



Activity Overview

Participants rate several everyday activities that pose various levels of risk of exposure to contamination. They check their ratings against that of a public health professional.

When to Use It

When the community faces a toxic threat and the group needs more familiarity with the contaminants of concern and the concept of risk stemming from exposure, and/or when reviewing or preparing input on a risk assessment.

Suggested companion activities

- Precede with Pieces of the Risk Puzzle
- Use with Exposed!, As Toxic As ... ?, and *The Change Agent: Staying Safe in a Toxic World* pp. 22-23 (for benzo[a]pyrene)

Steps

1. **Launch the activity:** Contaminants only pose a risk when people are exposed—when there's a point of contact between a person and the contaminant. For example, cigarettes cause cancer when people smoke them, but not when they are sitting on a shelf.
2. **In small groups:** Depending on the contaminant, the exposure pathway makes a big difference. Look at the different activities and put them in order from highest to lowest risk. Next, read the fact sheet for [contaminant]. Do you want to change your answers? Finally, read *Check Your Answers* for the contaminant to compare with a professional's opinion.
3. **Debrief:**
 - What exposure pathways were new to you? What surprised you?
 - How does this relate to your own situation?

Worth Noting

Eating or drinking contaminated food or water is often (but not always) high-risk. Risks for breathing, showering, or skin contact vary. For example, lead does not evaporate as easily as VOCs. So, if the soil beneath a home is contaminated with lead, breathing the air in that home may pose little risk. Remember that exposure is just one factor in calculating risk. See Pieces of the Risk Puzzle for the bigger picture.

Smart Moves

- Seek verification
- Talk it out

Skill: Explain how an environmental contaminant might harm you through different daily activities.

Time: 15 minutes

Preparation

Choose the contaminant you will use:

- Volatile Organic Compounds (VOCs)
- Polychlorinated Biphenyls (PCBs)
- Arsenic
- Benzo[a]pyrene, a Polycyclic Aromatic Hydrocarbon (PAH)

If none fit your situation, or for Spanish versions, use an ATSDR ToxFAQ for relevant contaminants: <http://www.atsdr.cdc.gov/toxfaqs/index.asp>

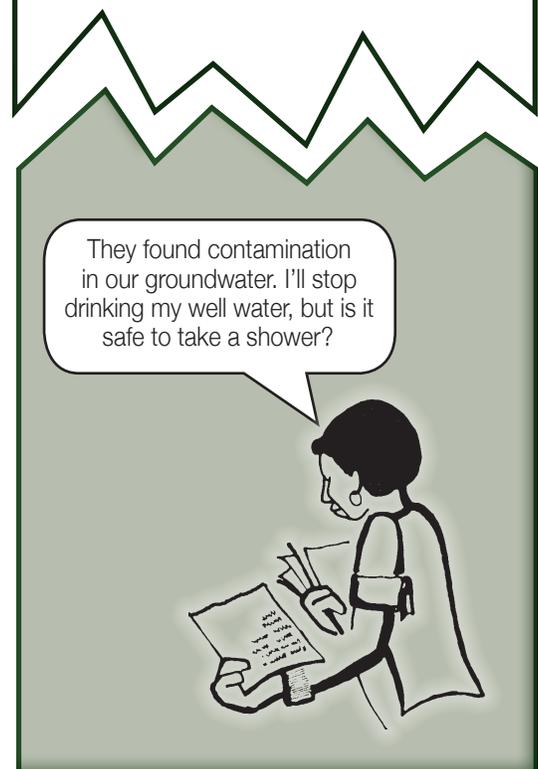
Cut out points of contact strips along dashed lines.

Materials

Points of contact strips, (one set per small group)

Fact Sheet for the contaminant, backed with *Check your Answers: [Contaminant]* (1 per participant).

