Hazardous Materials in Construction
BCBEC
Vancouver, June 20 2013

Jim Bagley MCIOB, EP
Who is LEVELTON?

Levelton is a Western Canadian firm with 45 years of experience delivering comprehensive and integrated services to clients throughout Canada and the world.

With over 220 people in nine offices in BC and Alberta, we specialize in engineering and scientific services over four main areas: materials engineering, environment and energy, geotechnical, and building science.

Challenges inspire us
Introductions

Jim Bagley, MCIOB EP
Senior Project Manager
Levelton Consultants Ltd.

- Construction professional for 35 years
- Member Chartered Institute of Building
- Environmental Professional (OHS) 15 Years
Seminar Outline

• Risks posed by hazardous building materials (Hazmats) to the public, contractors and building professionals

• Key Hazmats of Concern

• Hazardous Materials Legislation

• When do Hazmats become an issue?
How Hazmats Get into Buildings

• Wide range of Hazmats found in buildings

• Some installed materials largely phased out (Lead PCBs and Asbestos), others still installed (Mercury and RAMs)

• Microbial contamination not installed but caused by water damage, condensation, birds, bats and rodents

• Other hazardous materials can be associated with industrial or commercial use (flammables, explosives)

• Radon a result of natural geology
Increasing Recognition of Risk

• Risk posed by “Hazmats” were not generally recognized when installed

• Asbestos – wonder mineral in 10,000 building products – risks started to be recognized in 1930s

• Lead – excellent in paint for durability but increasing concern particularly for children

• Radon - Health Canada reduced recommended maximum levels from 800 Bq/M$^3$ to 200 Bq/M$^3$ – still higher than USA and WHO standards
Safety vs. Environmental Risk

• ODS - low safety risk level in situ, but harmful to the environment when released

• Mercury in light tubes – safe if tubes are unbroken, potential environmental impact for disposal

• PCBs in ballasts - generally safe unless skin contact or in fire (dioxins and furans released) environmental impact for disposal
Safety vs. Environmental Risk

• Lead paint and heavy metals – generally low exposure risk in-situ, but leachate testing prior to disposal

• Conversely mould – naturally occurring, no concerns regarding landfill disposal but may be of concern if amplifying in building, particularly for susceptible individuals
Summary of Occupant Risks

• Many installed Hazmats are reasonably safe until disturbed by renovation, fire or water damage

• Unless there is loose friable material, occupants of buildings with asbestos present are at no greater risk than those properties without asbestos

• Lead paint can be toxic to children

• PCBs and mercury low risk in undisturbed equipment – potential mercury spillage from thermostats

• Mould growth risk to susceptible individuals
Summary of Building Contractor and Professional Risks

• Potential exposure during building demolition and renovation
• Potential exposure during destructive testing and site supervision
• Potential liability for non-compliance with regulations
• Potential financial implications of inadequate specifications and contracts
Most Common Hazmats

- Asbestos
- Lead, Mercury and other Heavy Metals
- PCBs
- Radioactive Materials / Radon Gas
- Mould / Microbial Growth
- Crystalline Silica
- Explosives and Combustibles
Asbestos Properties and Asbestos in The Environment
What is Asbestos?

- “Asbestos” – Greek adjective meaning inextinguishable
- Naturally occurring; mined from open pits
- Top producing countries include:
  - Russia
  - China
  - Brazil
  - Kazakhstan
  - Canada (until 2011)
Asbestos in the Air

• Typical background asbestos levels in the air 0.0001 f/cc
• May be 2-10 X as high in urban areas compared with rural areas
• Some events may cause increase in levels
• We inhale 1 asbestos fibre every 5 minutes
Asbestos in Water

- 400,000 Miles of asbestos pipe carrying drinking water in North America
- Asbestos levels as high as 3000 million fibres per litre
- USA EPA standards 7 million fibres per litre
What is Asbestos?

- Asbestos ore (Calcium or Magnesium Silicate) is a fibrous fireproof rock found naturally in the earth’s crust.
- Asbestos fibres are microscopic; when bundled together become useful in a variety of products.
How is it used?

