



# Pre-Demolition Abatement

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## Removal and Disposal of Hazardous Materials

- Regulations and Requirements
- Abatement Best Practices
- Inspection and Air Monitoring
- Project Planning and Management

## Occupational Health and Safety Act, Regulation and Code

### Requirements Applicable to Specific Industries and Activities

- Part 30 – Demolition

### Hazardous Substances – Section 417

- Before demolition begins and while demolition work continues, an employer must ensure that
  - (a) all chemical and biological substances that may be hazardous to workers during demolition are removed from the structure or the part of the structure that is being demolished...

# What are Hazardous Materials?



## Hazardous Properties

- Combustible or explosive
- Compressed gas
- Flammable
- Oxidizing or reactive
- Toxic (ingestion, absorption, inhalation)
- Infectious or biohazard
- Radioactive
- Corrosive (acidic or basic)
- Contains PCB
- Dispersible toxic leachate

## Hazardous Building Materials

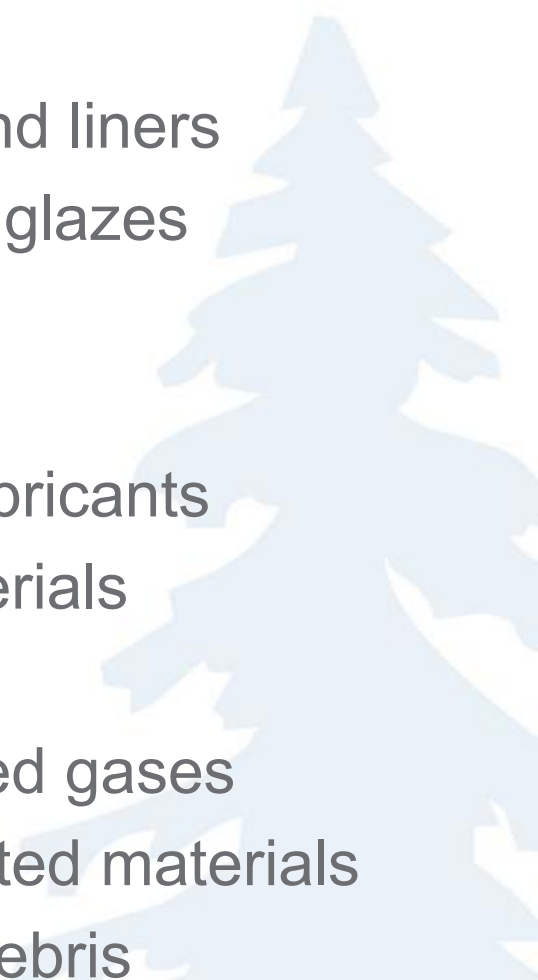
- Asbestos-Containing Materials (ACM)
- Lead (Pb)
- Mercury (Hg)
- Ozone-Depleting Substances (ODS)
- Polychlorinated Biphenyls (PCB)
- Silica (Si)
- Synthetic Vitreous Fibres (SVF)



## Other Hazardous Substances

- Bacterial and Bio-hazards
- Fungi (Mould, Animal Feces)
- Naturally-Occurring Radioactive Materials (NORM)
- Stored Operational Chemicals (Containers or Tanks)
- Process-Related Gases or Liquids (Residual)
- Spills or Contamination
- Sulphur and Sulphur Compounds

# Where are HazMat found?

- 
- 
- Thermal insulations
  - Asbestos-containing building materials
  - Instrumentation
  - Lamp bulbs
  - Lighting ballasts
  - Transformers
  - Pipelines
  - Equipment
  - Machinery
  - Ducting
  - Batteries
  - Flashing and liners
  - Paints and glazes
  - Fuels
  - Adhesives
  - Oils and lubricants
  - Spent materials
  - Aerosols
  - Compressed gases
  - Contaminated materials
  - Dust and debris

## Typical Sequencing for Facility End-of-Life

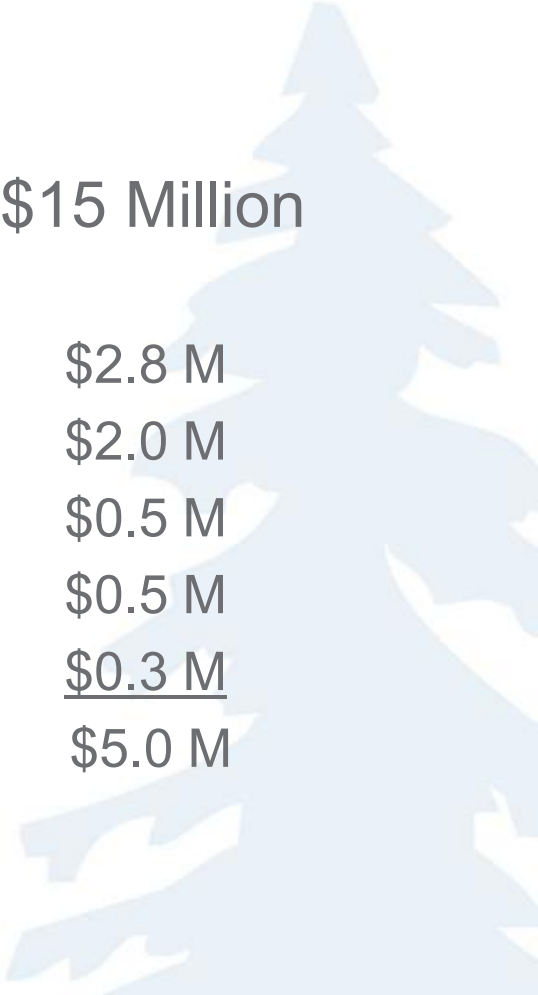
- Shutdown
- Decommissioning and Salvage
  - Purging and Cleaning
  - Electrical and Instrumentation
- Abandonment
  - Abatement
  - Demolition
- Reclamation

Hazardous Materials  
Assessment and  
Management

## Typical Abatement Project Budgets

### Oil and Gas Plant / Large Facility

\$5 - \$15 Million

A faint, light blue silhouette of a coniferous tree is positioned in the background on the right side of the slide.

○ Abatement	55%	\$2.8 M
○ Scaffolding	40%	\$2.0 M
○ Management and Supervision	10%	\$0.5 M
○ Inspection and Air Monitoring	10%	\$0.5 M
○ Disposal	5%	<u>\$0.3 M</u>
		\$5.0 M

## Occupational Health and Safety Act, Regulation and Code

### Requirements Applicable to All Industries

- Part 4 – Chemical Hazards, Biological Hazards and Harmful Substances

- Identifying and controlling **Worker Exposure**
- Ensuring worker **Decontamination** and **Hygiene**
- Developing and implementing **Codes of Practice**
- Handling of **Asbestos**, **Silica**, **Coal Dust** and **Lead**

## Occupational Health and Safety Act, Regulation and Code

### **Asbestos in a building to be demolished – Section 34**

- If a building is to be demolished an employer must ensure that materials with the potential to release asbestos fibres are removed first.

