Understanding Health Risks

Technical Assistance for Brownfields Program
EPA Region 1

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Welcome & Introduction
► Sara Wakai, PhD, Assistant Professor
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Acknowledgement - Technical Assistance of Brownfields Program
► Marisa Chrysochoou, PhD, Professor and Department Head
  - Civil and Environmental Engineering, UConn
  - Program Director UConn Technical Assistance for Brownfields Program (TAB), Region 1 (New England States)

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  - Civil and Environmental Engineering, UConn
  - Program Manager UConn Technical Assistance for Brownfields Program (TAB), Region 1 (New England States)
Presentation Objectives

• Health risks commonly associated with brownfield sites
• Common brownfield contaminants
• Routes of exposure and ways to avoid exposure
Estimating Health Risk

*Risk = Toxicity x Exposure*

Toxicity

- The potential of a substance to cause damage to living things.
Exposure

https://synergist.aiha.org/202105-sharks-and-swimmers

Environmental Exposure Pathways

https://synergist.aiha.org/202105-sharks-and-swimmers
Individual Exposure Pathways

1. Breathing
2. Eating or drinking
3. Direct contact with the skin

https://www.epa.gov/brownfields/understanding-brownfields

Factors that may influence exposure

- Distance from source
- Wind / Weather
- Length of Time
Risks may be greater for some people

Type of Exposure

The time duration and amount (dose) of exposure to a contaminant or toxic substance determines the imminent danger to life and health

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short time period</td>
<td>Long time period</td>
</tr>
<tr>
<td>Short-term health effects</td>
<td>Long-term health effects</td>
</tr>
</tbody>
</table>

Dose Response Assessment Tables | US EPA 2021
What is a Contaminant?

A contaminant may be a biological, chemical, physical or radiological substance that becomes harmful for humans or living organisms when introduced to air, water, soil or food.

www.safeopedia.com

Environmental Contaminants Often Found at Brownfield Sites

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Substance Type</th>
<th>Examples of Past Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lead (Pb)</td>
<td>Metals</td>
<td>Mining, fuel, paint, inks, piping, batteries, ammunition</td>
</tr>
<tr>
<td>2. Petroleum</td>
<td>Oil, hydrocarbon compounds</td>
<td>Drill and refining, fuel, chemical and plastic production</td>
</tr>
<tr>
<td>3. Asbestos</td>
<td>Fiber in rock</td>
<td>Mining and processing, piping, insulation, fire proofing, brakes</td>
</tr>
<tr>
<td>4. Polycyclic aromatic hydrocarbons (PAHs)</td>
<td>Hydrocarbon compounds, combustion byproduct</td>
<td>Coal tar, creosote, soot, fire, industry/ manufacturing byproduct</td>
</tr>
<tr>
<td>5. Other metals</td>
<td>Metals</td>
<td>Metal fabrication, plating, mining, industry/ manufacturing</td>
</tr>
<tr>
<td>6. Volatile organic compounds (VOCs)</td>
<td>Mannmade chemicals</td>
<td>Industry and commercial product solvents, degreasers, paint strippers, dry cleaning</td>
</tr>
<tr>
<td>7. Polychlorinated Biphenyls (PCBs)</td>
<td>Mannmade chemicals</td>
<td>Heat and electrical transfer fluids, lubricants, paint and caulk, manufacturing, power plant</td>
</tr>
<tr>
<td>8. Arsenic (As)</td>
<td>Metals</td>
<td>Pesticides, agriculture, manufacturing, wood preservative</td>
</tr>
</tbody>
</table>
### Environmental Contaminants Often Found at Brownfield Sites

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Potential Health Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lead (Pb)</td>
<td>Damage to brain, nerves, organs, and bone cancer</td>
</tr>
<tr>
<td>2 Petroleum</td>
<td>Headache, nervous system, immune, liver, kidney, and respiratory damage, cancer</td>
</tr>
<tr>
<td>3 Asbestos</td>
<td>Lung scarring, mesothelioma and lung cancer</td>
</tr>
<tr>
<td>4 Polycyclic aromatic hydrocarbons (PAHs)</td>
<td>Liver disorders; cancer</td>
</tr>
<tr>
<td>5 Other metals</td>
<td>Immune, cardiovascular, developmental, gastrointestinal, neurological, reproductive,</td>
</tr>
<tr>
<td></td>
<td>respiratory and kidney damage; cancer</td>
</tr>
<tr>
<td>6 Volatile organic compounds (VOCs)</td>
<td>Eye irritation, nausea, liver, kidney and nervous system damage, birth defects; cancer</td>
</tr>
<tr>
<td>7 Polychlorinated Biphenyls (PCBs)</td>
<td>Disruption or damage to the immune, hormone and neurological system, liver and skin disease</td>
</tr>
<tr>
<td>8 Arsenic (As)</td>
<td>Nausea, vomiting and stomach pain, blood disorders, nerve damage, skin disease, lung</td>
</tr>
<tr>
<td></td>
<td>and skin cancer</td>
</tr>
</tbody>
</table>

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**Lead**

[Prevent Childhood Lead Poisoning](https://www.cdc.gov/nceh/lead/docs/how-to-prevent-lead-poisoning-in-children-h.pdf)
Lead

Minimize Exposures:

• Maintain painted surfaces to prevent paint deterioration.
• Clean around painted areas where friction can generate dust, such as doors, windows, and drawers.
• Wipe these areas with wet paper towels to remove paint chips or dust.
• Clean debris out of outlet screens or faucet aerators on a regular basis.
• Wash children’s hands, bottles, pacifiers and toys often.
• Wipe and remove shoes before entering a home.
• Wash hands often.
• Eat well-balanced meals. Children with healthy diets absorb less lead. See Lead and a Healthy Diet, What You Can Do to Protect Your Child (PDF) | en español (PDF).
• If you are having home renovation, repairs, or painting done, make sure your contractor is Lead-Safe Certified, and make sure they follow lead-safe work practices (PDF).