Asbestos has been called the “magic mineral” because of its wide variety of desirable physical properties including:

• heat resistance
• electrical resistance
• chemical resistance
• good tensile strength
• flexibility
• thermal and acoustic insulation
• naturally occurring

Because of these unique properties, asbestos was used in a wide variety of commercial products.
History of Asbestos

- First used in Scandinavia in pottery 3000 years ago
- Used by Romans for Tablecloths and Napkins
History of Asbestos

• Used in many consumer products including Christmas Tree “Snow”
• Snow in the Wizard of Oz was asbestos
<table>
<thead>
<tr>
<th>Material</th>
<th>Approximate end of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprayed fireproofing</td>
<td>Mid 70s</td>
</tr>
<tr>
<td>Sprayed thermal insulation</td>
<td>Mid 70s</td>
</tr>
<tr>
<td>Sprayed decorative/acoustic</td>
<td>Mid 80s</td>
</tr>
<tr>
<td>Asbestos-containing vermiculite</td>
<td>Late 80s</td>
</tr>
<tr>
<td>Mechanical/pipe insulation</td>
<td>Early 80s</td>
</tr>
</tbody>
</table>
Fireproofing

Limpet Fireproofing (Amosite)
Acoustic, Decorative, Texture Finishes

Texture finish on walls and ceiling
Loose Fill Vermiculite Insulation

Description: Vermiculite loose (granular) fill masonry insulation
Location: attics, poured in to cavities of block cores or in cavity wall areas
Mechanical / Pipe Insulation

• Pipes, boilers, tanks, ducts etc.
• Stopped manufacture by 1975, use tapered out by early 1980’s
• Many buildings have a mixture of asbestos and non-asbestos insulation
Vinyl Sheet Flooring (VSF)

Can be sheet or rolled
## Non-Friable Asbestos

<table>
<thead>
<tr>
<th>Material</th>
<th>Approximate end of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos cement</td>
<td>Still being installed</td>
</tr>
<tr>
<td>Gaskets</td>
<td>Still being installed</td>
</tr>
<tr>
<td>Vinyl floor tile and sheet flooring</td>
<td>Mid 80s</td>
</tr>
<tr>
<td>Flooring compounds</td>
<td>Late 80s</td>
</tr>
<tr>
<td>Mastics, coatings and sealants</td>
<td>Late 80s</td>
</tr>
<tr>
<td>Roofing materials</td>
<td>Late 80s</td>
</tr>
<tr>
<td>Drywall taping/joint compound</td>
<td>Mid 80s</td>
</tr>
<tr>
<td>Ceiling tiles</td>
<td>Mid 80s</td>
</tr>
<tr>
<td>Plaster</td>
<td>Mid 80s</td>
</tr>
<tr>
<td>Window putties and caulking</td>
<td>Mid 80s</td>
</tr>
</tbody>
</table>
WorkSafe BC Date

- Whilst not explicitly stated in Section 20.112 of Occupational Health and Safety Regulation, 1990 is generally regarded as the date after which a building does not need to be tested for asbestos.
- The use of asbestos materials is not yet banned in Canada – though WorkSafe BC requires substitution wherever possible.
- Federal Government finally lifted their veto on asbestos being listed as a hazardous substance under Rotterdam Convention in September 2012.
Asbestos Cement

Siding

Flashing

ACM, base panel

(Transite or Trafford Tile)
Asbestos Cement Pipe

(Transite or Trafford Tile)
Asbestos Gaskets
Vinyl Floor Tile (VFT)

Can be 9 inch and 12 inches square
VFT and VSF

- VSF – asbestos only in backing pad or felt
- Unlike VFT, sheet flooring was not made in discrete squares or tiles
- Both VFT and VSF are made today in identical patterns but without asbestos
Mastics, Coatings and Sealants

Wall panel glues
Roofing Materials
Asbestos Paper, Textiles and Felts

Asbestos paper on ducts (may be friable)
Drywall Taping / Joint Compound (DTC / DJC)
Ceiling Tiles
Plaster
Window Putties and Caulking
Other Uses

Electrical wire insulation
Other Uses

Fire doors
Other Uses

Asbestos friction materials
Health Effects Associated with Exposure to Asbestos
A Brief History

• Asbestos mining began 4000 years ago
• Reference to negative health effects can be traced back as early as the 1\textsuperscript{st} century
• Pliny the Elder recommended that you should not buy slaves who had worked in asbestos mines
• First health claim related to asbestosis in 1927 in the US and 1942 in Canada
• Link to lung cancer in the 1930s
• Link to Mesothelioma in 1960
Asbestos Related Diseases

Exposure Pathways
- Inhalation of fibres
- Irritation to the skin
- Ingestion

Asbestosis
Lung Cancer
Mesothelioma
Pleural Plaques
Asbestos Related Diseases

The dimensions of the microscopic asbestos fibres (0.01 to 20µm) and their biopersistence in the lungs are believed to be the major cause of these health effects.
It is important to keep in mind that these diseases are often linked to prolonged, unprotected exposure to asbestos.
## Asbestos Related Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Latent Period (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestosis</td>
<td>10 to 20</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>30 to 45</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>15 to 25</td>
</tr>
</tbody>
</table>