#### **Exceptions:**

- Asbestos vinyl floor tiles (*without asbestos backings materials*)
- Materials covered under an “Acceptance from Section 34”
  - Non-friable, low asbestos content, demolition controls
  - Generally acceptable if there are hazards associated with removal
  - Not generally acceptable for vermiculite

## Occupational Health and Safety Act, Regulation and Code

### “Restricted Area”

- ...an area of a work site where there is a reasonable chance that the airborne concentration of asbestos, silica, coal dust or lead exceeds or may exceed the **Occupational Exposure Limit (OEL)** for one or more of the substances.

### OEL for Asbestos

0.1 fibres / cubic centimeter (f/cc)

# Abatement Best Practices



## **Alberta Asbestos Abatement Manual, Government of Alberta, August 2011**

- Best Practice / Guideline document
- Not a regulation
- Conceived around removal of asbestos from occupied buildings
- Used regularly as reference by OHS inspectors

## Alberta Asbestos Abatement Manual, August 2011

- Recommended procedural practices by work activity, in accordance with their potential to release asbestos fibres
  - Low Risk
  - Moderate Risk
  - High Risk
  
- Some provisions for **outdoor** and **pre-demolition** abatement

## 1. Site Isolation

- Banners and barriers
- Negative pressure
- Smoke testing

## 2. Worker Protection

- Respirators
- Disposable coveralls
- Showers
- Training

## 3. Work Procedures

- Dust suppression
- Hand tools
- Drop sheets

## 4. Clean up / Decontamination

- Spray glue encapsulant
- Washing
- Water filtering
- Disposal

# Site Isolation



Site isolation involves:

- Warning others of the potential for asbestos exposure
- Preventing entry to the work area by unauthorized people
- Containing asbestos waste, dust and debris

For high risk work – enclosure of the work area

- Controlling the release of airborne asbestos fibres from the work area
  - Plastic barriers
  - Negative pressure
  - Self-closing air-lock entry/exit points
- Preventing entry
  - Physical barriers and perimeter control zones
  - Signage



















# Asbestos Abatement







## Modern **containment** and **enclosure** systems

- Exceptional strength and durability when properly assembled
- Effective control of the release of asbestos
  - Airborne fibres
  - Bulk materials and debris
  - Water
- Require skilled, competent workers for effective and efficient assembly, maintenance and dismantling
- Often rely very strongly on scaffolding component

# Worker Protection



- Primary Route of Exposure: Inhalation of Airborne Fibres
  - Engineered and Administrative Controls only so effective
  - Personal Protective Equipment (PPE) and effective suppression of dust through procedures are essential
- OEL for Asbestos – **0.1 fibres** / cubic centimetre (f/cc)
- OEL for Glass Fibres – **1.0 f/cc** (not a known carcinogen)
- We may see this change in the future – likely to decrease
  - Asbestosis on the decline
  - Lung Cancer and Mesothelioma still prevalent

**Restricted Area** – High risk work activities create a “Restricted Area” where airborne fibre concentrations can be expected to exceed the OEL

## Fibre Concentrations During Abatement Activities

- Can be kept very low (<1.0 f/cc) through proper procedure and engineered controls
- Can routinely climb to 5.0 f/cc or more
  - Inadequate wetting
  - Careless handling
  - Deteriorated materials
  - Volume of work

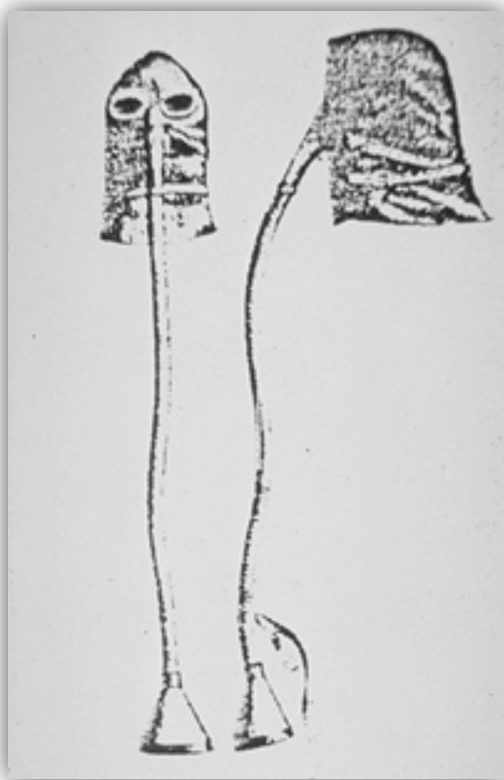
## What volume of air do you breath?

- Average worker (without respirator):
  - 500 mL per breath (br), 20 breathes per minute (1,200 per hour), 8 hours work in Restricted Area
  - =  $500 \text{ mL} / \text{br} * 1,200 \text{ br} / \text{hr} * 8 \text{ hr} / \text{day}$
  - = 4,800,000 mL (or cubic centimetres) / day
- *At 0.1 f/cc = 480,000 fibres / day*
- *At 5.0 f/cc = 24,000,000 fibres / day*

# Asbestos Exposure



# Worker Protection - Respirators



## Latest Advances

- High efficiency particulate air filter (HEPA Filter)
- Composed of very fine glass fibers
- Extremely efficient filters – 99.97%
- Used for very small airborne particles
- Produce little breathing resistance

