Pre-Demolition Abatement
Pre-Demolition Abatement

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
What are Hazardous Materials?

Hazardous Building Materials

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

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
Hazardous Materials Management

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
**Hazardous Materials Management**

**Typical Abatement Project Budgets**

**Oil and Gas Plant / Large Facility**

- **Abatement**: 55% \( \approx \$2.8 \text{ M} \)
- **Scaffolding**: 40% \( \approx \$2.0 \text{ M} \)
- **Management and Supervision**: 10% \( \approx \$0.5 \text{ M} \)
- **Inspection and Air Monitoring**: 10% \( \approx \$0.5 \text{ M} \)
- **Disposal**: 5% \( \approx \$0.3 \text{ M} \)

Total: \( \$5.0 \text{ M} \)

*Range: \$5 - \$15 Million*
Regulations and Requirements

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**
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)
Asbestos Abatement

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
Asbestos Abatement

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
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
Asbestos Exposure

- 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
Asbestos Exposure

**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
  - \(= 500 \text{ mL/br} \times 1,200 \text{ br/hr} \times 8 \text{ hr/day}\)
  - \(= 4,800,000 \text{ mL (or cubic centimetres) / day}\)

- \(\text{At } 0.1 \text{ f/cc} = 480,000 \text{ fibres / day}\)
- \(\text{At } 5.0 \text{ f/cc} = 24,000,000 \text{ fibres / day}\)
Asbestos Exposure
Worker Protection - Respirators
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
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
Asbestos Waste


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 Waste Disposal
Inspection, Testing and Air Monitoring
Inspections, testing and air monitoring are a recognized component of the abatement work

- 3rd 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)
Air Monitoring

- **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
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 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

- Abatement 55% $2.8 M
- Scaffold 40% $2.0 M
- Management and Supervision 10% $0.5 M
- Inspection and Air Monitoring 10% $0.5 M
- Disposal 5% $0.3 M

Total: $5.0 M
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
Hazardous Materials Management

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
Initial Considerations

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)
<table>
<thead>
<tr>
<th>Location</th>
<th>Potential ACM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal insulating materials</td>
<td>Insulating bricks or pre-formed blocks, lagging, steam tracer wrap, mudding compounds, mastics or sealants</td>
</tr>
<tr>
<td>Building construction materials</td>
<td>Exterior cladding, drywall, floor tiles, sheet flooring, wall insulation, vermiculite</td>
</tr>
<tr>
<td>Internal materials</td>
<td>Gaskets, packing compounds, refractory brick, mudding compounds</td>
</tr>
</tbody>
</table>
Detailed Site Survey

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
<table>
<thead>
<tr>
<th>Item or Material</th>
<th>Potential HazMat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermostats, thermometers, manometers</td>
<td>Mercury</td>
</tr>
<tr>
<td>Other instruments and gauges</td>
<td>Mercury, glycol, mineral oils</td>
</tr>
<tr>
<td>Electrical switches</td>
<td>Mercury</td>
</tr>
<tr>
<td>Lamp bulbs (fluorescent, HID)</td>
<td>Mercury vapour and amalgam</td>
</tr>
<tr>
<td>Lighting fixtures (ballasts)</td>
<td>PCB</td>
</tr>
<tr>
<td>Transformers (oil)</td>
<td>PCB</td>
</tr>
<tr>
<td>Batteries (various sources)</td>
<td>Lead-Acid, Ni-Cad, Mercury, Lithium</td>
</tr>
<tr>
<td>Air conditioners / refrigeration units</td>
<td>Halons</td>
</tr>
</tbody>
</table>
WARNING
AUTHORIZED PERSONNEL ONLY
WASTE STORAGE PAD MAY CONTAIN HAZARDOUS WASTE
Defining the Scope of Work
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
### Hazardous Materials Management

**Project Budgets**

**Oil and Gas Plant / Large Facility**

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Total: $5.0 M
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 an excellent option.
Outdoor and Pre-Demolition Work
Outdoor and Pre-Demolition Work

Workers Wetting Asbestos As Covering is Removed

Decontamination Trailer
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
Thank You

Questions?

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