

US EPA ARCHIVE DOCUMENT

# Measurement and Monitoring for Asbestos Inhalation Exposure



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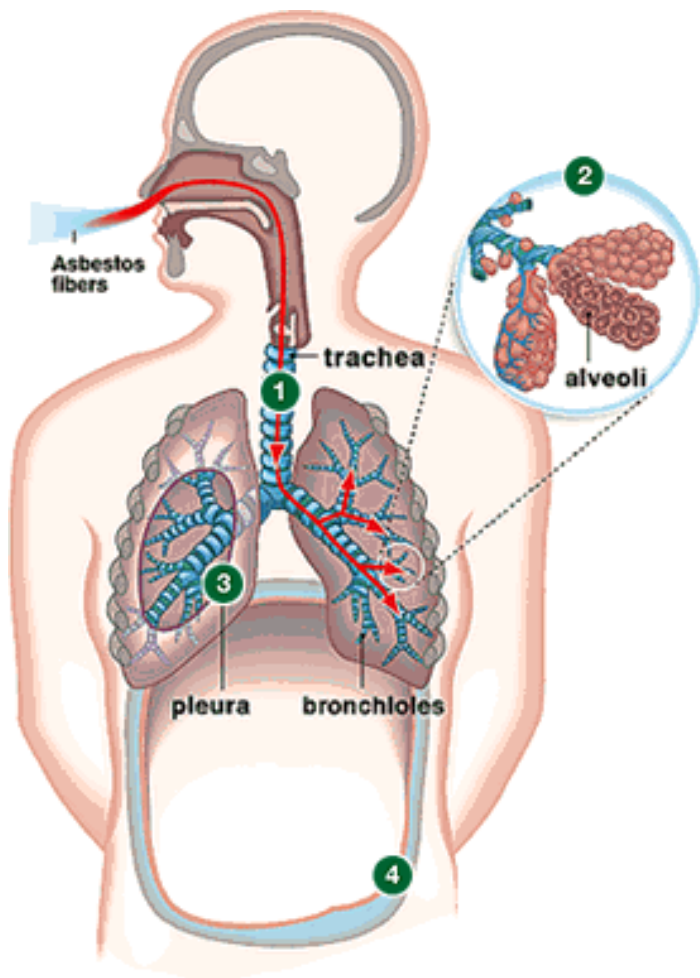
***EPA Region IX NOA Science Seminar  
August 18-19, 2004***

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NEIC  
Denver, CO*

# Objectives

- Review basic principles of exposure assessment;
- Provide an overview of the characteristics of asbestos that make it poisonous;
- Libby, MT Health Effects Summary
- Demonstrate some of the difficulties and pitfalls of asbestos exposure measurement.