## Modern Respirator Design Features

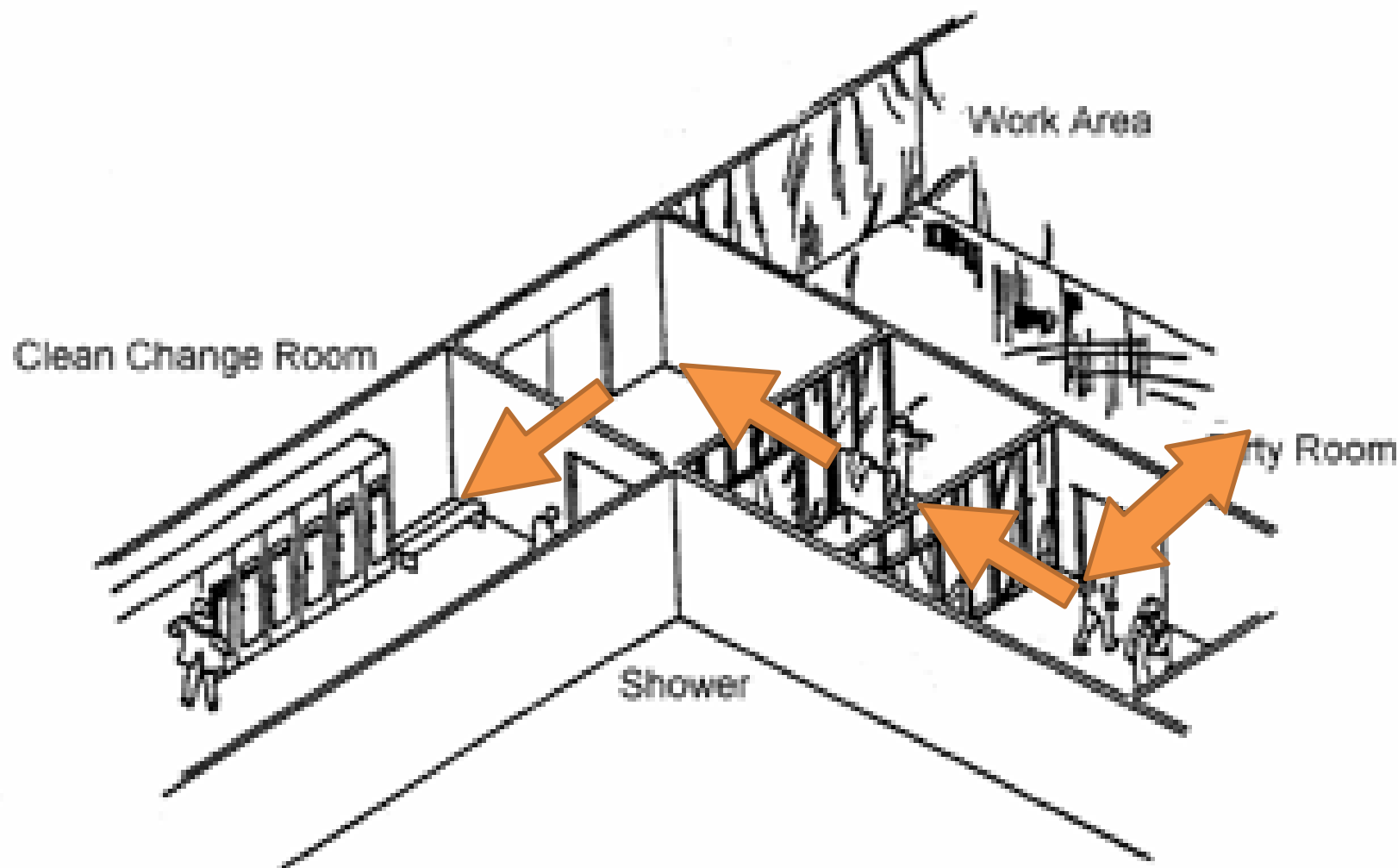
- Smaller face piece with lower profile
  - Greater field of vision
  - Permits use of other protective gear such as a hard hat
  - More comfortable
- Better protection – **Powered Air Purifying Respirator (PAPR)**



## Worker decontamination – OHS Code, Section 23

- If a worker may be contaminated by a harmful substance at a work site, the employer must
  - (a) provide the facilities, including showers, the worker needs to remove the contamination before the worker leaves the site, and
  - (b) ensure that only those articles and clothing that have been properly decontaminated or cleaned are taken from the work site by the worker.

# Worker Protection - Decontamination



# Worker Protection - Decontamination



# Worker Protection - Decontamination



# Work Procedures









Work procedures are about **dust suppression**

- Continuous, reliable supply of water
  - Amended water is required
- Working with the proper technique
  - Hand tools
  - Drop sheets
- Material handling
  - Keeping waste materials from drying out
  - Bagging waste materials as they are removed
  - Working on manageable sections at a time



# Asbestos Abatement





# Cleanup / Decontamination

# Asbestos Abatement













## Disposal of Asbestos Waste, Alberta Government, Feb 2012 ACCEPTABLE INDUSTRY PRACTICES

- Alberta Asbestos Abatement Manual
- Transportation of Dangerous Goods Regulations
- Guidelines for the Disposal of Asbestos Waste

Asbestos waste is non-hazardous provided that it is managed in accordance with the *Guidelines for the Disposal of Asbestos Waste*

- Friable asbestos waste is double-bagged
- Disposal in Class I or Class II landfill and immediately covered
- Landfill is approved to accept asbestos waste

# Asbestos Abatement



# Asbestos Waste Disposal





# Inspection, Testing and Air Monitoring



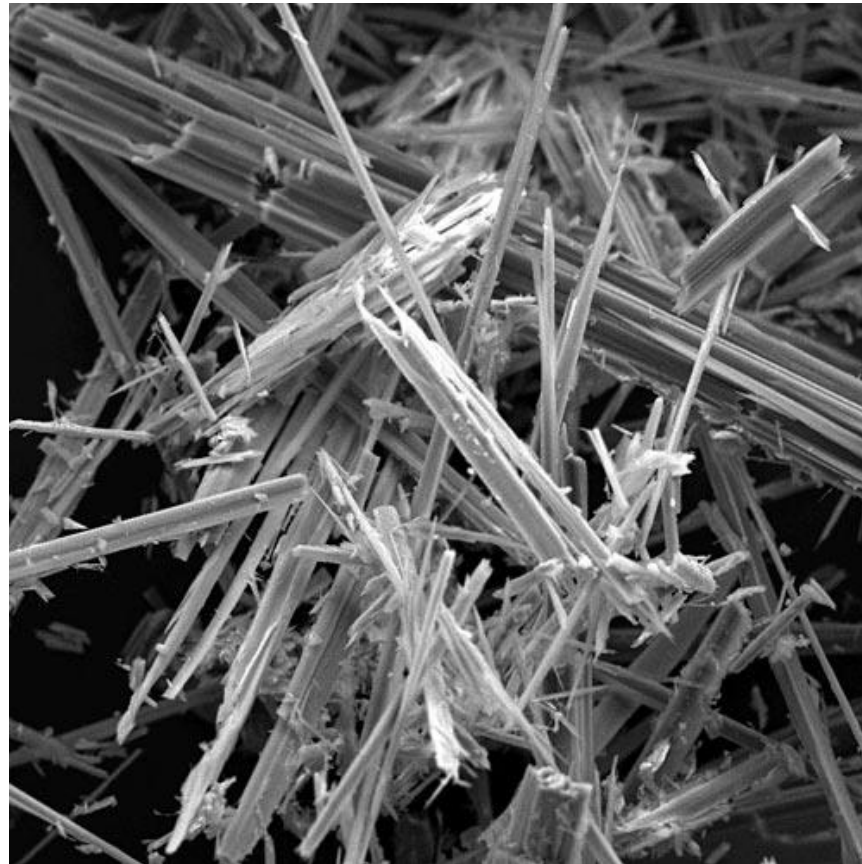
Inspections, testing and air monitoring are a recognized component of the abatement work