Source: Learn about Lead | US EPA
**Petroleum**

**Minimize Exposures:**

- Keep windows and door closed on windy days and when there is construction nearby
- Prevent contaminated dirt and dust from entering your home
- Identify possible sources and try to eliminate them
- Underground fuel storage tanks are the most common petroleum contamination source
- If you suspect your water is contaminated, get it tested and use bottled water or some other safe supply of water. Boiling or disinfecting water contaminated with toxic chemicals or fuels will not make it safe.

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**Asbestos**

**Sources:**

- Occurs in Rock Formations
- May be in building materials
- May be in the soil
- May be in atmospheric dust

**Health:** Asbestos may cause damage to lung tissue

Some non-cancer diseases are related to asbestos exposure:

- Asbestosis
- Pleural disease

Some cancers are related to asbestos:

- Lung cancer
- Mesothelioma is a rare cancer almost always caused by asbestos exposure
- Other cancers: Asbestos exposure can cause cancer of the larynx and ovary, and may possibly cause cancer of the pharynx, stomach, and colorectum.

Source: [https://www.atsdr.cdc.gov/asbestos/docs/limitingenvironmentalexposures_factsheet-508.pdf](https://www.atsdr.cdc.gov/asbestos/docs/limitingenvironmentalexposures_factsheet-508.pdf)
Asbestos

Sources:
- Occurs naturally in Rocks
- Building materials
- In the soil
- Atmospheric dust

Minimize Exposures:
- Identify possible sources and eliminate them
- Clean with a wet rag instead of a dry duster
- Prevent dirt and dust from entering your home
- Keep windows and door closed on windy days and if there is construction nearby

Minimize Exposures:
- Wipe down surfaces regularly to reduce dust exposure
- Remove footwear to reduce soil in living areas
- Keep windows & doors closed on windy days
- Evaluation and removal by professional services may be needed

Finding Exposure Information

Source: https://www.atdr.cdc.gov/asbestos/docs/limitingenvironmentalexposures_factsheet-508.pdf


Integrated Risk Information System

- EPA's Integrated Risk Information System (IRIS) is a human health assessment program that evaluates information on health effects that may result from exposure to environmental contaminants.

https://www.epa.gov/iris

Human health risk information on hundreds of chemical commonly found in the environment

Tetraethyl lead
CASRN 78-00-2 | DTXSID7023801

- IRIS Summary (PDF) (61 pp, 85 K)

Key IRIS Values | Other EPA Information

Noncancer Assessment

Reference Dose for Oral Exposure (RfD) (PDF) (61 pp, 85 K) Last Updated: 01/31/1987

Related Links
- EPA Chemicals Dashboard
- Tetraethyl lead
- ChemPortal
Finding Exposure Information

IRRIS PDF Summary document with detailed information

Tetraethyl lead; CASRN 78-00-2

Human health assessment information on a chemical substance is included in the IRIS database only after a comprehensive review of toxicity data, as outlined in the IRIS assessment development process. Sections I (Health Hazard Assessments for Noncancerogenic Effects) and II (Carcinogenicity Assessment for Lifetime Exposure) present the conclusions that were reached during the assessment development process. Supporting information and explanations of the methods used to derive the values given in IRIS are provided in the guidance documents located on the IRIS website.

STATUS OF DATA FOR Tetraethyl lead

File First On-Line 01/31/1987

<table>
<thead>
<tr>
<th>Category (section)</th>
<th>Assessment Available?</th>
<th>Last Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral RfD (L.A.)</td>
<td>yes</td>
<td>01/31/1987</td>
</tr>
<tr>
<td>Inhalation RfC (L.B.)</td>
<td>not evaluated</td>
<td></td>
</tr>
<tr>
<td>Carcinogenicity Assessment (IL)</td>
<td>not evaluated</td>
<td></td>
</tr>
</tbody>
</table>

1. Chronic Health Hazard Assessments for Noncancerogenic Effects

Ways to Test for Contaminants

- Ambient concentrations
  - Measures amount of contaminant in the environment
- Exposure modeling
  - Estimates exposure by combining environmental contaminant concentrations and individual’s activities and locations
- Personal monitoring
  - Measures exposure using a device
- Biomonitoring
  - Measures contaminants in the body

Exposure to Environmental Contaminants | US EPA
Personal Protective Equipment (PPE)

PPE equipment may include:

- Gloves
- Safety glasses and/or goggles
- Hard hat or helmet
- Earplugs or earmuffs
- Mask or respirator
- Coveralls, vest, and full body suits
- Shoe covers
- Close-toed shoes

Are you planning to visit a Brownfield Site?

- Avoid direct contact with any potential contaminants.
- Remove shoes before going inside your home or office to minimize “tracked-in” residue on floors.
- Avoid bringing personal items such as handbags and backpacks to the brownfield which may be exposed to potential contaminants.
- Avoid visiting a brownfield site on a windy day to reduce airborne dust exposure or wear a mask.
- Find out if PPE will be provided at the site and where you should dispose of it.
More resources about environmental contaminants.

- Common Types of Brownfields and their Contaminants | US EPA
- factors_to_consider_march_2019.pdf (epa.gov)
- Envirofacts | US EPA
- EFH-COMPLETE.PDF
- Examining urban brownfields through the public health "macroscope". (nih.gov)
- Toxic Release Inventory (TRI), EnviroAtlas National Data Fact Sheet, May 2020 (epa.gov)
- Brownfields Public Health and Health Monitoring (July 2006) (epa.gov)