



Welcome to the CLU-IN Internet Seminar

NARPM Presents...An Overview of Asbestos - Health Effects, Regulations, Sampling and Analysis, and a Case Study

Sponsored by: EPA Office of Superfund Remediation and Technology Innovation

Delivered: August 30, 2012, 1:00 PM - 3:00 PM, EDT (17:00-19:00 GMT)

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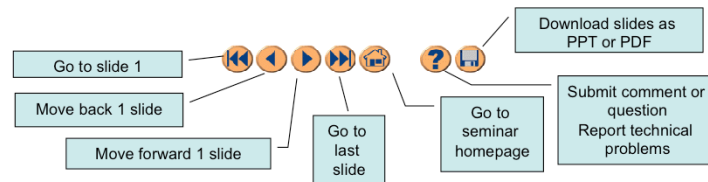
Moderator:

Jean Balent, U.S. EPA, Technology Innovation and Field Services Division (balent.jean@epa.gov)

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Housekeeping

- Please mute your phone lines, Do NOT put this call on hold
- Q&A
- Turn off any pop-up blockers
- Move through slides using # links on left or buttons



- This event is being recorded
- Archives accessed for free <http://clu.in.org/live/archive/>

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Although I'm sure that some of you have these rules memorized from previous CLU-IN events, let's run through them quickly for our new participants.

Please mute your phone lines during the seminar to minimize disruption and background noise. If you do not have a mute button, press *6 to mute #6 to unmute your lines at anytime. Also, please do NOT put this call on hold as this may bring delightful, but unwanted background music over the lines and interrupt the seminar.

You should note that throughout the seminar, we will ask for your feedback. You do not need to wait for Q&A breaks to ask questions or provide comments. To submit comments/questions and report technical problems, please use the ? Icon at the top of your screen. You can move forward/backward in the slides by using the single arrow buttons (left moves back 1 slide, right moves advances 1 slide). The double arrowed buttons will take you to 1st and last slides respectively. You may also advance to any slide using the numbered links that appear on the left side of your screen. The button with a house icon will take you back to main seminar page which displays our agenda, speaker information, links to the slides and additional resources. Lastly, the button with a computer disc can be used to download and save today's presentation materials.

With that, please move to slide 3.

An Overview of Asbestos

Health Effects, Regulations, Sampling and Analysis, and a Case Study

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206/553-1079

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Disclaimer

- This presentation represents my views as a member of the Asbestos Technical Review Workgroup and as a regional toxicologist.
- This presentation does not constitute official agency guidance or policy.

Acknowledgements

- Laura Buelow provided information on health effects
- John Pavitt provided information on NESHAPs and common asbestos-containing products
- Jed Januch provided many of the microscope images and has done invaluable work developing the fluidized bed

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What is asbestos?

- Naturally occurring, fibrous silicate minerals mined for their useful properties such as thermal insulation, chemical and thermal stability, and high tensile strength.



Asbestos mine in Swaziland

Chrysotile and Tremolite Asbestos



Chrysotile makes up 95% of commercial use of asbestos. Its fibers are flexible and curved.

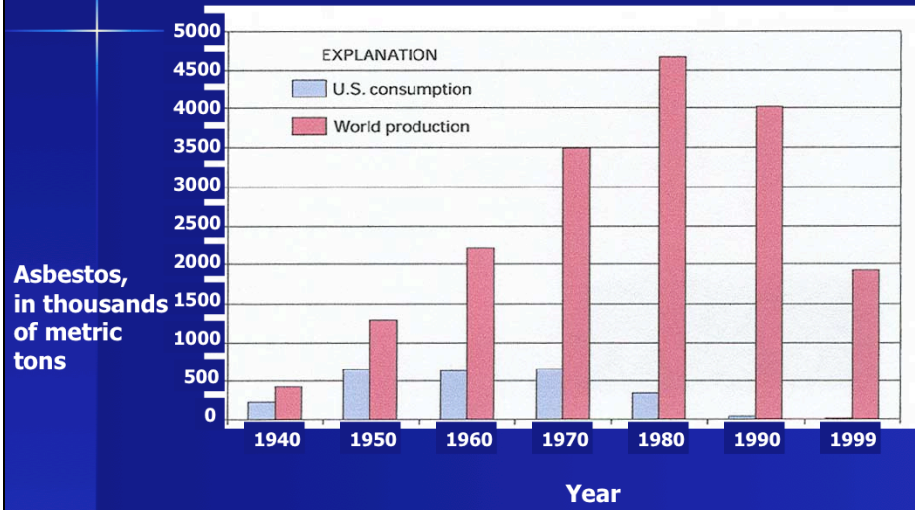


Amphibole fibers are brittle, rod- or needle-like shape. Tremolite is a type of amphibole asbestos.

Asbestos is a Carcinogen

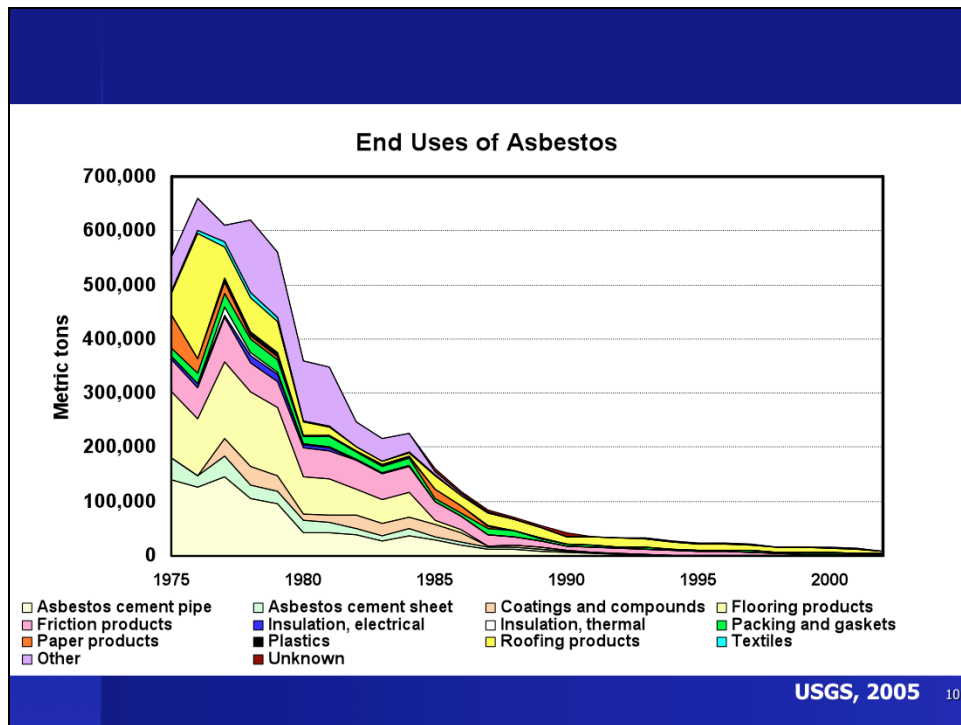
- International Agency for Research on Cancer: Class 1, Carcinogenic to humans
- EPA: Class A, Carcinogenic to humans

Asbestos Consumption



USGS, 2001

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Asbestos Containing Building Materials

- About 3500 materials are known to contain asbestos.
- Some products might *still* contain asbestos (most uses are *not* banned).
- The following slides show common materials which historically contained asbestos.

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Some common materials that have been known to contain asbestos. These slides do not show actual ACM representatives, they do represent materials that do, or have in the past, contained asbestos.

Roofing & Pavement Repair Materials.



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Some asphalt based roofing repair materials contain asbestos.

