Hazardous Materials In Buildings
Why, Where, What to Do ???

FEA-U Presentation
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Overview

- Background / History
- Getting Control / Regulations
- Common Hazardous Building Materials
- FEA Positioned to Assist
What is a Hazardous Building Material?

- Google search first return:
  “Dangerous goods, also called hazardous materials or HazMat, are solids, liquids, or gases that can harm people, other living organisms, property, or the environment.”

- USDOT Definition of Hazardous Material (9 classes):
  “A hazardous material is defined as any substance or material could adversely affect the safety of the public, handlers or carriers during transportation.”

- Merriam-Webster:
  a material (as flammable or poisonous material) that would be a danger to life or to the environment if released without precautions

  Materials incorporated into building construction that could be detrimental to building occupants or environment.
Development of Construction Materials

- Early 1900’s
  - masonry, concrete, plaster, steel, wood, clay tile, coal tar roofing

- 1920 >>> 1930 >>> 1940 >>> 1950 >>>>>>>>1960’s
  - more modified natural building products - 17 plywood mills by 1920
  - glues, adhesives and caulking/sealants – waterproof adhesives 1934
  - more paints and coatings, polyurethane, epoxy
  - insulation materials for pipes, walls, attics - AC 1920-50’s
  - gypsum board – US Gypsum 1916-26
  - acoustic treatments for ceilings and walls
  - Spray fireproofing for structural members - 1950
  - vinyl floor tiles - 1930 - 1960’s
  - cement board, siding, pipes - 1927 John Manville

- 1970’s – 1990’s increased activity to abatement hazardous materials in buildings. Abatement efforts are reducing but continue in older buildings.

- 1980’s forward – sustainability efforts become more popular which promotes use of environmental friendly alternatives many building materials.
The Concern – A Change in Attitude

- **EPA** - People spend more up to 90% of their time inside building controlled environments

- **Center for Disease Control and Prevention** – “many indoor environments have pollution levels two to five times higher than outdoor levels” >>>> *Need to Improve IAQ*

- The increases in **asthma related conditions** in 80’s – 90’s linked to building materials and indoor environments. Many **asthmagens** identified – any substance that can trigger asthma symptoms
  - 32 million people in US have had asthma
  - 12 m of 22m people currently with asthma > attack in previous 12 months
  - 4K die each year from asthma related illness

- Mid 1990’s one of five US schools reported inadequate indoor air quality
Regulations Enacted

- Identification of the Hazards
- Manifesting and Tracking
- Awareness Training
- Worker Training and Licensing
Hazardous Building Materials

- **Asbestos-Containing Materials** – in 10,000 + building products
- **Lead-Based Paints and Coating** – exposure risk to children
- **Polychlorinated Biphenyl (PCB)** – electrical devices, hydraulics, sealant
  (Chlorodiphenyl 42/54% chlorine)
- **Mercury** – contained in thermostats, light bulbs, electric switches
- **Ethylene Glycol** – contained in piping systems, capture/recycle
- **Chlorofluorocarbon (CFC)** - refrigeration/AC, environmental concern – capture/recycle
- **Urea-Formaldehyde** – foam insulation, glues wood products
- **Volatile Organic Compounds (VOCs)** – glues/mastics, sealants, paints

- **Biological Growth (mold)** – poor design/construction/maintenance
- **Radon Gas** – avoided by identification, good design and construction

http://transparency.perkinswill.com/main
Risk of Exposure to Hazardous Materials

- Presence does not indicate exposure to people or environment
- Many safe until disturbed by maintenance, renovations, or accidental damage
- Removal/abatement may create a larger exposure risk
- Type of material, condition, location, potential for disturbance
- Management of Exposure Risk
  - monitoring material conditions
  - appropriate maintenance
  - appropriate containment, transport, and disposal
- Risk not fully mitigated until appropriate disposal/recycle completed
Regulations to Control Hazardous Materials

Toxic Substances Control Act of 1976

EPA authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures.

Excluded from TSCA, among others, food, drugs, cosmetics and pesticides.