# Fiber Deposition in the Lung



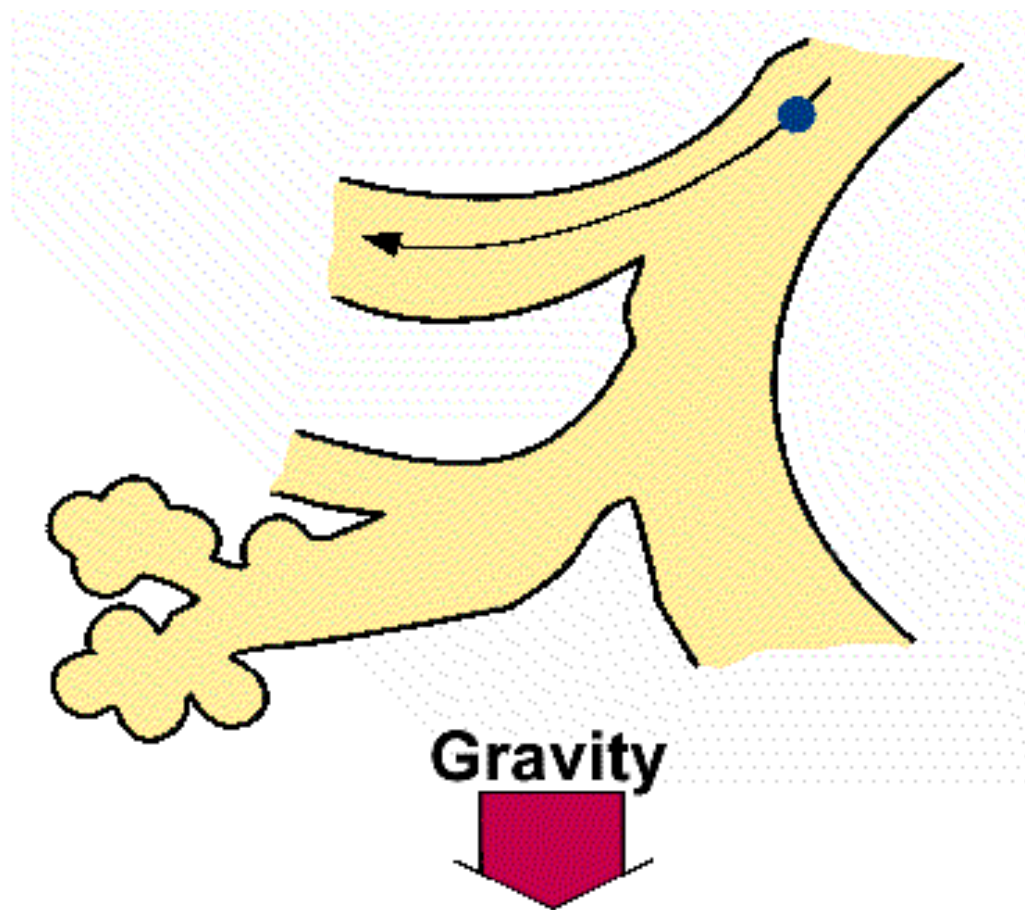
*Amosite asbestos fibers seen under electron microscope appear as tiny, fine, straight images.*

Human Hair

Tremolite



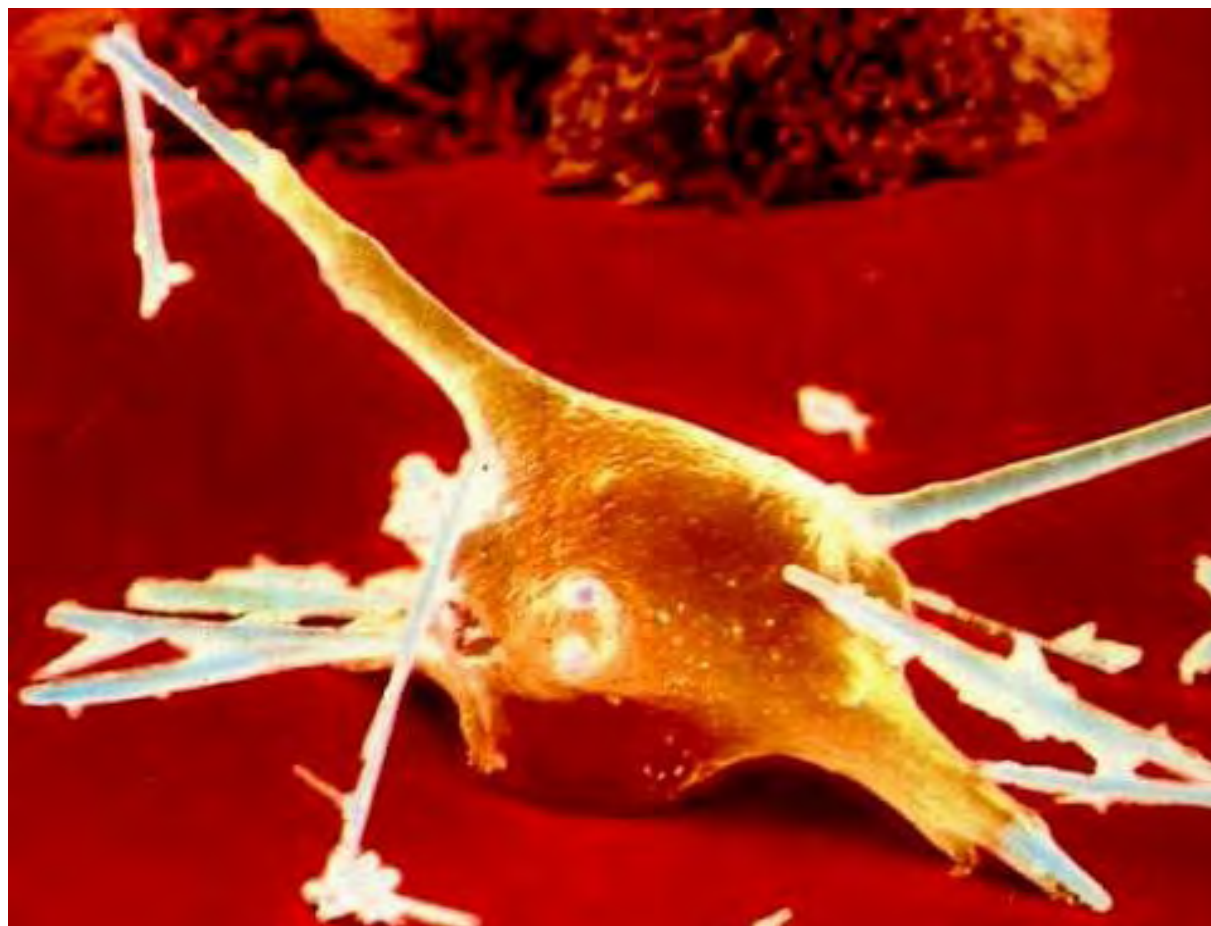
# Fibers Impact on Bronchial Lining due to Aerodynamics and Mass