Roofing Shingles, Asphalt Paper



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Or three tab roofing. A common product for residential dwellings and apartment complexes.

Mortar and Concrete



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It's what holds your bricks together.

Ornate Cement Board



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More siding

Cement Patching & Caulk



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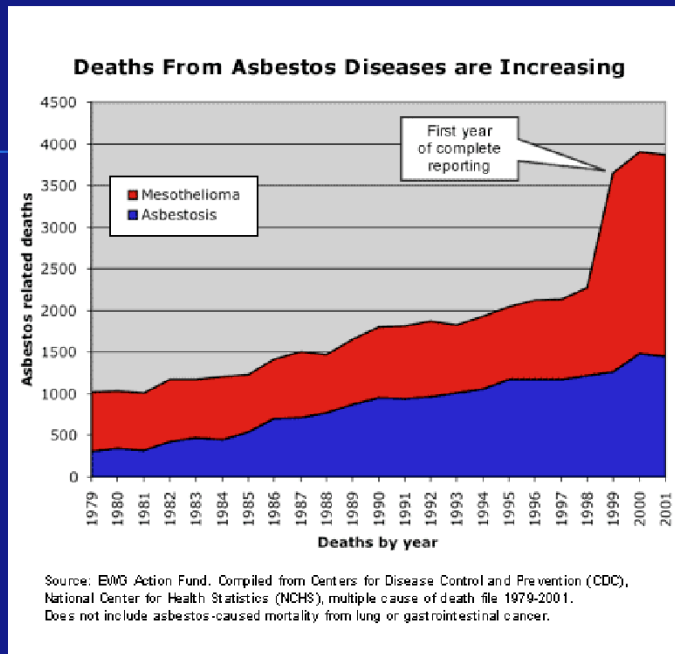
Powdered form when mixed with water makes a patching material.

Drywall & Joint Compound



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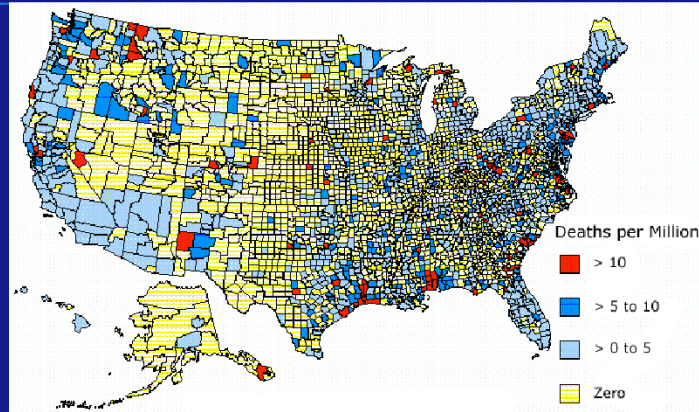
Asbestos fibers help bind it together and resist heat.



Asbestos Diseases

- First recorded asbestos death 1907
- Disease often takes 20-40 years after exposure to occur
- Usually patients have strong history of asbestos exposure

Asbestosis: Age-Adjusted Mortality Rates by County US Residents age 15 and over, 1983-1992

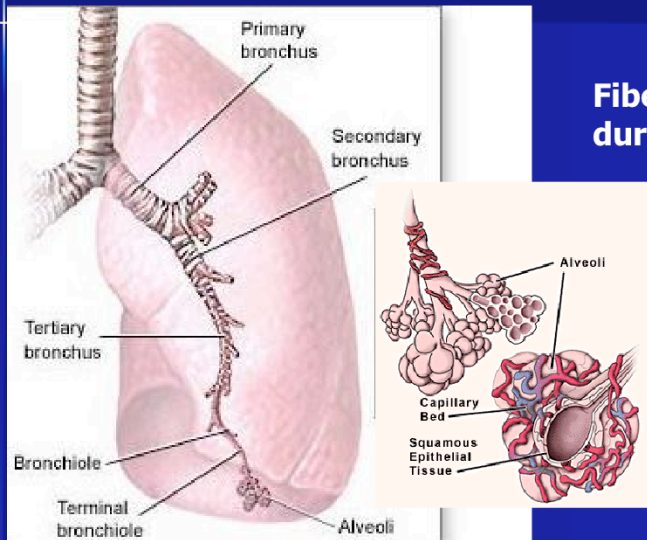


National Center for Health Statistics multiple cause of death data.
Population estimates from U.S. Bureau of the Census.

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<http://www.cdc.gov/niosh/docs/96-134/pdfs/96-134c.pdf>

Where Does Asbestos Go?



Fibers are durable

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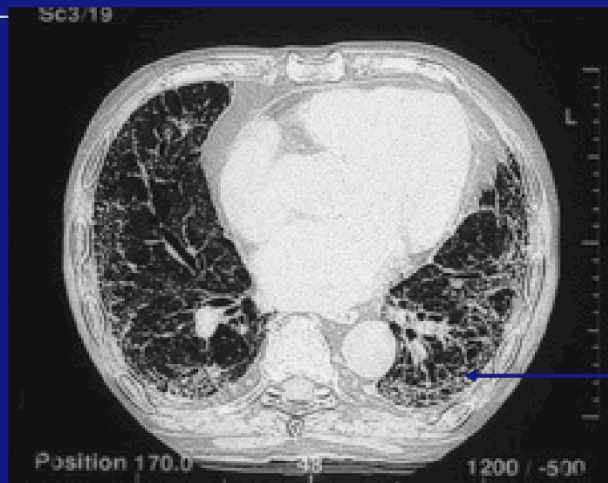
Types of Asbestos Diseases

- Asbestosis
- Lung cancer
- Malignant mesothelioma
- Benign pleural effusion
- Pleural plaques

Asbestosis

- Pulmonary fibrosis from asbestos
- Scarring of lung tissue
- Decreases oxygen exchange
- ~200,000 patients diagnosed and ~2000 deaths annually
- Shows up 20-30 yr after exposure

Asbestosis cont.



Honeycombing

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Asbestos and Lung Cancer

- First linked in 1890
- Small cell and non-small cell lung carcinoma
- ~2000-3200 deaths annually
- Synergistic effect with smoking

Asbestos Fibers in Lung Cells



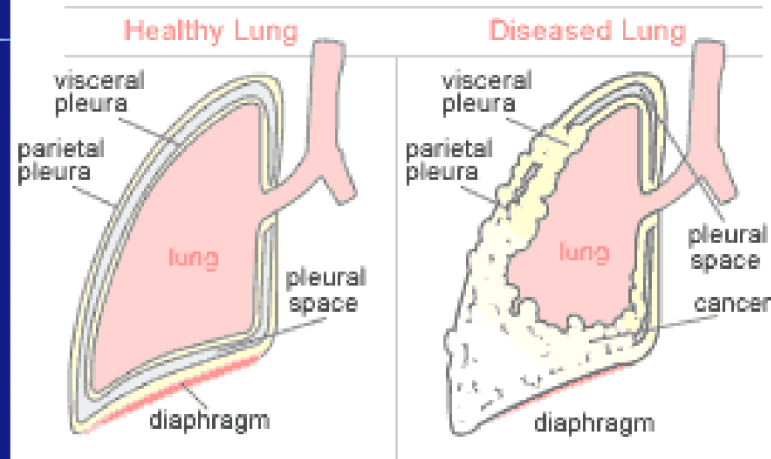
Center for Disease Control

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Malignant Mesothelioma

- Cancer in mesothelium, a protective sac that covers most of the body's internal organs
- ~2000 deaths annually
- Develops 20-40 years after exposure

Pleural Mesothelioma



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Benign pleural effusion

- Accumulation of fluid in the outer layer of the lung
- May indicate malignant mesothelioma
- 10-20 years to develop

Pleural Plaques

- ~50% of people with asbestosis develop plaques in the parietal pleura
- Collagen deposited in pleura



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References on Health Information

- EPA, USGS, American Cancer Society, National Cancer Institute, Center for Disease Control
- Mossman B.T. and Churg,A., Am J Respir Crit Care Med. 1998 May;157(5 Pt 1):1666-80.
- O'REILLY, K.M.A. et al., Am Fam Physician. 2007 Mar 1;75(5):683-8.
- Upadhyay, D. and Kamp, D.W., Exp Biol Med (Maywood). 2003 Jun;228(6):650-9.

