of elongate mineral particles are considered primary



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**NIOSH should ensure that four key components are included or refined in the Roadmap:**  
**(1) vision;**  
**(2) rationale;**  
**(3) goals; and**  
**(4) framework.**

determinants of toxicity to humans, thus allowing identification of specific types of mineral particles that would be of concern to human health.

### **RECOMMENDATION 1: CLARIFY THE VISION AND RATIONALE**

NIOSH should revise the Roadmap to clearly state the overarching vision and rationale for the research program.

- The overarching vision should point toward research that will differentiate effects from exposure to a range of elongate mineral particles and help determine the influence of size, shape, and other physical and chemical characteristics of these particles on human health. This research would identify which elongate mineral particles, or what characteristics of those particles, should be included in recommendations to protect the public and workers from hazardous occupational and environmental exposures.
- The rationale for the Roadmap should clearly articulate the influence that ongoing and future research can have on improving public and occupational health.
- A clearer vision and purpose would help strengthen the goals that the research is intended to support. The research should be prioritized as to the hazard and exposure.

### **RECOMMENDATION 2: INCLUDE KEY COMPONENTS**

NIOSH should ensure that four key components are included or refined in the Roadmap: (1) vision; (2) rationale; (3) goals; and (4) framework.

### **RECOMMENDATION 3: IMPROVE TERMINOLOGY**

NIOSH should revise its Roadmap with careful attention to consistency in the use of nomenclature and terminology. The goal is that authoritative terminology should permeate research and regulatory efforts, specifically:

- For research purposes, the term *elongate mineral particles* is useful for encompassing a broad category of mineral particles of a certain dimension and aspect ratio; more specific mineralogical terminology would be needed for regulatory purposes;
- Revisions should be made to the Roadmap glossary using accepted mineralogical terminology or nomenclature from the current American Geological Institute's *AGI Glossary of Geology* or other standard texts; citations should be provided for each definition; and nonstandard terms should be removed from the glossary and the main text; and
- Terminology used in sections referring to epidemiology and toxicology should also use definitions from current standard texts and be included in the glossary with citations.

### **RECOMMENDATION 4: STRENGTHEN THE EMPHASIS ON MINERALOGICAL RESEARCH**

NIOSH should revise the Roadmap to give greater attention to the mineralogical foundations of the proposed research. Discussions of mineralogy in the Roadmap should be strengthened by incorporating current understanding in this field using accepted terminology and by proposing research on the fundamental mineralogical properties relevant to toxicology, epidemiology, and exposure assessment. Specifically, mineralogical research is needed on physical and chemical properties, biopersistence, and mineral source characterization.

## **RECOMMENDATION 5: DEVELOP A REFERENCE MINERAL REPOSITORY**

NIOSH should work with other organizations and federal agencies to develop a repository of well-characterized and standardized reference minerals for use in research.

## **RECOMMENDATION 6: EMPHASIZE INTERDISCIPLINARY EFFORTS**

NIOSH should revise the Roadmap to emphasize the need for collaboration and integration of research among the mineralogical, toxicological, epidemiological, and exposure assessment disciplines.

## **RECOMMENDATION 7: DEVELOP A SYSTEMATIC STRATEGY FOR THE TOXICOLOGICAL ASSESSMENT OF ELONGATE MINERAL PARTICLES**

NIOSH should revise the Roadmap to describe a systematic tiered strategy for characterizing and testing the relative toxicities of elongate mineral particles and/or their mixtures. The strategy should include the following:

- Characterizing the chemical and physical properties of the elongate mineral particles
- Using tiered panels of in vitro and in vivo assays of increasing complexity to identify and characterize biological responses and categorize the potential hazards

## **RECOMMENDATION 8: EMPHASIZE ADDITIONAL RESEARCH AREAS**

NIOSH should revise the Roadmap to include an emphasis on the following:

- Incorporating petrographic analysis and developing new exposure assessment tools
- Toxicological mechanisms of action of a range of well-characterized elongate mineral particles with attention to early biomarkers of human health effects
- Additional opportunities for epidemiological research including studies of Libby, Montana, worker and resident populations, as well as cohorts exposed to elongate mineral particles in other countries
- Statistical methods for addressing analytic variability and determining the relationships between mineralogical and exposure variables and health outcomes

## **STEPS TOWARD A RESEARCH STRATEGY**

A research roadmap is one component of a larger research strategy. The committee urges NIOSH to continue its work with other federal agencies (such as the Environmental Protection Agency, the National Institute of Environmental Health Sciences, the U.S. Geological Survey, the Occupational Safety and Health Administration, the Mine Safety and Health Administration, and the Agency for Toxic Substances and Disease Registry) and private sector and nonprofit organizations with a focus on developing a research strategy. Such a strategy might include, in addition to the research framework and goals set forth in the NIOSH Roadmap, the following elements:

- An interdisciplinary system for prioritizing the various research activities to ensure maximum efficiency in an environment in which not everything possible can reasonably be undertaken at once and multiple disciplines need to work together to determine the priorities
- An approximation of the resources needed to carry out high- and middle-priority efforts
- A plan for review, evaluation, and accountability for those receiving support for research

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### **FOR MORE INFORMATION . . .**

Copies of *A Review of the NIOSH Roadmap for Research on Asbestos Fibers and Other Elongate Mineral Particles* are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, [www.nap.edu](http://www.nap.edu). The full text of this report is available at [www.nap.edu](http://www.nap.edu).

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