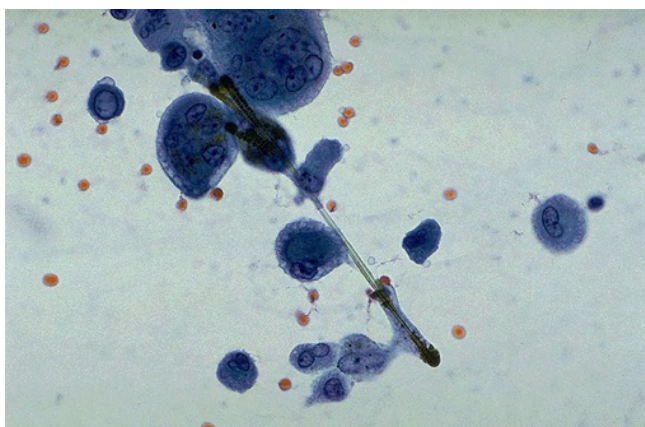
# Phagocytosis of asbestos fibers

pulmonary alveolar  
macrophage cell  
attempting to engulf  
and ingest several  
long crocidolite  
asbestos fibers

incomplete ingestion  
of asbestos fibers  
can lead to extensive  
'selective release' of  
proteolytic enzymes  
and ROS from the  
'frustrated' PAMs

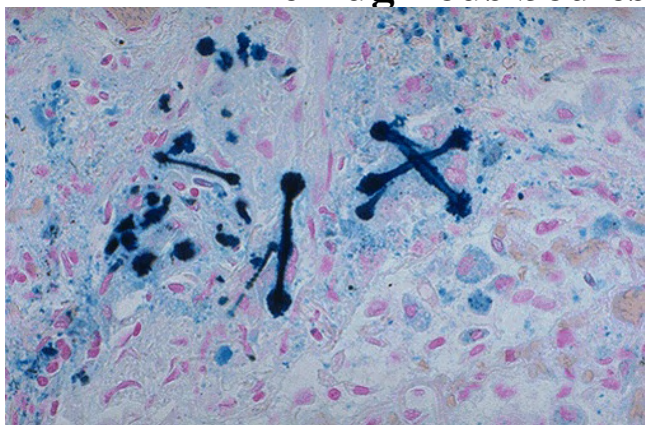


# Microscopic and Macroscopic Lung Abnormalities Caused by fibers



'asbestos bodies'

'ferruginous bodies'