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Federal Government

Departments and Agencies with responsibilities related to asbestos

EPA



DOL

OSHA



DHHS

CDC

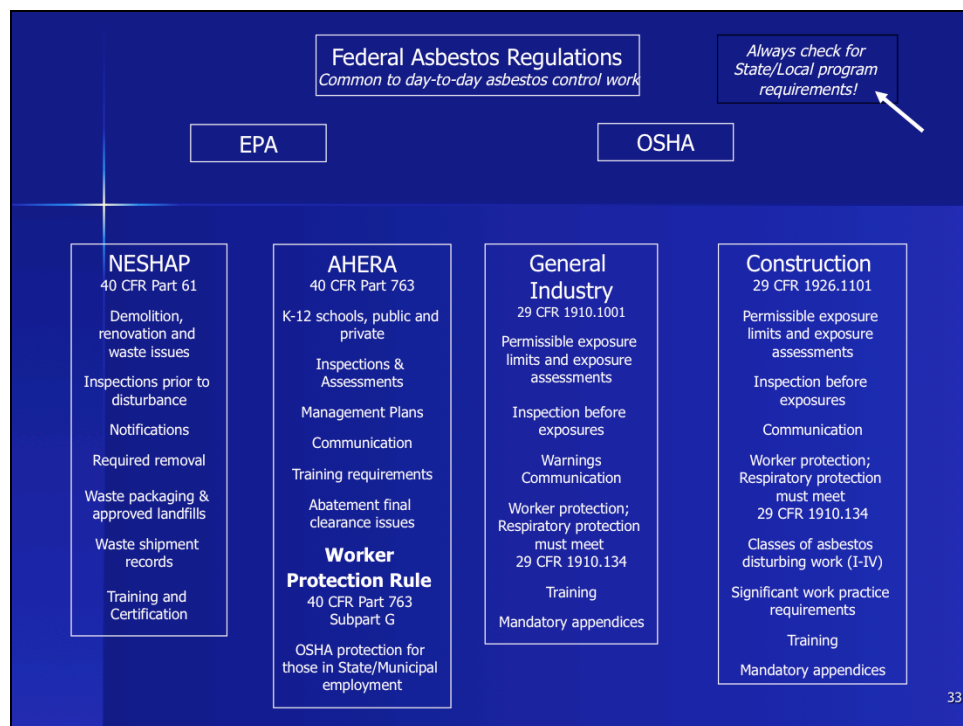
NIOSH &
ATSDR



CPSC

DOT





Three primary EPA statutes address asbestos

- Clean Air Act (CAA)
 - Asbestos NESHAP (1970s - demolition and renovation)
 - administrative, civil and criminal authority
- Toxic Substances Control Act (TSCA)
 - AHERA (1986 - abatement of asbestos in schools)
 - EPA Worker Protection Rule
- CERCLA/Superfund (1980)
 - hazardous substance, pollutant or contaminant
 - extremely broad - not limited to fiber type
- OSHA is primarily responsible for worker health and safety
 - 0.1 f/cc (down from 5 f/cc in 1970s) as 8 hour TWA (note that this standard has a risk of 3,400 in 1,000,000)
 - 1 f/cc as 30-minute STEL

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Regulatory Issues

- TSCA/AHERA and CAA/NESHAPs are focused on building materials
- CERCLA Remedial Investigations for Asbestos require consideration of unique issues
 - Fibers are complex, not single molecule
 - Analytical methods not standardized
 - Assessment likely involves air sampling
 - 1% is no longer used as a screening level for asbestos (M. Cook Memo)

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EPA's Authority Extends to a Broader List of Fibrous Minerals

EPA and OSHA regulations name six types of asbestos

- Chrysotile
- Amosite
- Crocidolite
- Tremolite
- Actinolite
- Anthophyllite

Asbestiform and fibrous minerals not specifically named in regulations

- Winchite/Richterite (other amphibole found in Libby vermiculite)
- Taconite (amphibole component as found in MN)
- Erionite (as found in OR, ND also Turkey)

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Regulatory Responsibilities

- Endangerment
- Enforce all applicable asbestos regulations
 - EPA (NESHAP, AHERA), OSHA, State/Local regulations
- CERCLA/Superfund, RCRA often separate issues from those in the “regulated” community
 - CERCLA hazardous substance, pollutant or contaminant
- NOT restricted to fiber type(s) or specific %
 - >1% does not apply to CERCLA work
- CERCLA/Superfund work examples:
 - Libby, Montana vermiculite issue
 - Natural occurrences of asbestos (“NOA”)
 - Land contamination from asbestos waste/debris

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Regulatory Issues (cont.)

- Federal & State/Local program regulators enforce the EPA, OSHA, State/Local asbestos requirements on the day-to-day work of the regulated community
 - Asbestos NESHAP and TSCA AHERA are the most common enforcement actions
- CERCLA/Superfund may apply regardless of other regulatory requirements
- Additional details on EPA regulations that deal with asbestos can be found at:
<http://www.epa.gov/asbestos/pubs/asbreg.html>

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Comprehensive Environmental Response, Compensation, and Liability Act (1980)

- Referred to as "CERCLA" or "Superfund"
- Provides for EPA authority to cleanup uncontrolled hazardous waste sites
- Failure to comply with the NESHAP or improper handling, storage, or disposal of asbestos may result in NPL listing
- Activities could be in either the Removal or Remedial Programs



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Overview of OSHA Requirements

- 29 CFR 1926.1101 is the OSHA standard for demolition of buildings containing asbestos
- Classes of work (I to IV) depend on type of ACM present, asbestos content and activity
- The standard presents training requirements, medical monitoring requirements, respiratory protection requirements, and required work practices
- Air monitoring requirements also are provided (PCM analysis required), but these are for ensuring worker safety and are not intended to replace EPA NESHAPs requirements (includes initial exposure assessment)

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OSHA Construction Standard (clearance levels)

- **1926.1101(g)(4)(ii)(B)** The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area surveillance during each work shift at each boundary of the regulated area, showing no visible asbestos dust; and ***perimeter area monitoring showing that clearance levels contained in 40 CFR Part 763, Subpt. E, of the EPA Asbestos in Schools Rule are met, or that perimeter area levels, measured by Phase Contrast Microscopy (PCM) are no more than background levels representing the same area before the asbestos work began.*** The results of such monitoring shall be made known to the employer no later than 24 hours from the end of the work shift represented by such monitoring. Exception: For work completed outdoors where employees are not working in areas adjacent to the regulated areas, this paragraph (g)(4)(ii) is satisfied when the specific control methods in paragraph (g)(5) of this section are used.

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Demolition practices

- Demolitions must follow the NESHAPs
- Worker protection requirements must be consistent with OSHA (***PCM analysis required***)
- An initial exposure assessment must be done to assess background in areas where abatements have not been completed
- Monitoring is needed for comparison to both TWA and STEL
- Perimeter monitoring results must be compared to background levels (e.g., AHERA Z test)

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“NESHAP”

National Emission Standard for
Hazardous Air Pollutants

40 CFR, Part 61, Subpart M
(Asbestos)

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What does NESHAP mean?

