# WHAT IS ASBESTOS?

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## Definitional Issues

NATIONAL ACADEMY OF SCIENCE (1971)

"Asbestos" is a generic term for a number of hydrated silicates that, when crushed or processed, separate into flexible fibers made up of fibrils. Although there are many asbestos minerals, only six are of commercial importance: Chrysotile, a tubular serpentine mineral, accounts for 95% of the world's production; the others, all amphiboles, are amosite, crocidolite, anthophyllite, tremolite, and actinolite. (NAS 1971).

IMPLICATIONS OF AN OBSOLETE TERMINOLOGY

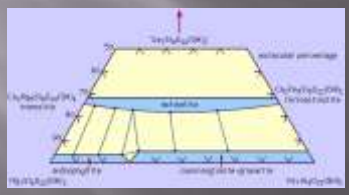
- Asbestos is an imprecise term.
  - Fibers are defining characteristic
  - Covers different minerological forms
  - Fails to cover similar minerological forms
  - Defined by commerce, history, and convention
- What is called "asbestos" is arbitrary.
  - The six forms are commercially used.
  - Other 70 fibrous silicates are not called asbestos even though they may be used in commerce (e.g. erionite).

## Big differences?

Structure of asbestos fibers by transmission electron microscopy (TEM): (a) serpentine and (bf) amphiboles. (a) International Union Against Cancer (UICC) asbestos chrysotile A standard, (b) UICC asbestos crocidolite standard, Death Valley, California, (c) UICC asbestos anthophyllite standard, (d) winchite-richterite asbestos, Libby, Montana, (e) tremolite asbestos and (f) UICC asbestos amosite standard. Chrysolite is the only member of the serpentine group. (Reprinted with permission from Denver Microbeam Laboratory at the U.S. Geological Survey).

## What is asbestos, really?

- Crocidolite is fibrous riebeckite.
- Amosite is fibrous grunerite.



## Not Counted as Asbestos

FIBROUS ERIONITE

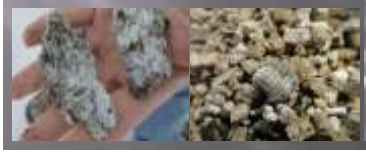
- Common worldwide
  - Tunneling risk
  - $Ca_3K_2Na_2[Al_{10}Si_{26}O_{72}]\bullet 30\ H_2O$
  - Fibrous

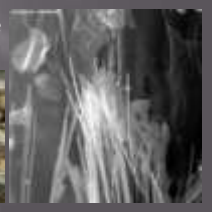
FIBROUS MODENITE

- An uncommon mineral
  - Sometimes encountered in tunneling
  - $|Na_2,Ca,K_2)4(H_2O)_{28}|\ [Al_8Si_{40}O_{96}]$
  - crystalline
- Toxicological studies suggest more potent than crocidolite inducing fibrosis, less potent in carcinogenicity

## Libby amphibole

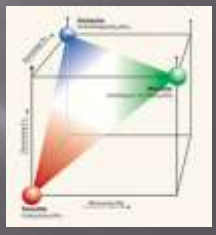
- Similar to tremolite, but pleomorphic
- Associated with widely distributed contamination due to extensive transport
- Contaminant of vermiculite
- Easily as potent as crocidolite





## Libby amphibole

- Asbestos samples vary in composition.
- Variable chemical composition within a single fiber
- Mixture of fibrous winchite, richterite, tremolite, magnesioriebeckite
- How is this meaningfully *not* asbestos?



## Regulatory Issues

- Asbestiform minerals other than the six recognized forms of commercial asbestos are not regulated by rules governing asbestos.
- This has interfered with management of Libby and with OH standards for Yucca Mountain.
- This is silly.
- These minerals have the same effect, varying in potency about as much as chrysotile and the amphiboles.
- Call them asbestos and be done with it.

## What is a duck?

If it…

- looks like a duck
- quacks like a duck
- swims like a duck
- belongs to the family Anatidae but has variable feather colour

…then call it a duck.