Optional: ToxFAQ for these or local contaminants (1 per participant)



**Ingesting (drinking or cooking with)
contaminated water**



Showering in contaminated water



Swimming or wading in contaminated water



Working or playing in contaminated dirt



Using contaminated water for cleaning or laundry



**Eating food grown in contaminated soil
or watered with contaminated water**



**Living or working in a building where
contaminants are present in the air**



**Living or working in a building where
the soil beneath the building is contaminated**





Fact Sheet: Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) are a category of chemicals including benzene, trichloroethylene (TCE), tetrachloroethylene (PERC), vinyl chloride, and styrene.

Sources: Paints, solvents, wood preservatives, aerosol sprays, cleansers and disinfectants, air fresheners, stored fuels and automotive products, glues, dry-cleaned clothing.

Physical Properties: VOCs volatilize (evaporate and go into the air) very easily. Some can dissolve in water.

Exposures: Mostly from breathing in VOC vapors in enclosed spaces. Vapors may come directly from stored VOCs, or from contaminated water or soil. You can also be exposed by touching or ingesting contaminated water or soil.

Health Effects: Eye, nose, and throat irritation; headaches, dizziness, nausea; damage to liver, kidney, and central nervous system. Some VOCs cause cancer in animals; some may cause cancer in humans.



Check Your Answers: Volatile Organic Compounds (VOCs)

Compare your ratings to those of Andrew Friedmann. He audits the handling of hazardous waste sites for the Massachusetts Department of Environmental Protection. (On a scale of 1 to 10, the least risky exposure is a 1, and the most risky is a 10.)

Type of Exposure	Risk	A risk assessment professional speaks:
Living or working in a building where contaminants are present in the air	10	Breathing in VOCs in air can result in high exposures. Fumes are easily absorbed by the lungs. Tip: Remove VOC sources or seal them carefully. Keep air clean with fresh air from outside.
Living or working where the soil beneath the building is contaminated	8-10	VOCs can evaporate and come up from the basement or outside. Tip: Test indoor air for contamination. Use a fan to vent basement air directly to the outside.
Ingesting (drinking or cooking with) contaminated water	9	Some VOCs dissolve in water. Tip: If tap water is contaminated, drink & cook with bottled water. If you can't, filter the water. If you can't filter it, heat it and let it sit in a ventilated place before drinking, so VOCs can evaporate.
Showering in contaminated water	5-6	VOCs can enter the body through breathing, through drinking, and, to a limited extent, through the skin. Tip: Take shorter showers, ventilate your bathroom well, don't drink from the shower head.
Working or playing in contaminated dirt	5	VOCs can enter your body if you accidentally get soil in your mouth or touch the soil with bare skin. Tip: Don't let small children play in contaminated soil. Adults should wear gloves and shoes.
Swimming or wading in contaminated water	4	Same exposures as showering, but outdoor air is better ventilated. Tip: Don't swallow any water. Risk from skin exposure is lower.
Using contaminated water for cleaning or laundry	1-2	Could release vapors, but the activity is short. Tip: Ventilation in the laundry room will help reduce any exposure.
Eating food grown in contaminated soil or with contaminated water	1	VOCs are not thought to accumulate much inside plants. You are more at risk from contamination on the surface of the plant. Tip: Peel food or wash it well.



Fact Sheet: Polychlorinated Biphenyls (PCBs)

Examples: PCB is a category including 209 different chemicals with similar properties, but it's rare to talk about an individual PCB. PCBs are all generally regulated the same way.

Sources: PCBs were used for most of the 20th century to cool and stabilize large electrical power equipment, like the industrial transformers at power stations or on utility poles. PCBs are sometimes known by trade names like Aroclor (Monsanto) and Pyrenol (General Electric). Many factories that put PCBs in electrical equipment are now very contaminated. PCBs were *not* usually used in household electronics like radios and TVs. PCBs were banned by the U.S. Congress in 1979, but they are still present in old power equipment. They might be found in rivers or ponds near contaminated sites, but they are rarely found in tap water or well water.

Physical Properties: PCBs don't break down easily, and stay in the environment for a long time. Like oil, PCBs do not mix easily with water, but unlike oil, they sink in water. Small amounts can stay in water, especially moving water like a river. They can also build up in animals like fish that swim in PCB-contaminated water. PCBs are semi-volatile, meaning, they can go into the air if it is hot or windy.