- 3<sup>rd</sup> Party Consultant working for the site Owner
- Field team of occupational hygiene technologist
- Works closely with Abatement Contractor

## **Abatement Quality Assurance and Control Plan**

- Regular and milestone inspections of work areas
- Daily air monitoring and results reporting
- Progress tracking
- Part of the Project Management Team

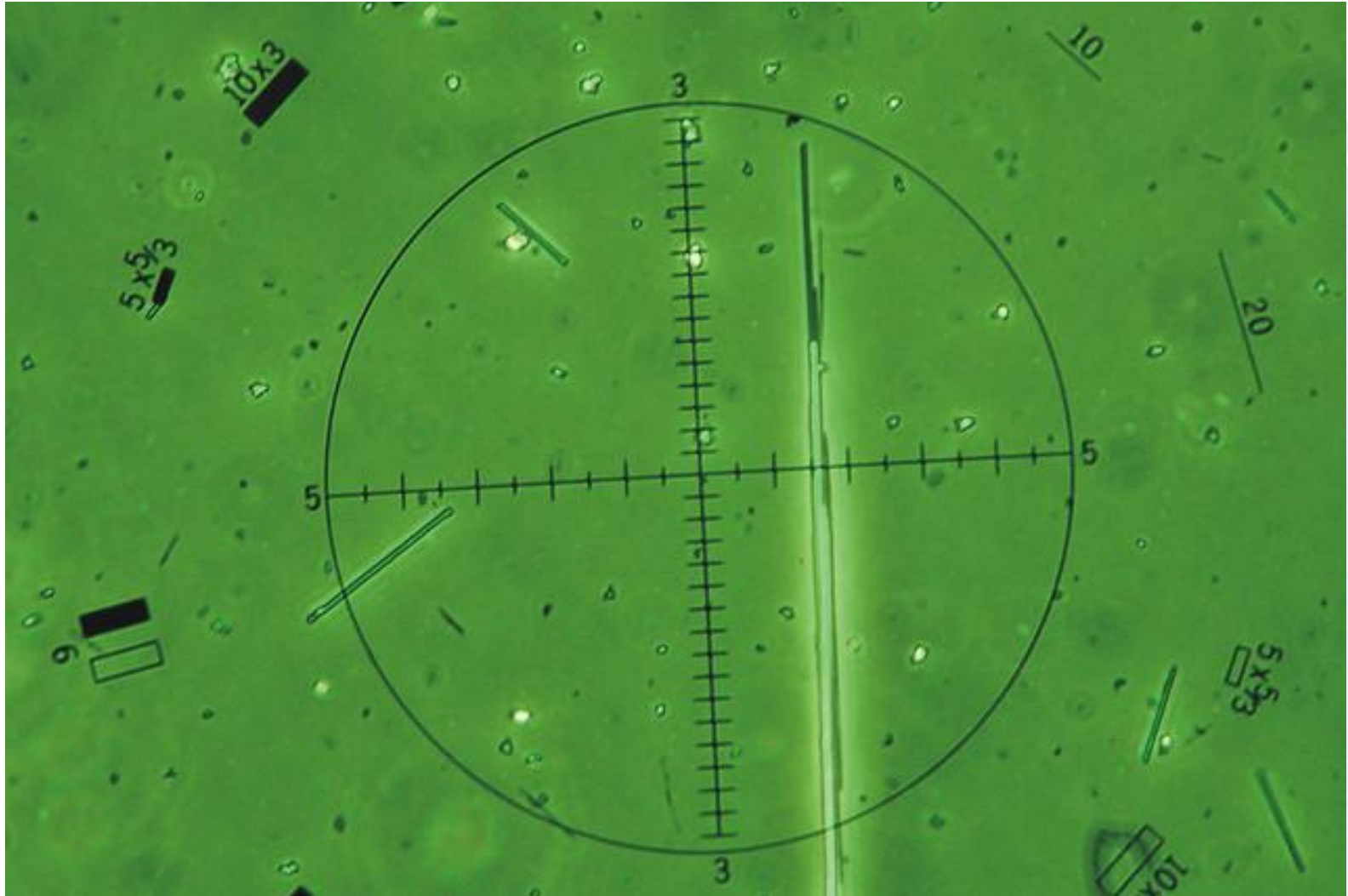
# Air Monitoring for Asbestos / Synthetic Fibres





- **Phase Contrast Microscopy (PCM)**
  - NIOSH Methodology 7400
    - Analysis performed at on-site **field laboratory / microscope**
    - **Does not differentiate** between asbestos and non-asbestos
    - Low cost, fast result, lower accuracy