Radiograph of  
Pleural plaques

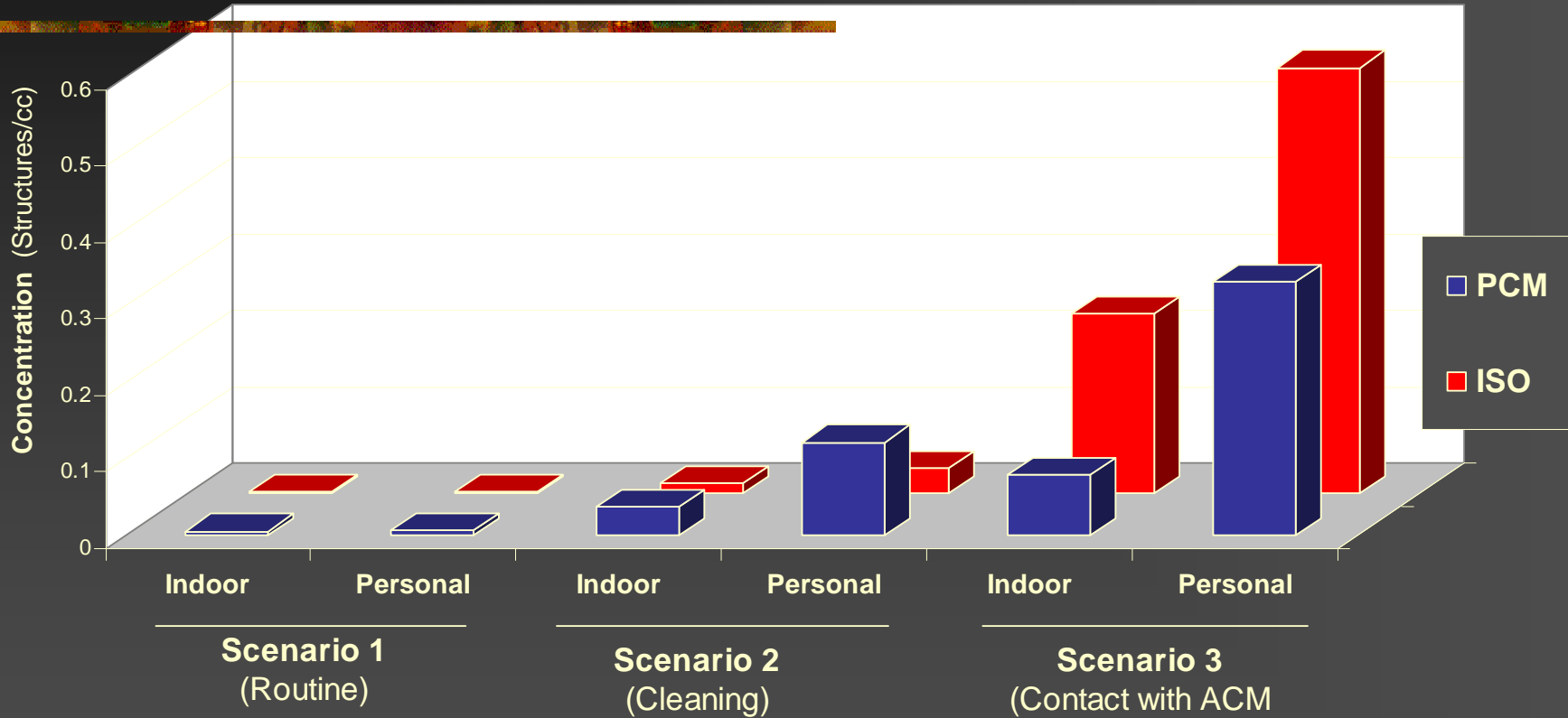
# Asbestos causes disease in the Lungs so.....

- Measures to estimate asbestos exposure should be **focused upon relevant pathways** of exposure;
- Exposure measures are most relevant if they **estimate asbestos in the breathing zone**;
- Activities near sources of friable asbestos cause it to stir into the nearby air. **Personal Dust Storm.**



- DRAFT -

### Asbestos Concentration



Note: Concentrations presented are averages of all non-zero values that were above the detection limit.

# Libby, Montana

- Located northwest Montana
- Population: 2600 city; 5000 city + surrounding area
- About 1100 homes: city