The Way It Should Work

- For Renovations and Demolitions:
 - Survey
 - Notification
 - Keeping It Wet
 - Handling It Carefully
 - Storing It
 - Transporting It
 - Disposing It
 - Confirming Disposal

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The Main steps to the asbestos and demolition process.

Assessments Needed at Sites Where Demolitions Occurred and NESHAP Was Not Followed

- Follow EPA's Framework for Assessing Asbestos-Contaminated Superfund Sites
 - http://epa.gov/superfund/health/contaminants/asbestos/pdfs/framework_asbestos_guidance.pdf
- Consult with EPA's Technical Review Workgroup for Asbestos
 - Remove visible ACM
 - Conduct activity-based sampling
 - Long-term monitoring may be needed
 - **TEM analysis** required for risk assessment

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Practical Considerations

- You cannot see asbestos fibers.
- Workers must be alerted to the presence of asbestos in order to protect themselves.
- Surface pickup of ACM is not be adequate to mitigate future exposures.
- Future exposures must be prevented; interim measures are not adequate in the long term.

Framework

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TRW Asbestos Committee

- Develops new guidance for site assessment at hazardous waste sites contaminated by asbestos
- Provides site consultation in support of Regional requests for technical assistance
 - The committee is available to provide site-specific support to application of the framework
- Identifies research needs—data gaps in asbestos site assessment and risk assessment

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Asbestos Committee is a group of EPA experts who provide support for asbestos site and risk assessment in the Superfund program.

Background – Cleanup versus Risk-Based –

- 1% in soil historically used as clean-up level – NOT risk-based
- August 2004 Cook memo rescinded 1%
 - Regions should develop risk-based, site-specific action levels based on air concentrations
 - “an accurate exposure value could only be determined through site sampling techniques that generate [airborne] fibers from soil”

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The committee was charged with developing guidance to fill the gap created in asbestos site assessment by the Cook memo.

To provide guidance concerning assessing sites using a risk-based approach.

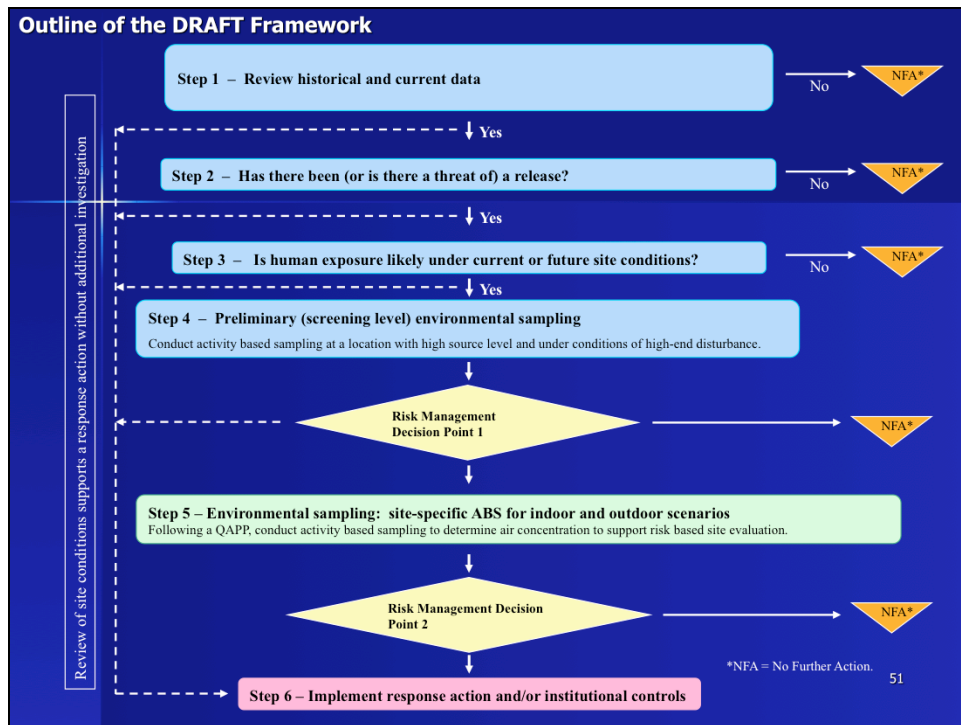
Why Doesn't 1% Work?

- Asbestos NOT uniformly distributed in soil
 - 2 aliquots of same soil sample can yield vastly different asbestos concentrations (ND to > 1%)
- Risk assessment CANNOT predict inhalation exposure & risk from soil concentration using 1% because
 - soils w/ asbestos levels below 1% can create high risk inhalation exposures when disturbed
 - “1 percent threshold for asbestos in soil/debris . . . may not be protective of human health in all instances”

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1% cannot be used because:

1. Different activities on the same soil sample can yield vastly different airborne asbestos concentrations (ND to >1%)
2. Risk assessment can NOT predict inhalation exposure and risk from soil concentration using models. At sites soils w/ asbestos levels below 1% have shown high risk inhalation exposures when disturbed. “1 percent threshold for asbestos in soil/debris . . . may not be protective of human health in all instances”



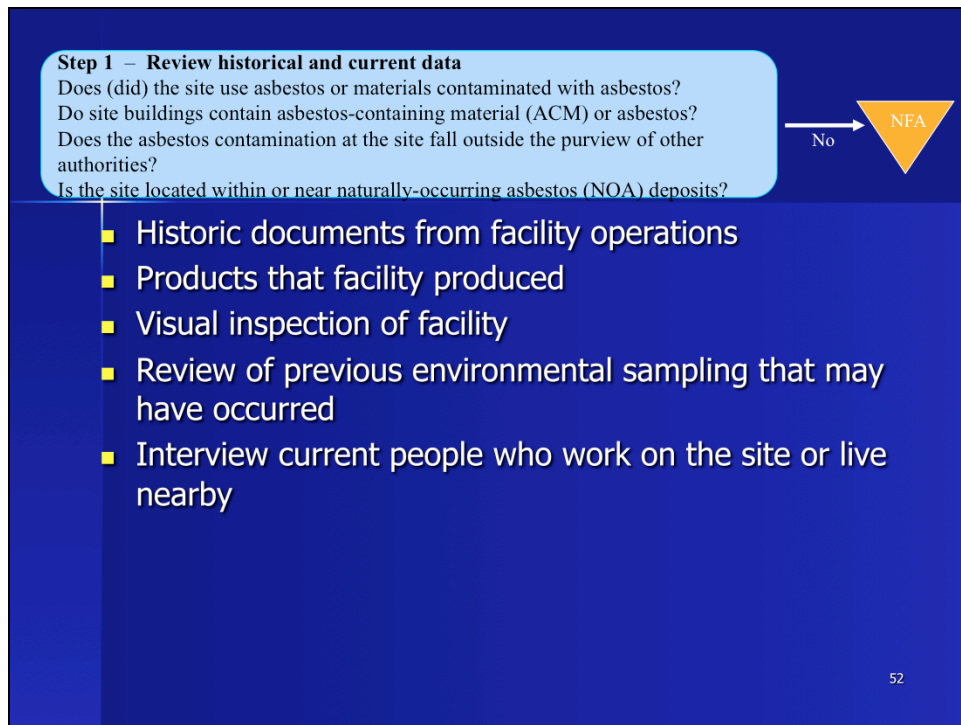
Recommended framework for investigating and evaluating the potential for asbestos exposure

Recommended for Removal and Remedial sites

Addresses outdoor and indoor exposures

Uses the latest analytical methodologies

Risk managers can choose to take response action at any point along the framework



Is asbestos an issue at the site?