This means that claims being made today are related to exposure that occurred in the 1970s and 1980s.
## Asbestos Related Diseases

### Lung Cancer

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Increased Chance of Lung Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy smoking (versus non-smokers)</td>
<td>10 to 12 times</td>
</tr>
<tr>
<td>Heavy asbestos (versus non-exposed, non-smokers)</td>
<td>5 to 9 times</td>
</tr>
<tr>
<td>Heavy smoking and heavy asbestos</td>
<td>50 to 90 times</td>
</tr>
</tbody>
</table>
Asbestos Related Diseases

Lung Cancer
Number of claims$^1$ accepted for asbestos-related diseases, 1972–2009

1 Claims accepted for health-care benefits only are not included.
Percentage of claims accepted for asbestos-related diseases by occupation group\(^1\), 1990–2009

- Other: 25%
- Metal workers and mechanics: 21%
- Plumbers and fitters: 10%
- Carpenters and painters: 8%
- Insulators and drywallers: 8%
- Electrical workers: 8%
- Other construction workers: 6%
- Marine workers: 6%
- Welders: 4%
- Boiler workers: 4%

\(^1\) Claims accepted for health-care benefits only are not included.
Heavy Metals
Lead – In Buildings

- Paint
- Sheeting for acoustic insulation
- Radiation shielding
- Masonry plugs for fasteners
- Glazes and ceramics
- Pointing mortar
- Lead pipe and solder
- Residue present in firing ranges, soldering operations, foundries
- Batteries in alarm and telecom systems
Health Risks of Lead

• Exposure through inhalation or ingestion
• Inhalation unlikely unless activity disturbs lead – grinding, sanding, welding etc.
• Children eat 200mg of dust every day and absorb 50% of lead from dust
Health Effects of Lead

- Lead exposures can cause:
  - Heart attack and strokes
  - Kidney failure
  - Central nervous system damage
  - Reproductive and fertility problems
Usage Period

- Phased out of architectural paints from mid 1970s
- Still in use for rust inhibition on metal structures
- Still in use in sheet applications and ceramics
Mercury – In Buildings

• Current Use:
  – Fluorescent tubes
  – Compact fluorescent lamps
  – Halide lamps

• Historic Use
  – Thermostats
Health Effects of Mercury

- Mercury exposure through ingestion (more common) and inhalation
- Neurological effects
  - Lighthouse Keepers
  - Mad as a Hatter
PCBs – In Buildings

- Fluorescent Ballasts and transformers phased out late 1970s
- Hazards mainly associated with burning and overheating and skin contact
- Become concentrated in environment in fish and wildlife
Radioactive Materials – In Buildings

• Americium-241 in smoke detectors, low quantity, low risk
• Radon gas
• 7% of Canadian Building exceed Health Canada Guidelines
• 2nd leading cause of lung cancer after smoking
Mould – In Buildings

- Mould ubiquitous in environment
- Will grow on wood with MC >17% and Drywall with MC >0.7%
- Health effects generally irritant and respiratory problems
- More serious effects for susceptible individuals
Other Organisms of Concern

• Bird and bat droppings can contain highly pathogenic fungi
• Histoplasmosis and Cryptococcosis
• Deer mice droppings may contain hantavirus
Crystalline Silica

- Found in concrete, and other cementitious products, bricks and ceramic tile
- Does not become aerosolized unless cut, crushed or ground
- Carcinogen and ALARA
Regulations

Assessment, Removal, Transport and Disposal of Hazmats
Regulations

Asbestos is governed by 3 primary legislative documents in BC:

The Occupational Health and Safety (OHS) Regulation

The Transportation of Dangerous Goods (TDG) Regulation

The BC Hazardous Waste Regulation (HWR)
Table 5.4 Exposure Limits and Designations

5.7 Designations

- Asbestos has an exposure limit of 0.1 fibers per milliliter and is designated K1 and A.

- As asbestos is designated a K1 (confirmed human carcinogenic) material the employer must implement an exposure control plan to maintain worker exposure As Low as Reasonably Achievable (ALARA) below the exposure limit listed in Table 5.4.
6.1 Definition

“asbestos-containing material” means a manufactured article or other material, other than vermiculite insulation, that would be determined to contain at least 0.5% asbestos...