# Libby, Montana Health & Exposure Issues



Town 6 miles downwind from mine





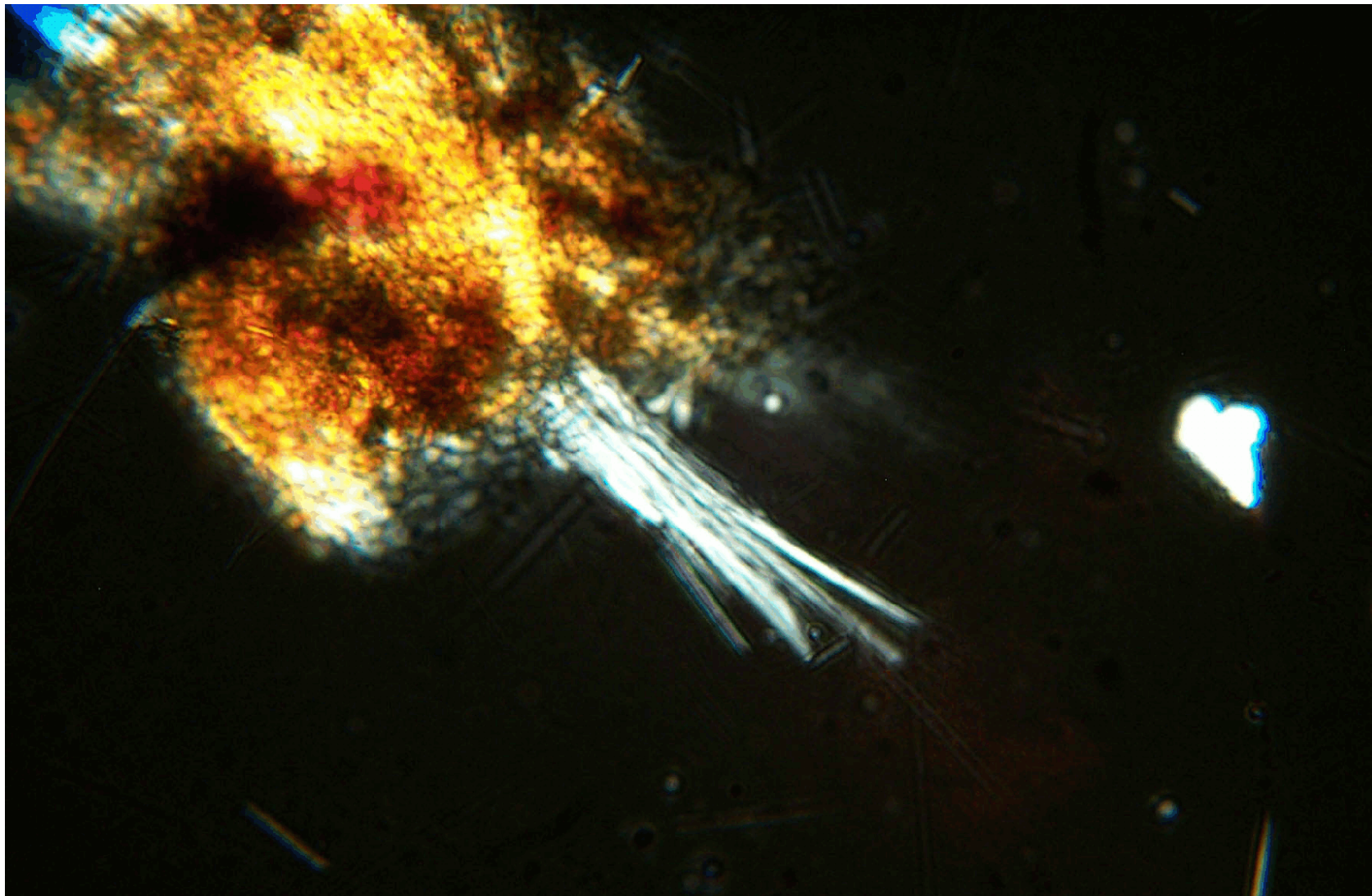
# Soil Sampling

- Polarized light microscopy (PLM) is a useful screening tool if large quantities of asbestos are present;
- Nondetects with PLM do not mean that there is no asbestos in the sample. It may be present at levels too low to see in the microscope;
- Often, levels too low to measure with PLM can result in elevated air concentrations that exceed regulatory standards.