What historic documents from facility operations are available for review that can provide information regarding potential for asbestos exposure?

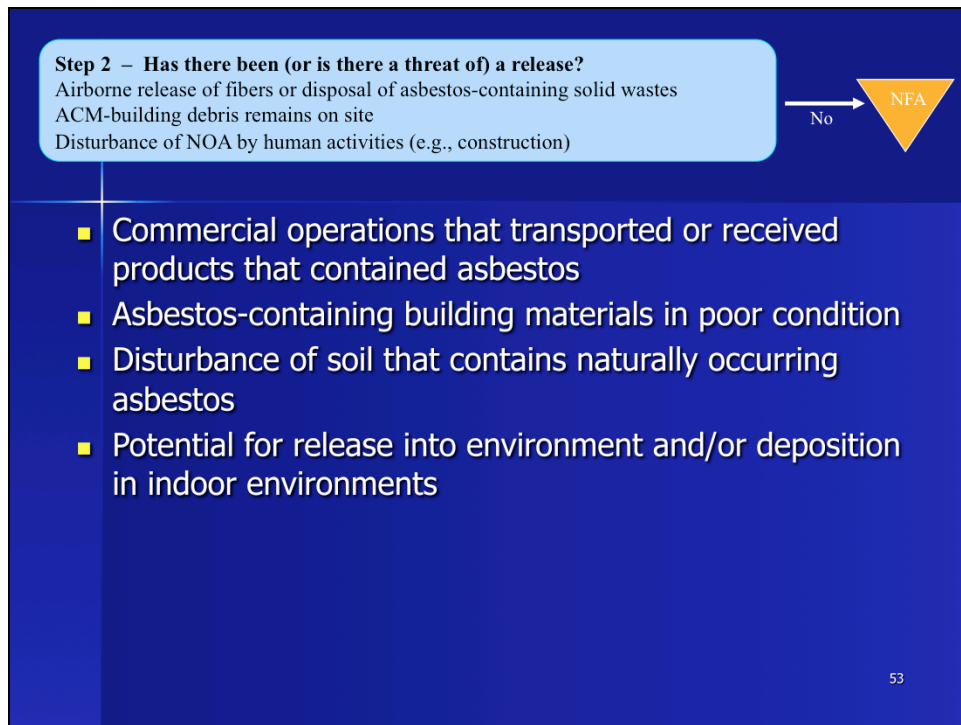
How long were operations conducted?

What products did the facility produce?

What is seen by the naked eye? Later slides will show raw asbestos.

Did any previous environmental sampling occur? If so when? What were the results? Are the results available?

Query the present workers and nearby residents if historical record is incomplete.



Is there a threat of release or has a release occurred?

What materials containing asbestos were transported in or out?

What are the conditions of the ACM?

What human activities are causing soil disturbance or uncontrolled release?

Step 3 – Is human exposure likely under current or future site conditions?
Are human exposure pathways currently present and complete?

→ No → NFA

- Begin with current receptors that may come in contact with contaminated materials
 - Workers, trespassers, recreational activities, nearby residential buildings
- Estimate potential future uses of the property
- Generally, a pathway would be considered to be complete unless there is no activity possible at the site or if the contaminated media is unavailable for contact (e.g., under pavement)

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Is there a complete human exposure pathway (current or future)?

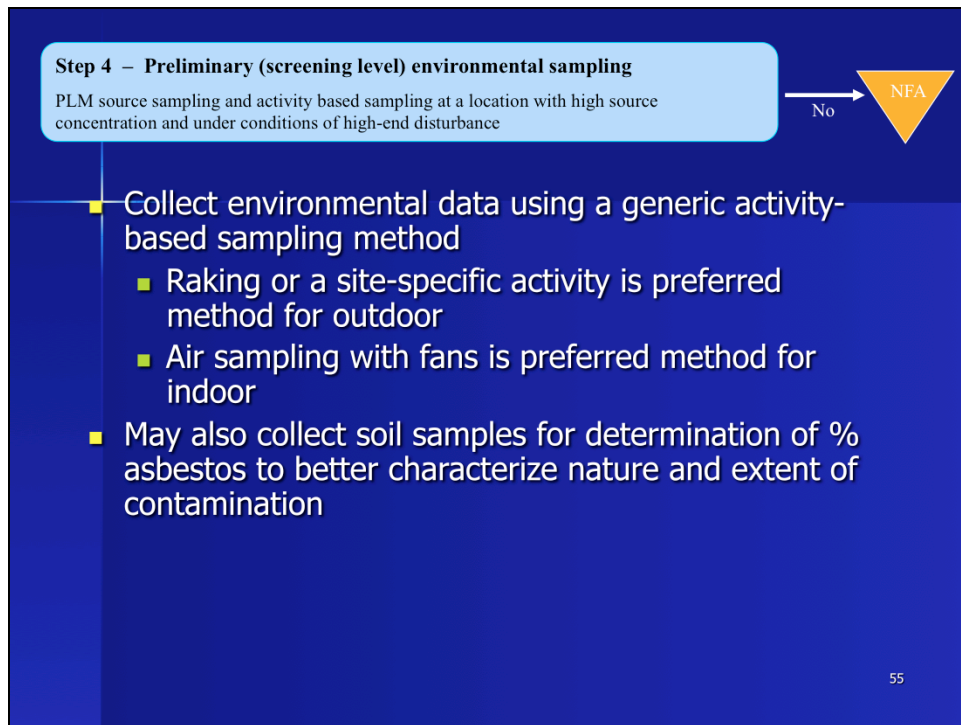
Assume exposure pathway is complete unless it can be ruled out.

Who can be exposed?

Is it possible there will be no exposure due to no activity on the site?

How will the property be used in 5 years, 10 years, 20 years, or more?

Is it possible the contaminated media has been covered? Will it continue to be covered in the future?

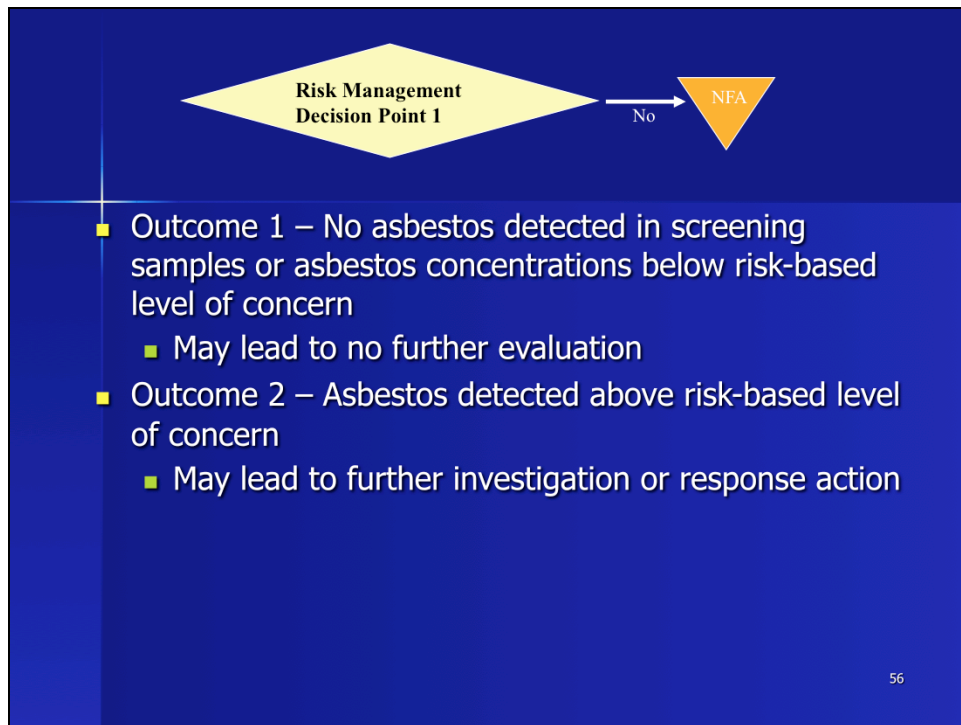


First sampling step is preliminary characterization of exposure potential. If RME exposure scenario is used to assess area where highest soil/dust concentration of asbestos is expected, results would be expected to be on high-end of exposure for site. This is a screening step.