TSCA addresses the production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint.
EPA History: Toxic Substances Control Act Press Releases

Quarles Testifies on the Need for Toxic Substances Act - July 10, 1975

EPA Incinerator Approvals to Speed PCB Disposal - February 10, 1981

EPA Announces Rule Requiring Schools to Test for Asbestos - May 24, 1982

Signing of Asbestos Hazard Emergency Response Act - October 23, 1986

Indoor Radon Abatement Act of 1988 - October 28, 1988
DOT Definition of Hazardous Material: any substance or material that could adversely affect the safety of the public, handlers or carriers during transportation. *Track and monitor transport* of hazardous materials they grouped into nine classes of materials.

**Class**
1. Explosives
2. Compressed Gasses
3. Flammable Liquids
4. Flammable Solids
5. Oxidizers/Organic Peroxides
6. Toxic Materials
7. Radioactive Materials
8. Corrosive Materials
9. Miscellaneous

- **Health Hazard**
  - 4: Deadly
  - 3: Extreme Danger
  - 2: Hazardous
  - 1: Slightly Hazardous
  - 0: Normal Material

- **Fire Hazard - Flash Point**
  - 4: Below 73°F
  - 3: Below 100°F
  - 2: Below 200°F
  - 1: Above 200°F
  - 0: Will Not Burn

- **Specific Hazard**
  - OXY: Oxidizer
  - ACID: Acid
  - ALK: Alkali
  - COR: Corrosive
  - ↑: Use NO WATER
  - ✪: Radiation Hazard

- **Reactivity**
  - 4: May Detonate
  - 3: Shock and Heat May Detonate
  - 2: Violent Chemical Change
  - 1: Unstable If Heated
  - 0: Stable
Asbestos Regulations and Laws

**EPA Laws**
The Asbestos Hazard Emergency Response Act (AHERA)
The Asbestos Information Act (AIA)
The Asbestos School Hazard Abatement Reauthorization Act (ASHARA)
The Clean Air Act (CAA)
Safe Drinking Water Act (SDWA)

**EPA Regulations**
EPA Asbestos Regulations
Asbestos-Containing Materials in Schools Rule (40 CFR Part 763, Subpart E)
Asbestos Worker Protection Rule (40 CFR Part 763, Subpart G)
Asbestos Ban and Phase-out Rule (Remanded) (40 CFR Part 763, Subpart I)
Asbestos Materials Regulations and Laws

Occupational Safety and Health Administration (OSHA) oversees workers occupational safety and health standards.

**Asbestos General Standard**—

**Asbestos Construction Standard**—
Covers *construction work* involving asbestos, including worker practices during demolition and renovation, worker training, disposal of asbestos waste, and specification of permissible exposure limits – 29 CFR 1926.1101
Residential Lead-Based Paint Hazard Reduction Act of 1992

- To develop a national strategy to build the infrastructure necessary to eliminate lead-based paint hazards in all housing as expeditiously as possible

40 CFR Part 745 - Lead-Based Paint Poisoning Prevention in Certain Residential Structures Lead Renovation, Repair and Painting Program (RRP) Rule:

- Requires that those engaged in RRP activities in homes or child-occupied facilities built prior to 1978 be trained and certified in lead-safe work practices, and to guard against lead contamination.
- Requires that contractors provide information on lead safety prior to beginning work.

Lead Abatement Program: Training and Certification Program for Lead-based Paint Activities (TSCA sections 402/404):

- Requires that those engaged in lead abatements, risk assessments and inspections in homes or child-occupied facilities built prior to 1978 be trained and certified in specific practices to ensure accuracy and safety.
Residential Lead-Based Paint Disclosure Program (Section 1018 of Title X):
• Requires that potential buyers and renters of housing built prior to 1978 receive certain information about lead and lead hazards prior to purchase or renting, and provides the opportunity for an independent lead inspection for buyers.

Residential Hazard Standards for Lead in Paint, Dust and Soil (TSCA Section 403):
• This sets standards for dangerous levels of lead in paint, household dust, and residential soil.

Department of Housing and Urban Development (HUD) - 1995
• Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing
Polychlorinated Biphenyls (PCBs) Regulations and Laws

- **PCB Regulations: 40 CFR 761**
  Current PCB regulations updated as of July 1 each year.