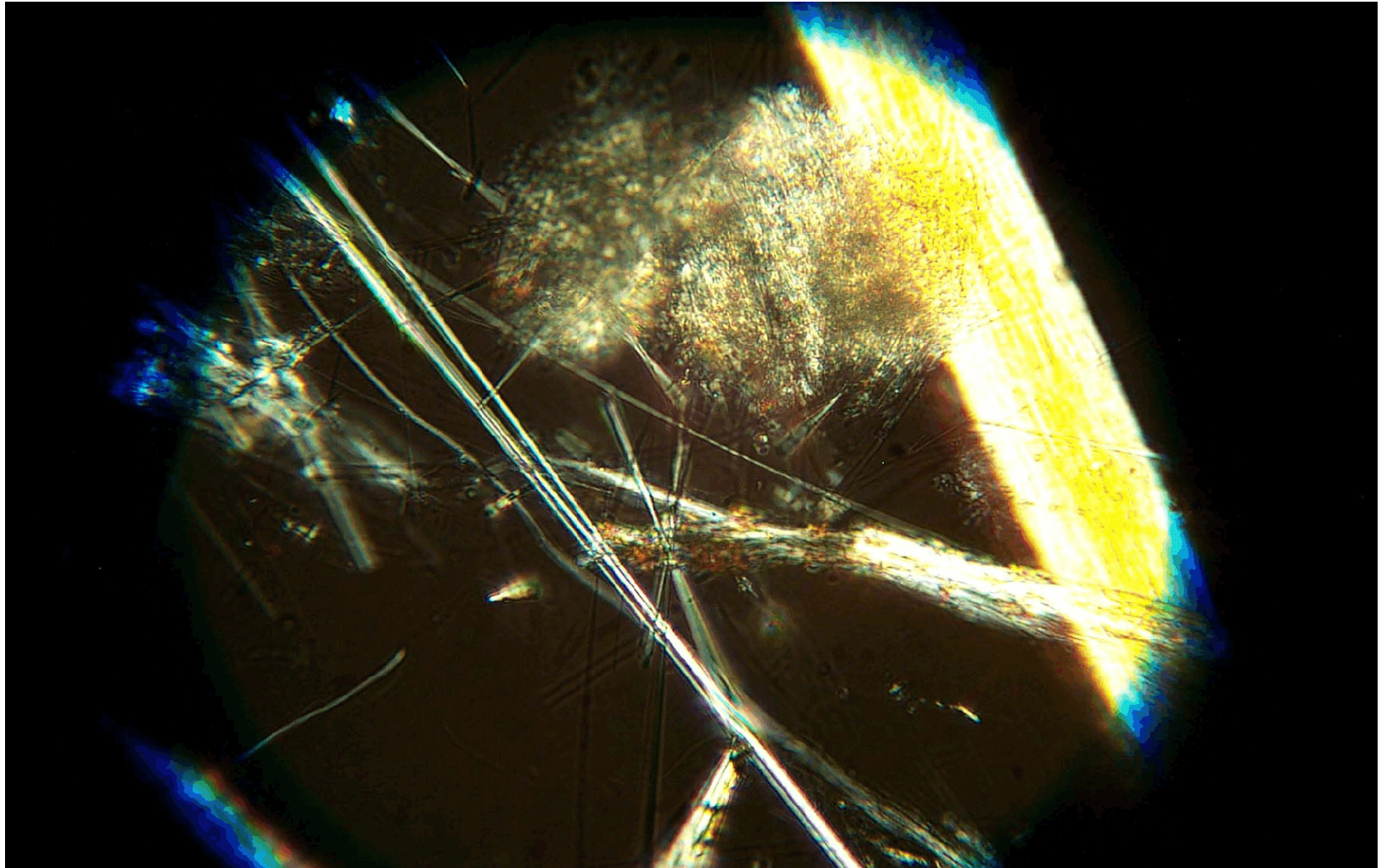
# PLM Microscope



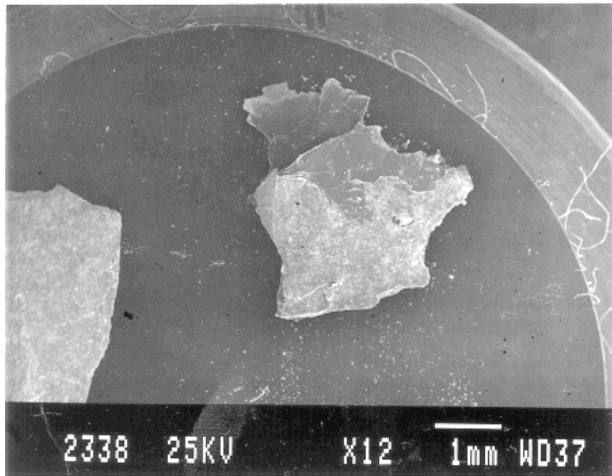
# PLM Photo of Tremolite



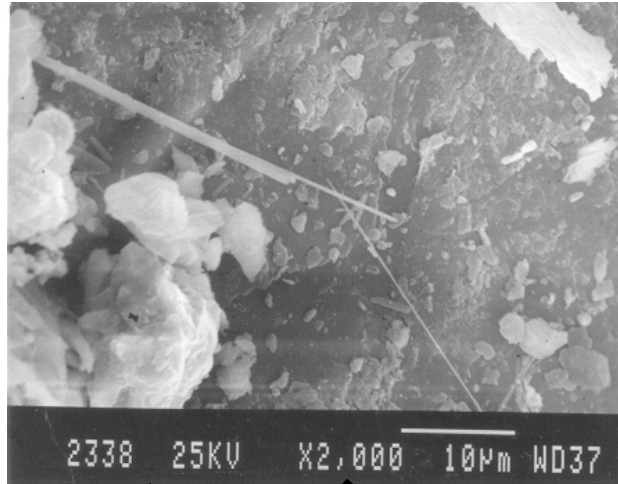