Collect outdoor data using common sampling methods that disturb the soil. An RME exposure scenario (activity) is recommended, such as raking. Although most likely activity may also be appropriate (playing or biking).

Activity based sampling is recommended for areas of site where asbestos contamination is expected to be highest.

Soil sampling is suggested to supplement and provide additional site information.



Step 4 sampling is intended to be high end. If the results of preliminary sampling show no exposure, then users can decide that no further evaluation is needed

If asbestos exposure is found or the results are uncertain, the committee recommends additional site characterization or a response action to prevent exposure.

Step 5 – Environmental sampling: site-specific activity based sampling (ABS) for indoor and outdoor scenarios

Following a QAPP, conduct activity based sampling to determine air concentration to support risk based site evaluation

- Collect more site-specific data to determine appropriate response
 - Use of actual site-specific scenarios that are expected to occur on the site (RME)
 - Samples collected over a larger area and/or frequency of sampling increases to obtain a better estimate of site-wide exposures

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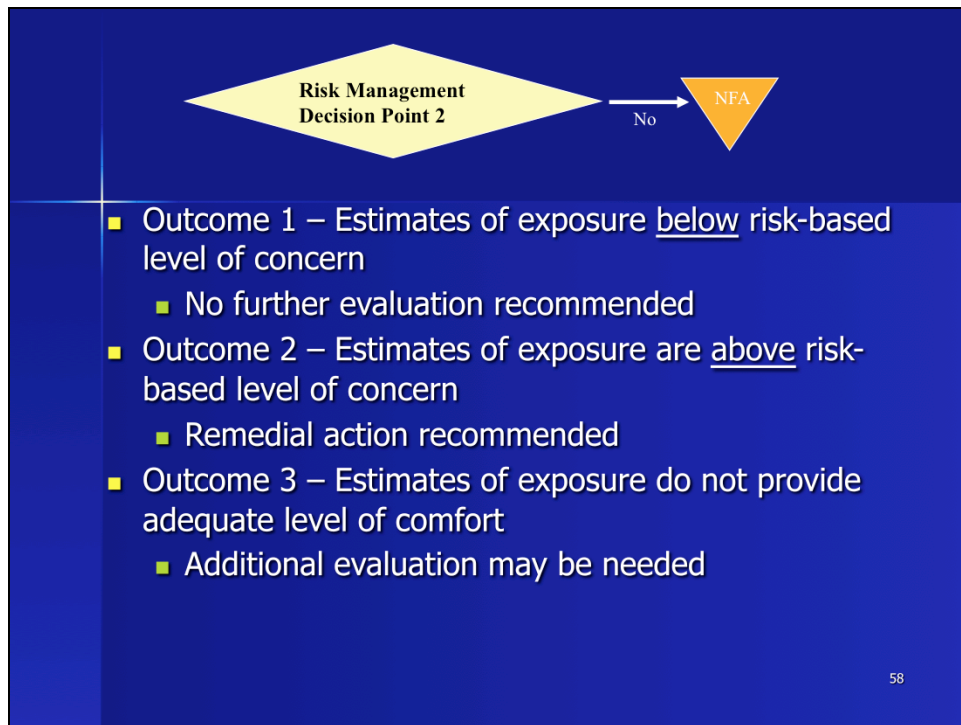
This step recommends more detailed and specific sampling at the site to more fully characterize exposure.

This step supports risk-based site evaluation by

-Following a QAPP

-Conducting ABS using actual or anticipated expected scenarios

-Collecting more site-specific data and expand sampling to larger area



The results of step 5 provide users with asbestos exposure results from more detailed ABS.

Those data provide information to make a decision comes from 3 choices:

Results are uncertain and more evaluation is needed

OR

No further evaluation because exposure was below a level of concern

OR

Response action is recommended because exposure was above a level of concern

Step 6 – Implement response action and/or institutional controls

- Variety of options are available
 - Remove soil or contaminated material
 - Install a permanent cap over the contaminated areas
 - Place institutional controls on the property that restrict use (and therefore exposure) to the contaminated areas
 - Combination of above

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Response actions (including ICs) are used to prevent exposure to contaminated soil/dust at the site.

- Remove the soil or dust
- Install a cap
- Place ICs
- Combination of the above

The determination of appropriate response action is a risk management decision.

Key Recommendations: The Framework

- Is risk-based investigation of exposure
- Is applicable to removal and remedial sites
- Addresses outdoor and indoor exposures
- Uses the latest sampling analytical methodologies
- Allows users to take response action at any point in the process

A Case Study

NORTH RIDGE ESTATES

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North Ridge Estates

22 families lived in the footprint of a former marine recuperation barracks. Most of the residents left the site in June of this year following a settlement with the developer.

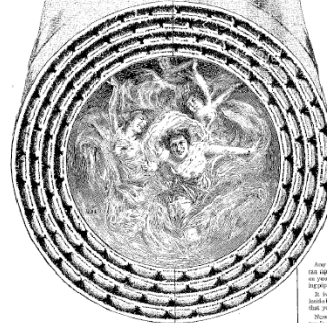


"Air Cell" Insulation

- Pre-formed, cardboard-like insulation.
- Lower heat applications (hot water pipes, radiators).
- Banned in 1975 for manufacturing.
- Some relatively intact pieces found on-site.

84 The Literary Digest for May 2, 1925

Using dead air to keep heat *alive*



Cover your heater and pipes now!

How heating costs are slashed by the use of Improved Asbestocel is shown in this illustration. It is the most efficient and most economical way to keep your home warm and comfortable. It is the only material that is so light and so strong that it can be used in any position. It is the only material that is so fireproof and so resistant to heat that it can be used in any position. It is the only material that is so easy to install and so easy to maintain that it can be used in any position.

Insufficient!

The cost of heating is slashed by the use of Improved Asbestocel. It is the most efficient and most economical way to keep your home warm and comfortable. It is the only material that is so light and so strong that it can be used in any position. It is the only material that is so fireproof and so resistant to heat that it can be used in any position. It is the only material that is so easy to install and so easy to maintain that it can be used in any position.

Look for the Red Brand

To keep heat alive from furnace to radiator is everybody's problem. But it is not a difficult one.

To preserve live heat, surround it with dead air—a scientific principle.

It is upon this principle that Johns-Manville Improved Asbestocel is designed. There are multitudes of separate dead air cells in every three-foot length of this pipe covering. Ordinary pipe covering contains long, open cells through which air circulates and carries away heat.

It is this difference that makes Improved Asbestocel the most efficient pipe insulation, per dollar of cost.

JOHNS-MANVILLE Inc., 252 Madison Avenue at 41st Street, New York City
Representative for Localities: Pink Coatings Co., 1000 Broadway, New York City

JOHNS-MANVILLE
Improved Asbestocel saves coal



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Intact Air Cell



64



**Piece of Damaged Corrugated-type Pipe
Insulation Found on Residential Parcel
North Ridge Estates**

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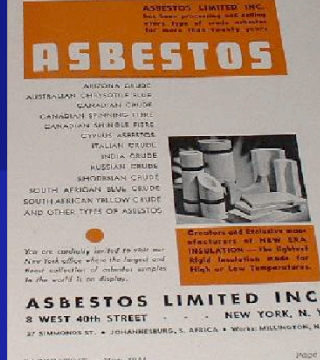
"Mag Block" Magnesium Calcium Silicate Insulation



He's Taming High Temperatures
...With One Material!