6.4 Inventory

• Every workplace must have an survey of asbestos-containing materials by qualified person and keep inventory current

• Level of compliance low – primarily institutional employers
20.112 Demolition – Hazardous materials

Before work begins, the employer or owner must:

- ensure that a Qualified Person (QP) inspects the site to identify asbestos-containing materials, lead or other heavy metal or toxic, flammable or explosive materials that may be handled, disturbed or removed,

- have the inspection results available at the worksite, to show the locations of any hazardous substances,

- ensure that any hazardous materials found are safely contained or removed, and

- if hazardous materials are discovered during demolition work that were not identified in the inspection, ensure that all work ceases until such materials are contained or removed.
Regulations – WorkSafeBC
Sample Frequency 20.112

- Minimum of 3 samples required of most types of suspect asbestos construction materials
- Greater numbers for larger areas
- Typical demolition of residential property ~25 asbestos samples and ~12 lead paint samples
- Larger commercial building significantly more samples
- Stop positive approach reduces sample costs
- Inventory survey is not sufficient for pre-renovation/demolition
Regulations – WorkSafeBC

20.112 Demolition – Hazardous materials

• 1990 GENERALLY ACCEPTED AS CUT OFF DATE BY WORKSAFE AFTER WHICH ASBESTOS TESTING IS NOT REQUIRED

• LEAD PAINT NOT USED RESIDENTIALY AFTER LATE 1980S

• NO CUT OFF DATE FOR OTHER HAZMATS – ALL BUILDINGS NEED A SURVEY POSTED ON SITE EVEN IF IT SIMPLY STATES THAT HAZMATS ARE NOT PRESENT
Regulations – TDG

- Only friable asbestos material is regulated by the TDG Regulations
- More than 5 kg of friable asbestos material must be packaged, manifested and transported fully in accordance with the TDG Regulations
- Friable asbestos materials may only be transported by a licensed waste handler
Regulations – HWR

• “waste asbestos” a waste containing friable asbestos fibres or asbestos dust in a concentration **greater than 1%** by weight either at the time of manufacture, or as determined using a specified laboratory method.

• Waste asbestos can only go to a secure landfill unless:
  - a permit or an approval has been issued under the Act to operate the landfill
  - The asbestos is contained in two 6 mil plastic bags
  - the asbestos is immediately buried with a minimum of 0.5 m of cover material at the landfill
  - approval of the landfill owner is received before disposal takes place
  - the deposit is authorized by a director
Asbestos Disposal
Asbestos Cleanup
Regulations – Lead

• Lead paint is not specifically defined in WorkSafe BC Regulations

• Federal Regulations define lead based paints as paint containing more than 0.5% lead

• WorkSafe guidelines state that: removal of paint with a lead concentration as low as 0.06% by aggressive techniques can approach the occupational exposure limit

• Prior to disposal at a landfill all lead-painted materials must be tested for leachability. (N.B. Local Practices)

• All other lead products should be recycled.
Regulations – PCBs

• All ballasts and transformers containing PCBs may only be disposed of at a hazardous waste facility. The only hazardous waste facility accepting PCBs in Canada is Swan Hills in Alberta.

• PCBs awaiting disposal must be stored. PCB-containing lighting ballasts must be stored in approved containers in a secure, weather protected area. The containers must be on a sealed surface. Gravel, dirt or other permeable surface is not acceptable and any floor drains must be sealed.

• PCB ballasts and fluorescent tubes can be collected and disposed of FOC through the BC LightRecycle program
Regulations – Mould

• Mould is not specifically referred to in the WorkSafe Regulations Section 6 – Hazardous Substances

• Mould is however recognized as hazardous by WorkSafe and any work disturbing mould must be carried out in accordance with WorkSafe Guideline 4.79

• Mould contaminated materials may be disposed of at any landfill site.
Regulations – Silica

- Silica is carcinogenic and ALARA – must have ECP
- Exposure underestimated in construction and demolition
- Produced by cutting and grinding concrete, bricks and tile, sanding drywall compound and mixing cement, tileset etc.
- Health effects are dose related (unlike some asbestos related illnesses)
When do Hazmats Become an Issue?

• For workplace owners / employers inventory mandatory at all times

• When renovation or demolition disturbs materials

• When fire or flood damages building

• Property transaction – Stage 1 PSA, financial due diligence and liability

• Change of use – lead paint
Responsibilities - Contractors

• Must have ECP for each material if potentially exposing workers to asbestos, lead or silica

• Must ensure that materials have been tested before employees disturb them

• Must file NOPA or NOPL with WorkSafe before disturbing asbestos or lead
Responsibilities - Professionals

• Should verify that appropriate testing has been done before specifying demolition, repair or refurbishment work

• Should verify that contractors have adequate training, and insurance for hazmat work

• Should stop work if un-tested suspect asbestos materials are exposed
Questions?
Contact Us

Lower Mainland – Arvind Chowdhari
604-207-6118
Vancouver Island South – Kathy Muirhead
250-475-1000
Vancouver Island North – Jim Bagley
250-218-0490
BC Interior – Jeff Widmer
250-419-9778

hazmat@levelton.com