- No longer commercially produced in the United States

- PCBs may be present in products and materials produced before **1979 PCB ban**

- EPA regulates the management, cleanup and disposal of PCB wastes and the management of PCB-containing materials and equipment still in use.
# Permissible Exposure Limits

## HOW MUCH IS SAFE

EPA and OSHA regulations set limits of permissible release into the environment and worker exposure limits to protect workers.  

<table>
<thead>
<tr>
<th>Substance</th>
<th>Limit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>&gt;1% asbestos by weight</td>
<td>0.01 fibers/cc of air</td>
</tr>
<tr>
<td>Lead</td>
<td>&gt;0.5% weight, 1.0 mg/cm² (XRF)</td>
<td>&gt;5 µg/deciliter blood, 100/500/800 µg/ft² dust</td>
</tr>
<tr>
<td>PCB</td>
<td>50 ppm regulated disposal</td>
<td>0.5 to 1 ppm</td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
<td>0.1 mg/m³ (shift TWA)</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>&lt; 0.75 ppm worker (shift TWA), &gt; 0.1 ppm labeling required</td>
<td>&lt;0.05 ppm (CA, cert prod)</td>
</tr>
<tr>
<td>Mold</td>
<td>levels change daily/hourly</td>
<td>less than outside air</td>
</tr>
<tr>
<td>Radon</td>
<td></td>
<td>100 pCi/l (pico curies per liter)</td>
</tr>
</tbody>
</table>

Strive to **eliminate the risk to avoid exposure** as the best approach for the general public and environment.
The drive for sustainable, environmentally friendly construction and building operations gain increased focus and importance worldwide.

USGBC-LEED, GBI-Green Globes, and others, have rating items related to improvement of indoor air quality including:

- Prerequisites for minimum performance, tobacco smoke controls, asbestos and PCB removal
- Increased outside air ventilation and monitoring
- HVAC and building envelope commissioning
- Construction indoor air quality management plan
- Indoor chemical and pollutant source control
- Low-emitting materials
- Flushing building and HVAC prior to occupancy
- Mold prevention
- Green Operating and Cleaning
Common Hazardous Materials in Buildings
Asbestos and Lead in Buildings

- Two most abated hazardous materials in buildings.
- The United States EPA, OSHA, and HUD have produced regulations and rules related to asbestos-containing materials and lead-based paint.
- Environmental surveys for friable and non-friable asbestos, and lead, conducted by a certified environmental consultant are required by Law before disturbance in structures built before 1978.
- Contractors providing asbestos and lead abatement services are required to be trained and certified in using current safe work practices.
- Contractors are responsible for following all health and safety regulations relating to the handling, transport, and disposal of asbestos and lead-based materials.

Beware! – asbestos and lead are still used in some materials still produced in and out of the US.
Natural mineral - chrysotile; crocidolite; amosite; anthophylite; tremolite; and actinolite.

Most concerned with control of **friable** asbestos materials. **Friable** material can be crumbled in your hands to a power.

- Cement pipe and board
- Fireproofing
- Vinyl flooring
- Ceiling acoustic treatments
- Gypsum board and joint compound
- Thermal insulation - piping and HVAC
- Textured paints
- Roofing and siding
- Sealants
Asbestos Materials Control Options

- **Manage-in-place** for the life of the building
  - Repair, encapsulate, enclose
  - Operations and Maintenance Programs
  - Notifications to building occupants
  - Training Custodial and Maintenance Workers
  - Monitoring Conditions
  - Emergency Response Plans
  - Documentation

- **Abatement** – remove and dispose, encapsulate, enclose

- **Removal and disposal** is the only long term final solution to eliminating potential exposure to asbestos

- Selected option normally based on the condition of material and likelihood of disturbance by users or maintenance workers
Asbestos Abatement

- Abatement Contractors with specialized training and licensing required to perform abatement operations.
- Establishment of isolation barriers, negative pressure enclosures, air filtration
- Removal and disposal, meticulous cleaning, final clearance testing
- Most common to have a third party monitoring and testing firm to obtain air and bulk sampling to document completed abatement operations
Lead-Containing Materials

- A heavy metal that may be hazardous to health if breathed or swallowed, lead can bio-accumulate in fish and wildlife.