THE CONVENTION has just called out long lines of workers. With one material, handling is made so much easier. The material is so light, it can be carried by one man. It is so strong, it can be used in high temperature applications. It is so versatile, it can be used in many different ways. It is so easy to handle, it can be used in many different ways. It is so strong, it can be used in many different ways. It is so easy to handle, it can be used in many different ways.

KAYLO — *Start to finish, all the way*
Manufactured by **OWENS ILLINOIS** Glass Container, Bridge 1, Ohio



ASBESTOS LIMITED, INC.
Sole Importers and Distributors
of all types of asbestos products
for North America

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SOUTH AFRICAN BLUE
SOUTH AFRICAN YELLOW
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For the complete list of products and prices, write for the latest edition of the "Asbestos Handbook" to be sent to you free of charge.

ASBESTOS LIMITED, INC.
3 WEST 40TH STREET - NEW YORK, N. Y.
27 BROADWAY ST. - JOHANNESBURG, S. AFRICA - WILMINGTON, N. C.

"JULY 1950" - Page 28

- Typically pre-formed.
- Used for high temperature applications (boilers, piping).
- Banned in 1975 for manufacturing.
- On-site – heavily weathered.

ACM pipe insulation on ground...



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...next to swing set



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Activity-Based Sampling/Child Playing



NRE is a residential development. We wanted to know if children playing outdoors had unsafe exposures to asbestos fibers from ACM in soil.



Activity-Based Sampling/Weed-Whacking: NRE residents specifically asked if it was safe to trim weeds in the forest fire-prone area.



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Rototilling



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Ambient air monitoring



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One of Two Current Repositories at North Ridge Estates

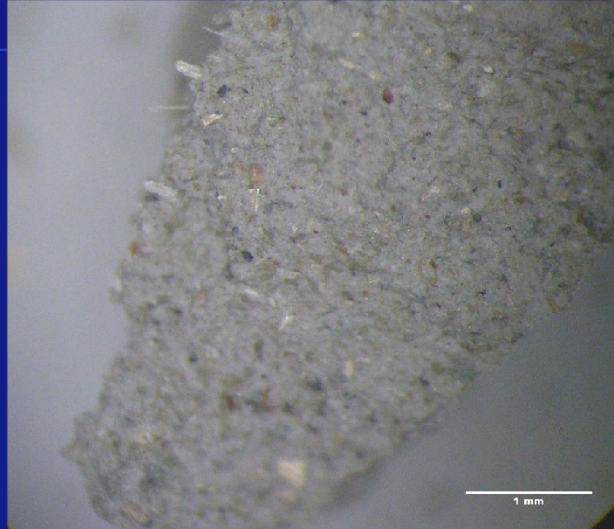


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Analytical Methods

- PCM – Phase contrast microscopy
- PLM – Polarized light microscopy
- TEM – Transmission electron microscopy
- SEM – Scanning electron microscopy

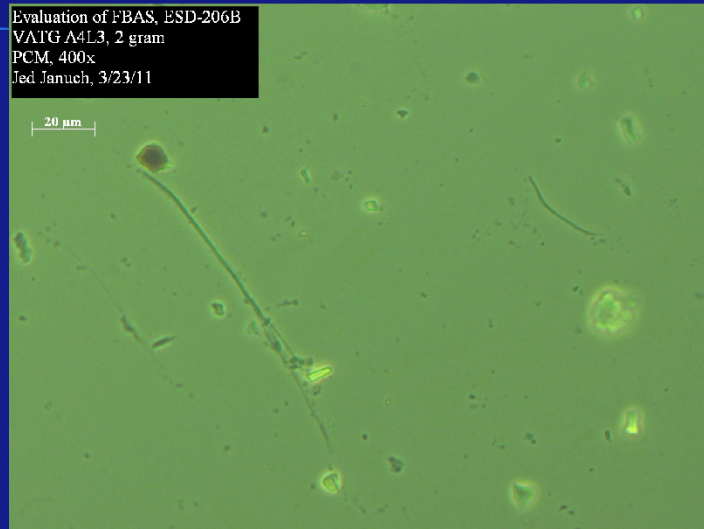
Stereomicroscope image of fiber bundles in soil from
the Sumas Mountain Asbestos Site



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Phase Contrast Microscope (PCM) image of chrysotile

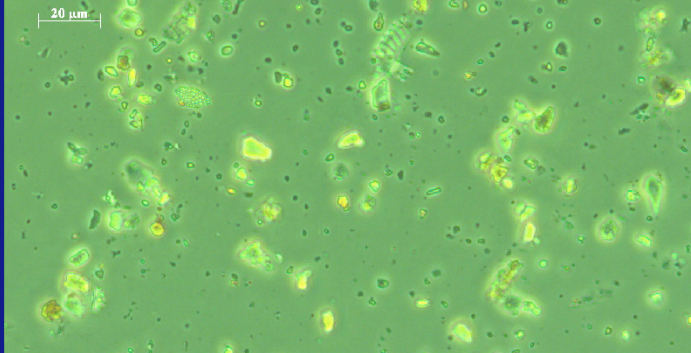
Evaluation of FBAS, ESD-206B
VATG A4L3, 2 gram
PCM, 400x
Jed Januch, 3/23/11



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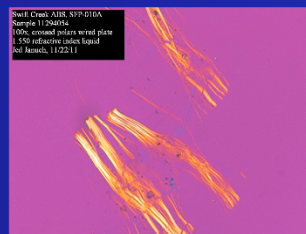
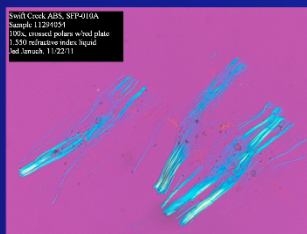
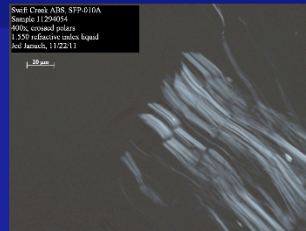
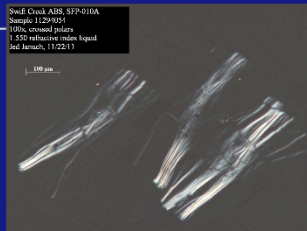
Phase Contrast Microscope (PCM) image from North Ridge Estates

North Ridge Estates
Sample 11374017
FBAS, 1 gram, 3 minute run
PCM, 400x magnification
Sample prepared 11/8/11
Slide imaged 3/15/12
Analyst: Jed Januch

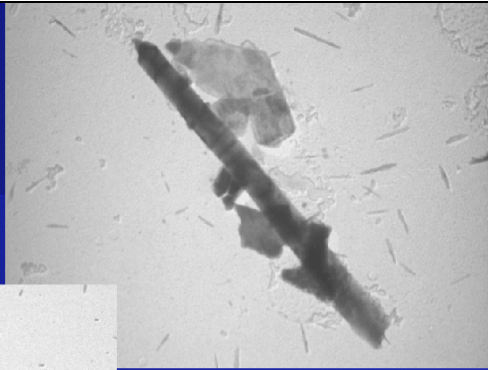


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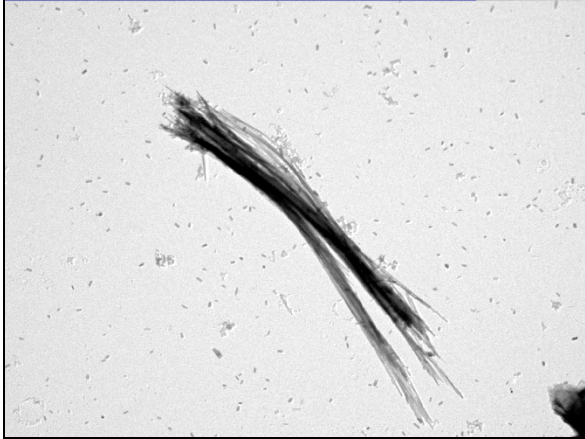
Swift Creek ABS – ORD Support
Project Code: SFP-010A
Sample Number 11294054