Exposures: You can be exposed to PCBs by breathing in contaminated air, eating contaminated food or water, or from touching contaminated soil or old electrical equipment containing PCBs. PCBs are stored in the fat in your body. PCBs can go from mother to child while breastfeeding.

Health Effects: Some PCBs are much more toxic than other PCBs. Some are very similar to dioxin (one of the most toxic chemicals of all) and can give you cancer. PCBs can also affect your immune and reproductive systems. Studies have shown that babies exposed to PCBs in utero had a lower birth weight, and had mental and physical development problems.



Check Your Answers: Polychlorinated Biphenyls (PCBs)

Compare your ratings to those done by Wendy J. Heiger-Bernays. She's an Associate Professor of Environmental Health at the Boston University School of Public Health. (On a scale of 1 to 10, the least risky exposure is a 1, and the most risky is a 10.)

Type of Exposure	Risk	A public health professional speaks:
Eating food grown in contaminated soil or with contaminated water (meat only)	8	Eating animal meat, including fish, is the big source of exposure for most people. PCBs build up in animal fat. Animals higher on the food chain will have more PCBs. Tip: Avoid eating meat from any contaminated area.
Swimming or wading in contaminated water	4-6	PCBs are found on the bottom of rivers and ponds. If you stir up the bottom, PCBs can be absorbed through the skin. Tip: Avoid swimming or wading in contaminated areas.
Working or playing in contaminated dirt	6	PCBs can be absorbed through the skin. Tip: Wear gloves, and wash hands well before eating. Keep children away from contaminated soil.
Living or working in a building where contaminants are present in the air	6	PCBs might go into the air in a contaminated building, or if old electronics containing PCBs get broken open. They might also be present in old building materials. Tip: If you know there are PCB sources nearby, have your building air tested. If PCBs are in the air, improve the ventilation.
Living or working where the soil beneath the building is contaminated.	5	If PCB levels are low, and you don't have direct contact with the soil, the risk is low. Dust from outside can come inside, though. Tip: If contamination is high, use air filters inside to take dust out of the air. If your work stirs up dust, wear a mask and gloves.
Eating food grown in contaminated soil or with contaminated water (vegetables only)	2 (plants)	Vegetables aren't known to soak up PCBs from the ground. However, contaminated soil can get on the food. Tip: Use raised beds or mulch in gardens. Wear gloves while gardening and keep the soil wet to reduce dust. Keep children away from contaminated soil. Wash food before eating.
Showering in contaminated water	2	PCBs are unlikely to be in tap or well water. It is only a concern if the water comes directly from a river or lake without treatment. Contamination is only very high in rare cases. In those cases, avoid all contact.
Using contaminated water for cleaning or laundry	2	
Ingesting (drinking or cooking with) contaminated water	1	



Fact Sheet: Arsenic

Sources: Occurs naturally in soil. Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, mainly on cotton fields and in orchards.

Physical Properties: Arsenic is a heavy metal. Many common arsenic compounds (called “arsenates”) can dissolve in water. Most of the arsenic in water end up in soil or sediment. Arsenic does not easily volatilize (evaporate and go into the air) but arsenic dust can be blown into the air by wind, construction, or industrial processes.

Exposures: Arsenic may enter the air, water, and land from wind-blown dust and get into water from runoff and leaching. Rain and snow remove arsenic dust particles from the air.

Health Effects: Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs, and may eventually cause lung cancer. Ingesting (eating or drinking) very high levels of arsenic can be deadly. Exposure to lower levels can make you sick and vomit. Inorganic arsenic can give you cancer of the skin, liver, bladder, and lungs. It can damage your blood cells, which hurts your immune system. Damaged blood cells also make it harder to get oxygen to all parts of your body, hurting your heart and blood vessels, and causing tingling in your hands and feet. Ingesting or breathing low levels of inorganic arsenic for a long time can darken your skin and cause small “corns” or “warts” on your hands, feet, and body. Touching inorganic arsenic may cause redness and swelling.