# PLM of Amosite and Human Hair



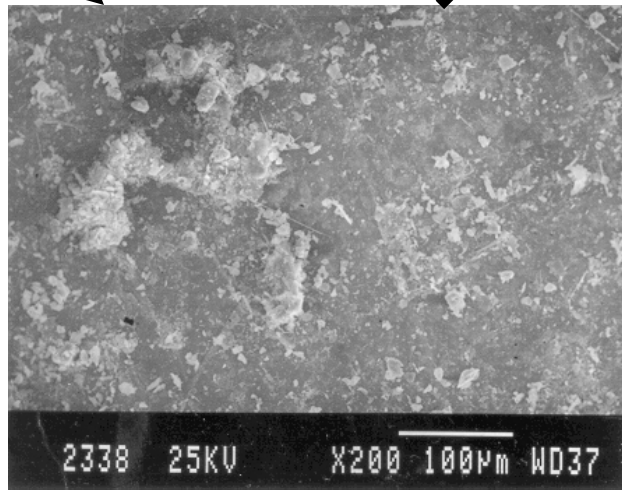
# Effect of increasing microscope magnification



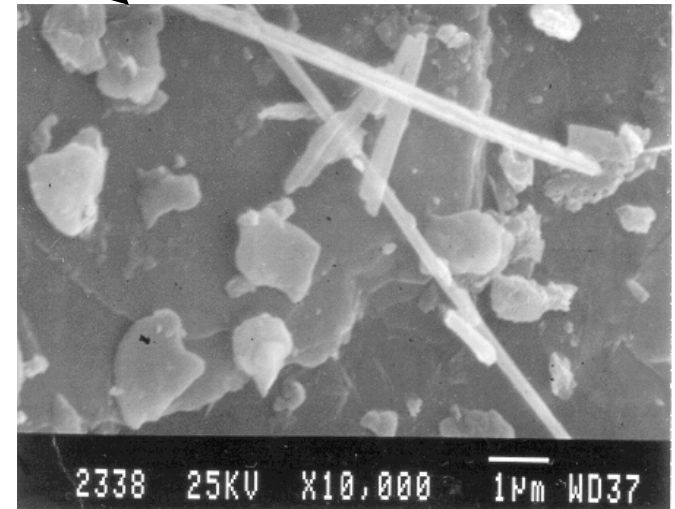
12X Mag.



2,000X Mag.



200X Mag.