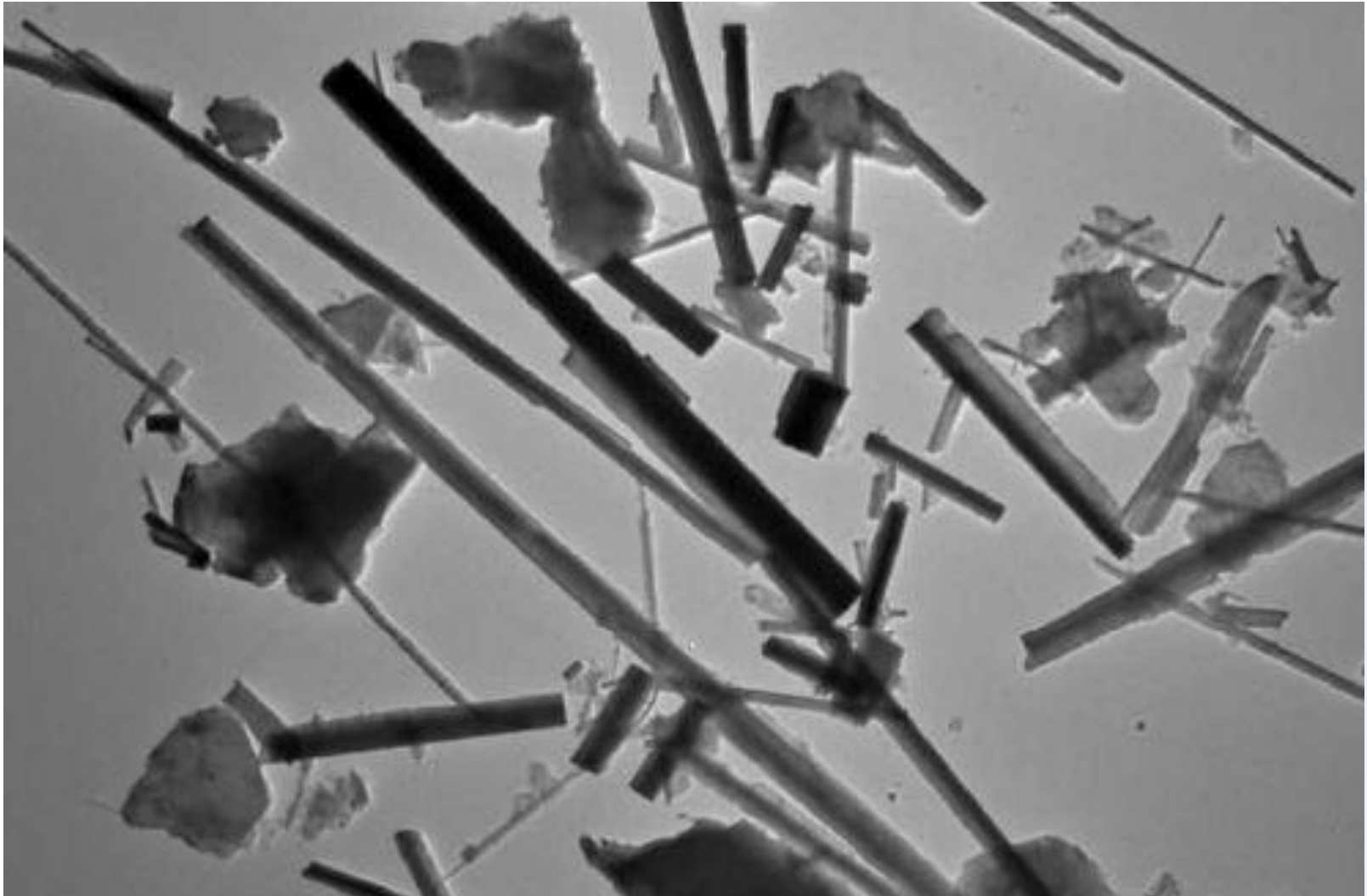
# Phase Contrast Microscopy (PCM)



- **Transmission Electron Microscopy (TEM) - NIOSH Methodology 7402**
  - Analysis at **remote** laboratory (few options available)
  - **Will differentiate**
    - Asbestos
    - Non-asbestos
    - Specific fibre types
  - Higher cost
  - Slower result
  - Only when necessary