Actinolite Fiber ->

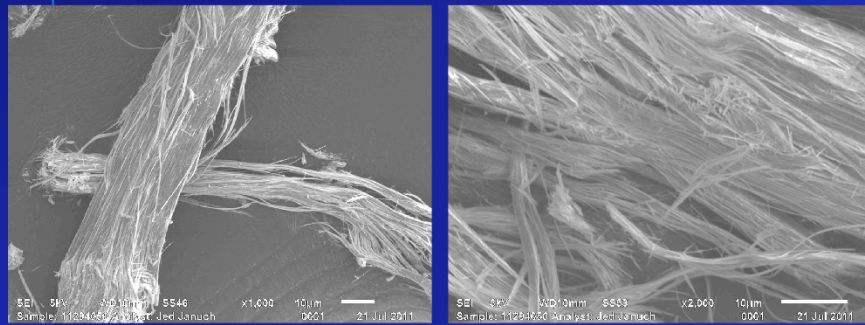


<- Chrysotile Fiber
Bundle



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SEM Images of Chrysotile from the Sumas Mountain Asbestos Site, Whatcom County, WA



Asbestos in Soil

- Emerging issue affecting a broad spectrum of sites
 - Libby sister sites
 - Spokane and Portland (in Region 10)
 - North Ridge Estates
 - Dawson Trucking
 - Swift Creek
 - El Dorado, Chicago Beaches, Fairfax County, Georgia, etc.

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Asbestos in Soil

- Requires new methods to evaluate exposure and risk
 - Soil methods (PLM, TEM)
 - Glovebox
 - Elutriator
 - Fluidized Bed Asbestos Segregator (FBAS)
 - Releasable Asbestos Field Sampler (RAFS)
 - Activity-based sampling techniques

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Glovebox

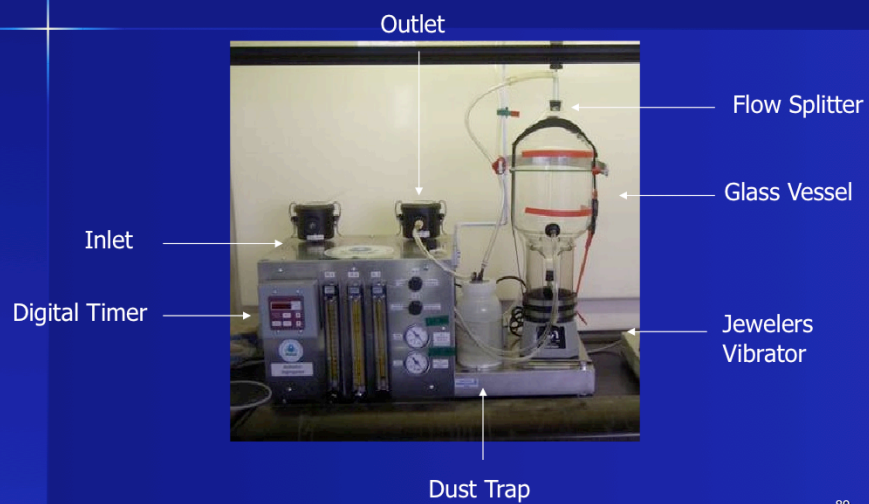


87

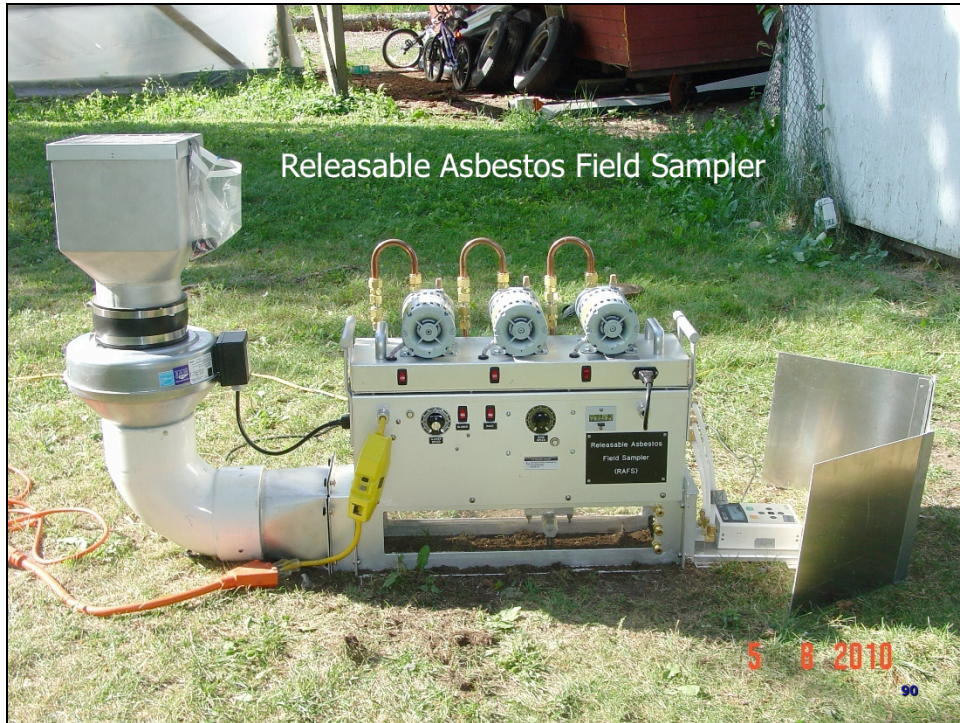
Elutriator



FBAS with EPA Modifications



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Websites and Literature

- EPA Asbestos Home Page
<http://www.epa.gov/asbestos/index.html>
 - IRIS – Asbestos
<http://www.epa.gov/iris/subst/0371.htm>
 - ATSDR Asbestos profile
<http://www.atsdr.cdc.gov/toxprofiles/tp61.html>
 - EPA's Technical Review Workgroup for Asbestos
<http://www.epa.gov/superfund/health/contaminants/asbestos/index.htm>
- Journal articles and asbestos documents available on request for reference

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Resources & Feedback

- To view a complete list of resources for this seminar, please visit the [Additional Resources](#)
- Please complete the [Feedback Form](#) to help ensure events like this are offered in the future

The screenshot shows a web form titled "EPA Technology Innovation Program". The header includes the EPA logo and the text "U.S. EPA Technical Support Project Engineering Forum (Green Remediation, Opening the Door to Field Use Session C (Green Remediation) Tools and Examples) Seminar Feedback Form". The form contains several input fields: "First Name", "Last Name", "Email Address", "Phone Number", and "Company Name". There is a checkbox labeled "Please send a copy of my feedback to the EPA" and a checkbox labeled "I would like to receive any feedback you might have that would make this service more valuable". A red circle highlights the "Please send a copy of my feedback to the EPA" checkbox. An arrow points from the text "Fill out the feedback form and check box for confirmation email." to this checkbox.

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