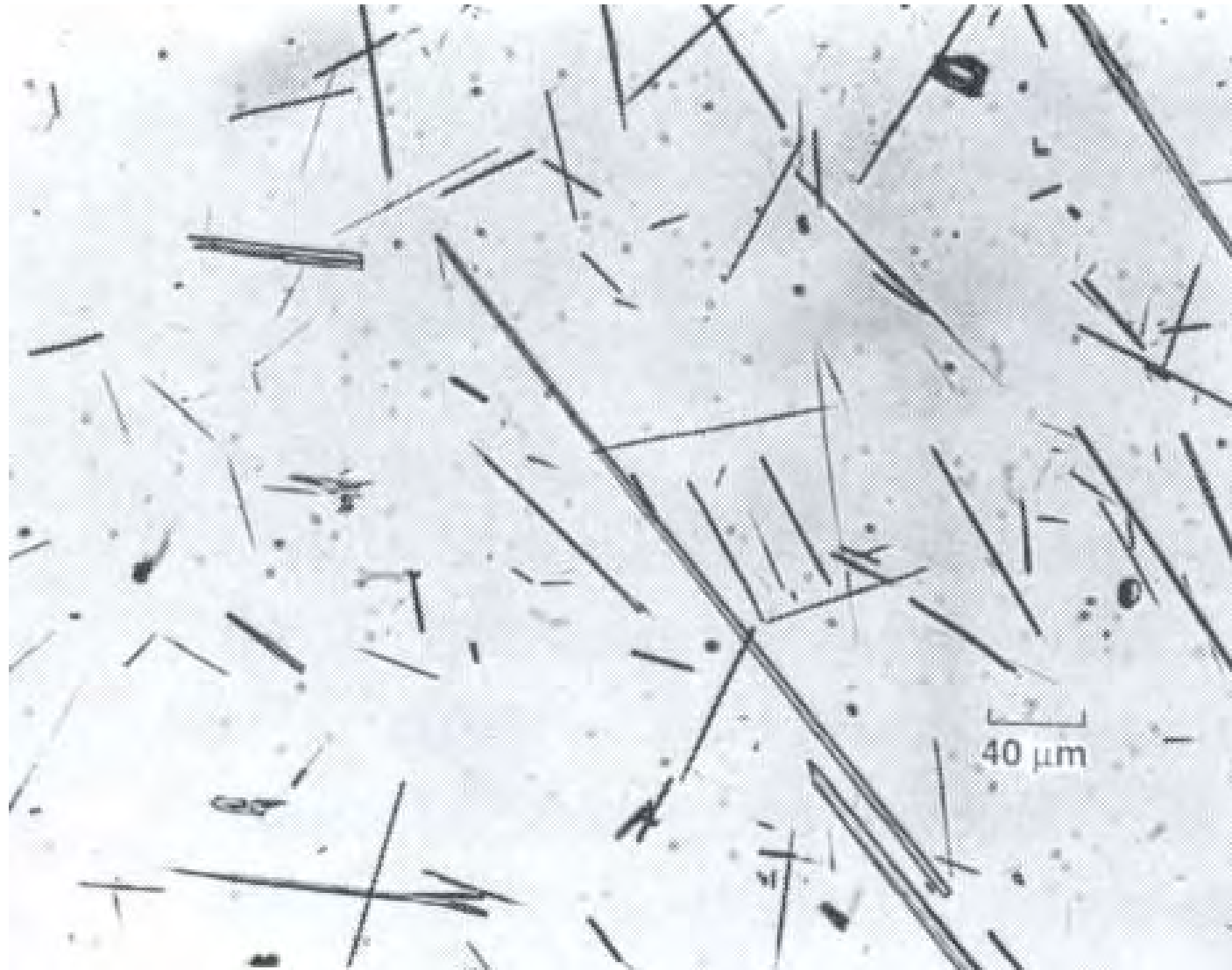
10,000X Mag.

# Air sampling

- Is necessary for meaningful human exposure assessment;
- Should be done in the breathing zone if to be used for exposure evaluation;
- Is sensitive to the volume of air through the filter and the area of the filter which is evaluated for fiber;
- May be highly sensitive to the type of filter used (MCE vs. Nucleopore)



# Tremolite Asbestos



## Libby simulated scenario sampling

- 3 scenarios were developed which encompassed the plausible range of exposures;
- Samples were collected in the breathing zone of residents or trained asbestos workers who posed as residents;
- Stationary samples were collected nearby for comparison.

# Task-Based Exposure Monitoring



# Exposure Assessment Summary

- Measurements made directly from the breathing zone are most valuable;
- Measurements from stationary monitors do not provide reliable estimates of human inhalation exposure;
- Dust measurements and/or solid media (soil, ore, concentrate, etc) measurements are extremely difficult to convert to estimation of exposure



# Libby Health Data Summary

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- **Medical Screening (7,307 participants; 6,668 18 yrs or older had chest x-rays)**
  - 17.8% with asbestos-related pleural abnormalities
  - 29 exposure pathways were evaluated
  - Abnormalities increased with increasing exposure
  - 6.7% for those with no known exposure to 34.6% with 12 or more pathways of exposure.