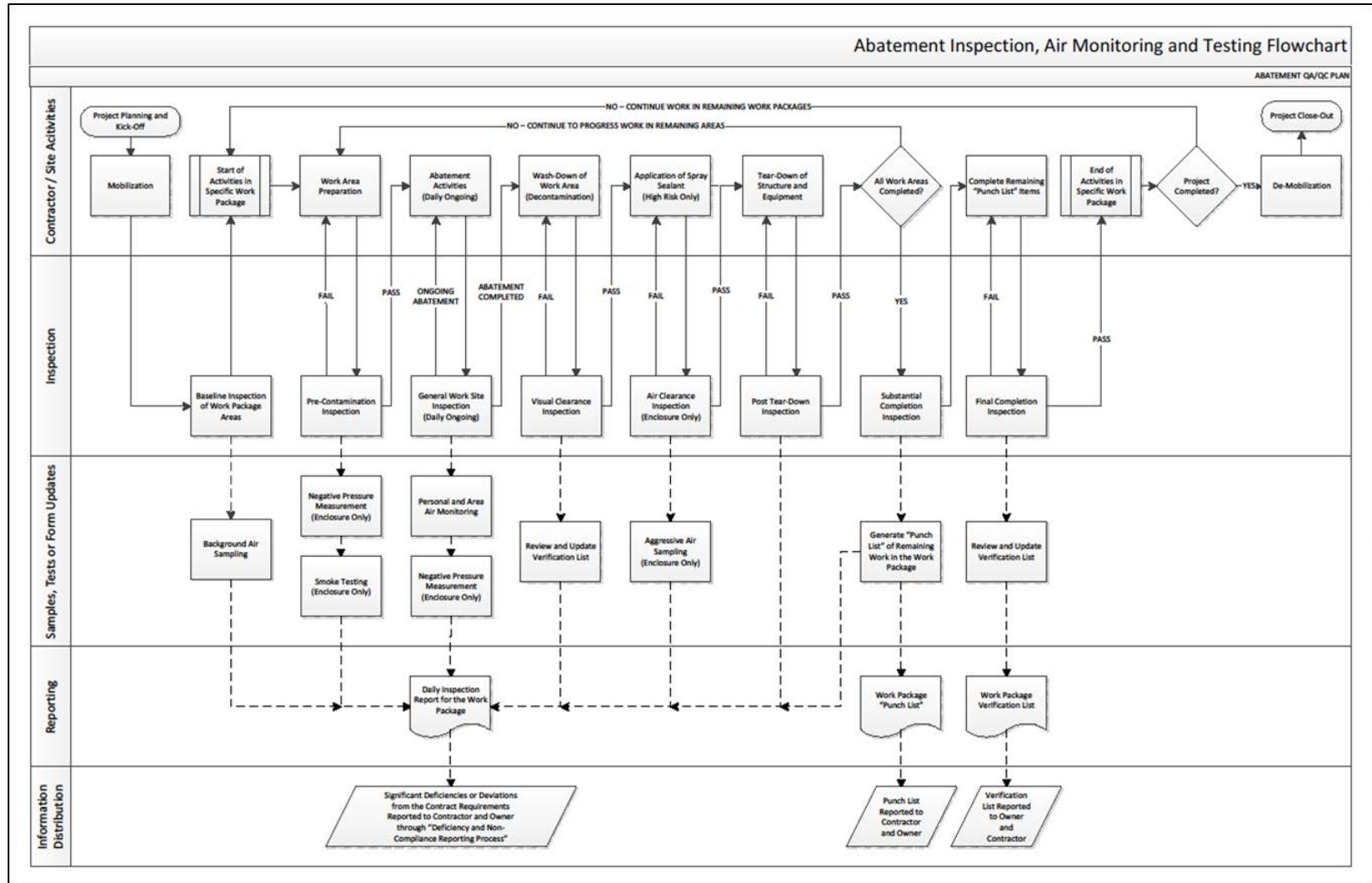


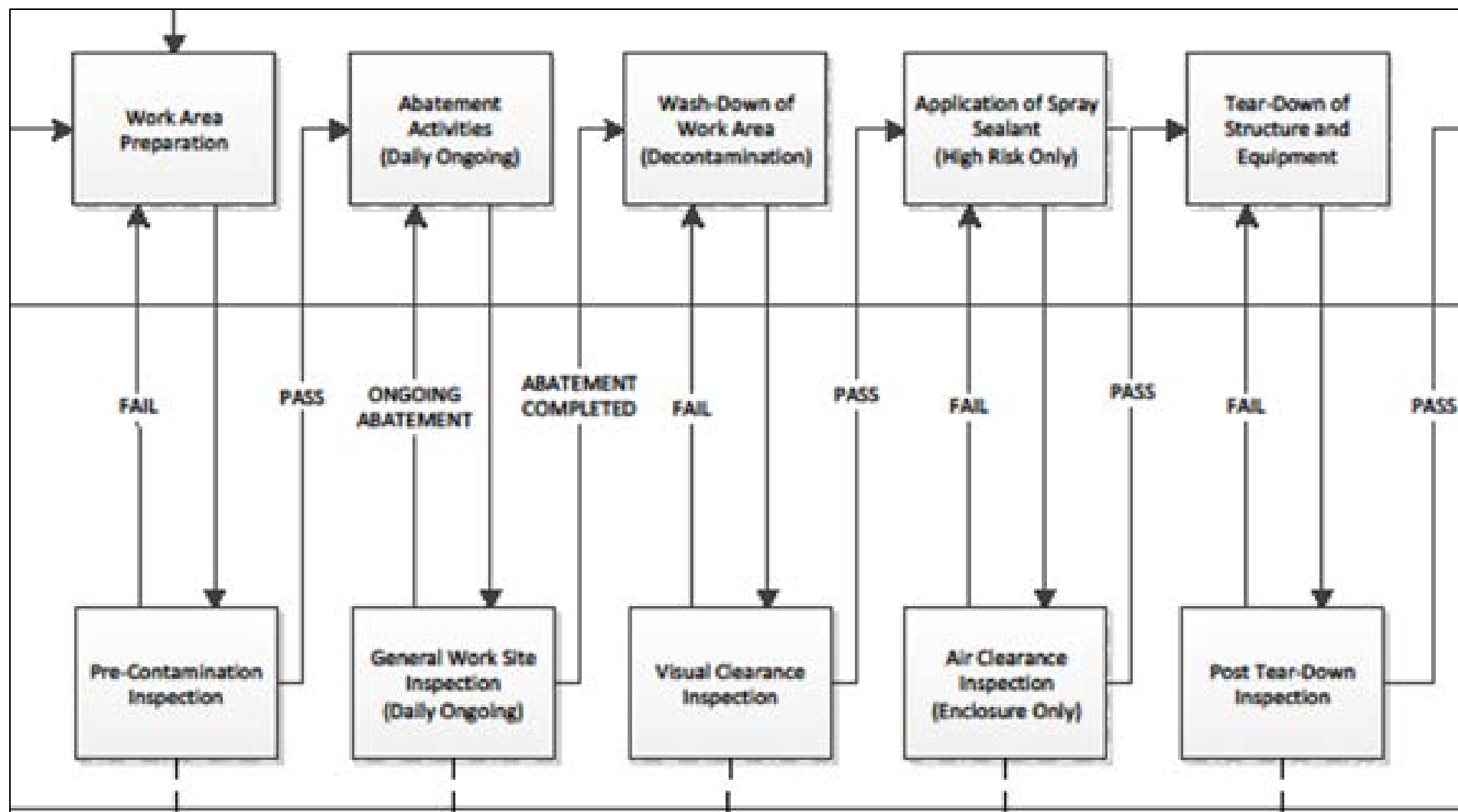
# Transmission Electron Microscopy (TEM)



- **Personal** air samples
  - Sampled directly in the worker “breathing zone”
  - Demonstrates occupational exposure levels
  - Used for confirming appropriate respiratory protection
  
- **Ambient Area** air samples
  - Sampled wherever potential exposures may exist
  - Sampled at work area perimeter to demonstrate fibre control
  
- **Clearance Area** air samples
  - Final sampling within containment area upon completion
  - Aggressive techniques are suggested and effective method

# Site Inspection and Reporting





## Milestone Inspections for High Risk Work Areas

### 1. **Pre-Contamination**

- Confirms site preparation before any work

### 2. **Visual Clearance**

- Confirms removal is complete

### 3. **Air Clearance**

- Confirms airborne fibres are minimal

### 4. **Post Tear-Down**

- Confirms work area is acceptably finished



# Pre-Contamination Inspection



# Ongoing Inspection and Monitoring



- Ongoing Work Site Inspection
  - Daily, Regular or Random inspection
  - Entry to asbestos work areas
  - Work procedure confirmation
  - Containment inspection
  - Negative pressure monitoring
  - Progress tracking
  - Issue investigation and resolution



# Abatement Project Management



# Abatement Project Considerations

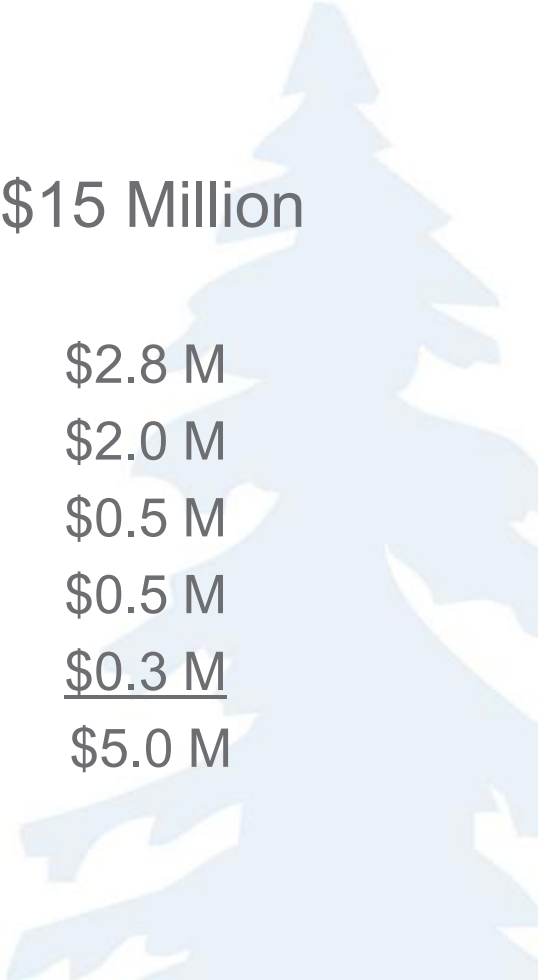
- How will the **project** be managed?
- Who will be affected or involved in **decisions**?
- What is your anticipated **budget**?
- How clear is your **scope**?
- What volume of **waste** will you generate?
- How distant are your **landfill** options?
- Where is your **location**?
- How close to “**best practice**” do you need to be?
- Can you consider outdoor or pre-demolition **options**?
- Will there be **re-occupancy**?
- What is your **schedule** for abatement and demolition?
- Are there **efficiencies** to be realized?