- Almost any painted item could have lead-containing paint prior to 1960

- Primary ingestion risk to children in buildings constructed prior to 1960

- Encapsulate to contain, remove by stripping paint from item, or removing item with paint

- Identify to contractors - OSHA work protection and EPA waste disposal
Polychlorinated Biphenyl (PCB)

- A group of toxic, persistent chemicals used in electrical transformers and capacitors for insulating purposes, and in gas pipeline systems as lubricant.

- The sale and new use of these chemicals, also known as PCBs, were banned by law in 1979.

- Low risk to occupants, moderate risk to maintenance workers

- Manage in-place, monitor conditions, remove and dispose, replace with alternative
Mercury

- A naturally occurring element found in air, water, and soil. Exists in several forms: elemental or metallic mercury, inorganic mercury compounds, and organic mercury compounds.

- Thermometers, manometers, barometers, gauges, valves, switches, batteries, and high-intensity discharge (HID) lamps.

- Low risk of exposure to occupants, moderate risk to maintenance workers.

- Maintain in-place, remove/dispose, replacement with alternative.
Urea - Formaldehyde

- Formaldehyde is a chemical widely used to manufacture building materials and numerous household products.
  - add permanent-press to clothing and draperies
  - as a component of glues and adhesives
  - layered/laminated wood board products
  - preservative in some paints and coating products
  - spray foam insulation
  - furniture

- Moderate risk from exposure to emitted gases, usually dissipating with time after construction

- Adequate ventilation, alternate material replacements
Volatile Organic Compounds (VOCs)

- Organic chemical compounds used in the manufacture of construction products that emit gases in liquid and solid state
- Wide variety used in paint, glue, mastic, roofing, sealants.
- Mfg moving to produce low VOC products
- LEED credits for low VOC materials
- Adequate ventilation, VOC’s dissipate with time, alternate material replacements
Ethylene Glycol

- Ethylene glycol has many uses, including as antifreeze in cooling and heating systems, in hydraulic brake fluids, and as a solvent

- Contained in building cooling and heating piping systems and equipment

- Low risk of exposure to occupants and maintenance workers

- Maintain systems to avoid leaks, appropriate capture and recycle/disposal
Chlorofluorocarbon (CFC) refrigerants were synthesized in 1928, used widely during early air conditioning equipment, aerosols >> no longer used

- Contained in air conditioning and refrigeration piping systems and equipment >> homes, commercial, autos

- Low risk of exposure to occupants and maintenance workers.

- Concern of escape to environment, ozone depleting

- Maintain systems to avoid leaks, appropriate capture and recycle/disposal
Radon Gas

- Colorless, odorless, naturally occurring, radioactive, inert, gaseous element formed by radioactive decay of radium (Ra) atoms
- Geology dependent - seeps into lower areas of buildings
- Moderate risk to exposure in radon areas without controls
- Adequate seals/barriers at foundation walls and floors below grade, ventilation systems
Fungal and Bacteria Growth in Buildings

- Natural fungal growth (mold), many spices, airborne spores **common in outdoor air**
- Active growth sites release **airborne spores**, can cause respiratory irritations, headaches
- Mold growth requires a food source (cellulosic), moisture, and ideal temp conditions
- Mold in buildings is completely avoidable with good design, construction and maintenance, **inside<outside**
- Increased importance on identification, remediation and avoidance of mold growth in buildings through 2000’s. Some states have rules/regulations controlling related activities.
- Legionnaires' disease may also be called "legionellosis" a term for any disease caused by *Legionella* bacteria. Water within cooling towers is an ideal environment for Legionella heat-loving bacteria to grow.
What to Do With HazMat in Buildings

- Inventory materials of concern prior to disturbance
  - Surveys, research, MSDS, and materials testing
  - Evaluate material conditions
  - Identify potential for disturbance
  - Select options to manage, abate, remove
  - Notifications to occupants and workers
  - Document actions – cradle to grave

- Follow established **federal and state** regulations – evaluations, management, abatement, removal and disposal

- Involve appropriately trained/qualified professionals and contractors

- Diligent review of all materials incorporated into building >>> many adequate alternatives
STUMP THE CHUMP!!!