# Abatement Project Considerations

## Project Budgets

### Oil and Gas Plant / Large Facility

\$5 - \$15 Million

A faint, light blue silhouette of a coniferous tree is positioned on the right side of the slide, behind the budget breakdown table.

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○ Scaffold	40%	\$2.0 M
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# Objectives and Timeline

## 1. Preliminary Assessment

- Historical review and planning

1-2 months

## 2. Detailed Survey and Scope of Work

- Identification and Quantification

1-4 months

## 3. Abatement Contractor Selection

- Scope of work and Specifications
- Tender and evaluation

3-4 months

## 4. Abatement Execution

- Removal and Disposal
- Inspection and Air Monitoring

6-12 months

The process can be lengthy and there are many potential snags

## Build the team EARLY

- **Establish** abatement project team lead and initial members
  - Project Manager
  - Hazardous Materials Consultant
  - Demolition Consultant
  - Others to consider
    - Site Supervisor
    - Health, Safety and Environment
    - Local staffing/talent
    - “Old Timers”
- **Involve** them in the planning and educate on abatement process

## Build the team EARLY

- Interface with other project teams to accomplish goals
  - Shutdown, Decommissioning and Salvage (SDS)
  - Abandonment and Reclamation (A&R)
  - Health, Safety and Environment (HSE)
  - Waste Managers
  - Operators and Technicians
  - Company Management and Stakeholders
  - Regulatory bodies (ERCB, AESRD, WHS)
  - Community involvement, landowners



## Preliminary Planning

- Interview “Old Timers”
- Review historical documentation
  - Insulation specifications
  - Assessment or abatement reports
  - Asbestos Management Plan (AMP)
  - Determine construction dates
- Differentiate and define major systems and buildings
- Develop a survey scope, sampling strategy and schedule

## Consider what information is necessary when planning the hazardous materials assessment

### Objective: **Identify, Inventory and Quantify**

- Asbestos-Containing Materials (ACM)
- Non-asbestos or suspect ACM – Synthetic Vitreous Fibre (SVF)
  - Calcium silicate
  - Fibre glass, mineral wool, rock wool
  - Cellular glass
  - Refractory Ceramic Fibre (RCF)
- Lead-Based Paints (LBP)
- Naturally Occurring Radioactive Materials (NORM)

# Detailed Site Survey

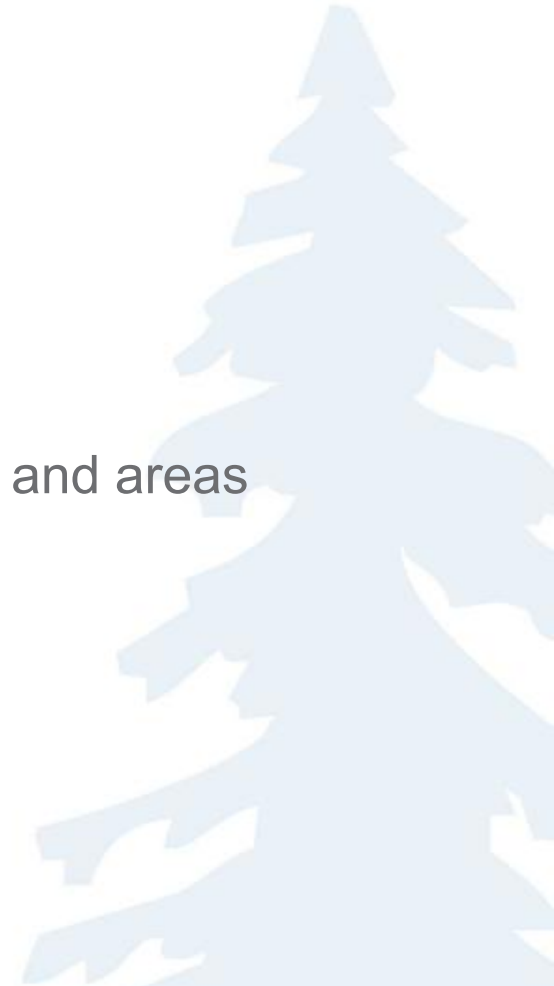
Location	Potential ACM
Thermal insulating materials	Insulating bricks or pre-formed blocks, lagging, steam tracer wrap, mudding compounds, mastics or sealants
Building construction materials	Exterior cladding, drywall, floor tiles, sheet flooring, wall insulation, vermiculite
Internal materials	Gaskets, packing compounds, refractory brick, mudding compounds

## Requirements

- Typical budgets \$50 K to \$250 K for large plants
- Completion Timeline: 2 – 4 months

## Results

- Detailed Scope of Work for abatement planning
- Full inventory of all pipelines, equipment, buildings and areas
  - Asbestos content / type
  - Surface coatings (lead-based paint)
  - NORMs
- Materials quantified – Waste Types and Volumes



# Other Hazardous Materials

Item or Material	Potential HazMat
Thermostats, thermometers, manometers	Mercury
Other instruments and gauges	Mercury, glycol, mineral oils
Electrical switches	Mercury
Lamp bulbs (fluorescent, HID)	Mercury vapour and amalgam
Lighting fixtures (ballasts)	PCB
Transformers (oil)	PCB
Batteries (various sources)	Lead-Acid, Ni-Cad, Mercury, Lithium
Air conditioners / refrigeration units	Halons







# Defining the Scope of Work

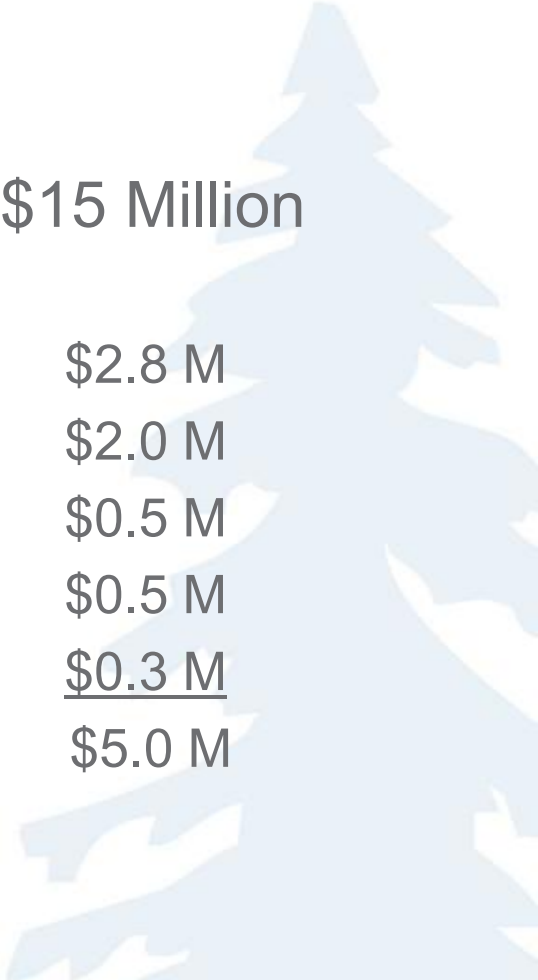


- **Invest the time to clearly define the Scope of Work**
  - Work areas delineated
  - Drawings
  - Specifications
  - Site requirements
  - Expectations
  - Contractor responsibilities
  - Owner provisions
  
- These steps can eliminate a 10%+ scope creep, preventing a potential increase of \$500 K or more

## Project Budgets

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Explore alternate abatement methodologies

- **Outdoor removal methods**

- Eliminate traditional containments/enclosures
- Most effective on pipelines
- Easier to control on unoccupied sites
- Several different methods in use – must be evaluated
- Can see cost differences of over \$0.5 M

- **Wrap-and-cut**

- Efficient alternative to insulation removal
- Pipeline or equipment is wrapped and sealed
- Entire package is disposed of as asbestos waste



## **"Re-occupancy" of work areas**

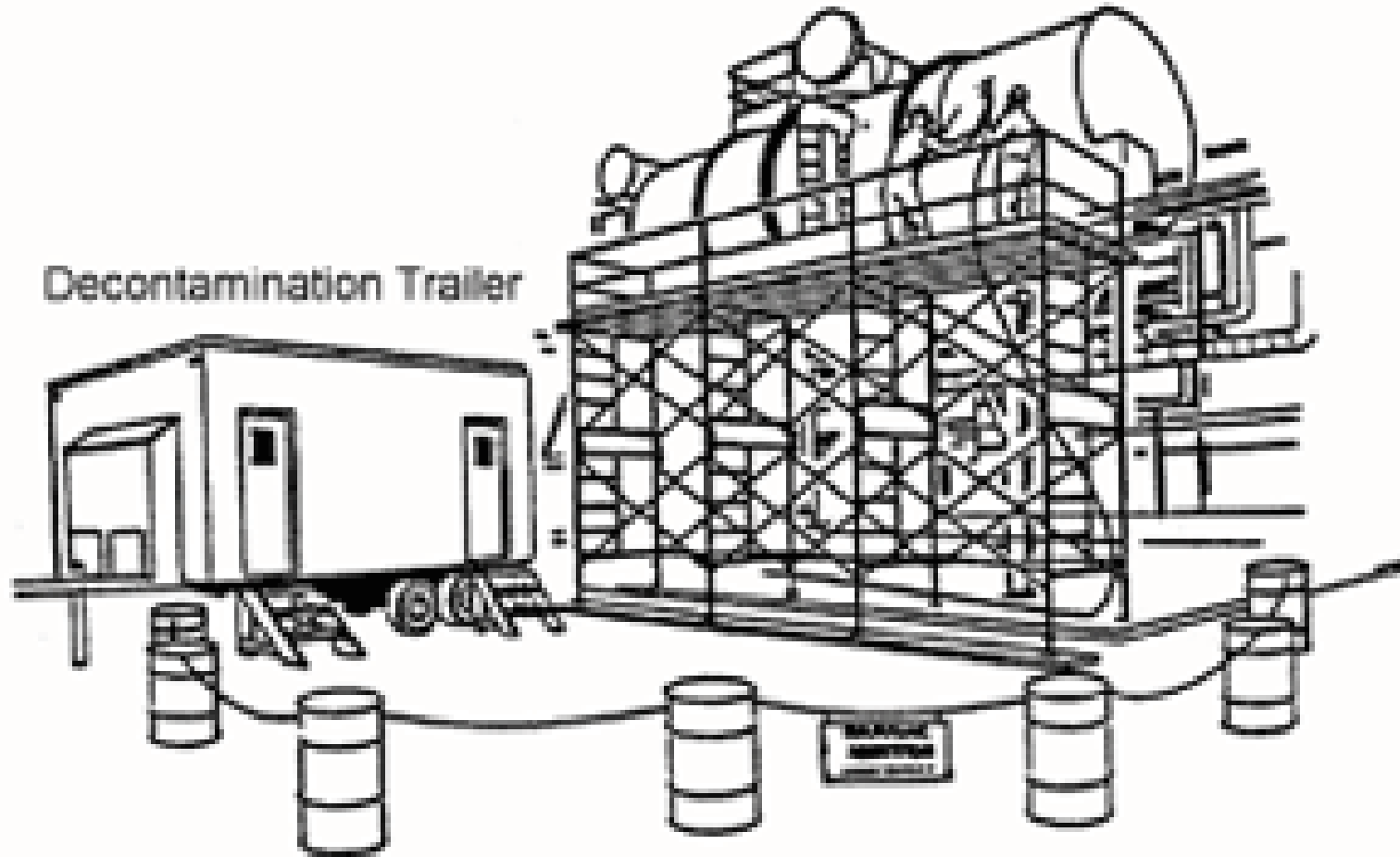
- Define areas where it is essential that other site occupants/workers, without appropriate personal protective equipment, will be returning into the abatement area following the abatement work
- Re-occupancy involves a higher level of risk and typically a more stringent standard of work area control and decontamination
- Reduced abatement costs in areas that will not be re-occupied
- Overlapping abatement and demolition is excellent option

# Outdoor and Pre-Demolition Work



# Outdoor and Pre-Demolition Work

Workers Wetting Asbestos As Covering is Removed



## Define Inspection and Air Monitoring Expectations

- Alberta Asbestos Abatement Manual is a guideline only
- Best practices may not be understood the same way
  - Specifications
  - Inspection Schedule
  - Air Sampling Strategy
- Puts all bidders on equal terms – fair comparison
- Avoid disagreements / misunderstandings during the project

# Demolition



# Thank You



## Questions?

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