Check Your Answers: Arsenic

Compare your ratings to these ones by Jim Luker, an Environmental Professional. (On a scale of 1 to 10, the least risky exposure is a 1, and the most risky is a 10.)

Type of Exposure	Risk	An environmental professional speaks:
Ingesting (drinking or cooking with) contaminated water	9	Food and water are major sources of exposure. Ingesting high levels can result in death. Consuming arsenic for a long time can cause digestive problems, anemia, skin discoloring, and nerve and organ damage. Tip: If you suspect contaminated food or water, avoid eating or drinking it and have it tested immediately.
Living or working in a building where indoor air is contaminated	8	This is rare, because an industrial process or continuous wind is needed to keep arsenic in the air. But if it does happen, breathing arsenic dust (including fine sawdust) can cause lung irritation or lung cancer. Tip: Wear a facemask if working around arsenic dust.
Working or playing in contaminated dirt	8	You can be exposed by accidentally eating soil or touching it with bare skin. High levels can cause illness, cancer, or death. Lower levels irritate skin. Tip: If the contamination is only moderate, adults working with the soil can wear gloves and facemasks and avoid dusty conditions to reduce exposure. Children should never play in soil with arsenic contamination.
Showering in contaminated water	6	Breathing arsenic in the shower is unlikely. High levels of arsenic may irritate or damage your skin, or you could accidentally swallow some. Tip: Avoid showering in highly contaminated water. Consider filtering less-contaminated water.
Swimming or wading in contaminated lake or pond	6	Same exposures as with showering. Swimming is riskier than wading because there is more contact. Swimmers swallow a little water, too. Tip: If you regularly swim or wade in a lake, have the water tested.
Eating food grown in contaminated soil or with contaminated water	6	Plants can pick up arsenic from the soil. Vegetables grown in the ground (carrots, potatoes) absorb more arsenic than on-the-vine vegetables (tomatoes, beans). Plants high in iron (spinach) absorb the most arsenic. You can also be exposed by touching or breathing in contaminated dirt while gardening. Tip: If soil is contaminated, grow lower-risk plants. Use raised-bed gardens with clean soil. Wear gloves and facemask while gardening. Keep the soil wet to reduce dust. Wash vegetable thoroughly before eating.
Using contaminated water for or laundry	1	Arsenic does not volatilize. If levels are very high, your skin might be harmed. Tip: Avoid drinking shower water. Take short showers in contaminated water.
Living or working where the soil beneath the building is contaminated.	1	Arsenic does not volatilize. Risk is small unless there is arsenic dust in the air. Tip: Avoid direct contact with contaminated soil and dust.



Fact Sheet: Benzo[a]pyrene, a PAH (Polycyclic/Polynuclear Aromatic Hydrocarbon)

Benzo[a]pyrene is one of many Polynuclear Aromatic Hydrocarbon (PAHs). Some of this information is about benzo[a]pyrene specifically, and some is generally true about PAHs.

Sources: PAHs come from burning something. They are found in smoke (including cigarette smoke), as well as ash, tar, asphalt, creosote, and waste from any industrial process that involves fire or burning. Grilling meat and vegetables also creates PAHs. PAHs enter the air mostly as releases from forest fires, burning coal, automobile exhaust, and volcanoes.

Physical Properties: PAHs go into the air when they are created, then they settle into soil and water. Some PAHs can volatilize easily (evaporate and go into the air) even after they have settled, but benzo[a]pyrene does *not* volatilize easily. It tends to stick to soil.

Exposures: Mostly from breathing in smoke, fumes, and car exhaust. Some exposure from ingesting (eating or drinking) contaminated soil or water. PAH levels are generally higher in cities than in rural areas. People who work around sources of PAHs have higher exposure. Contaminated soil can also blow in the wind, and be carried from place to place on people's shoes and clothes. PAHs can accumulate in fish and shellfish in a way that concentrates the PAHs.

Health Effects: Exposure to benzo[a]pyrene can cause cancer, as well as reproductive and developmental difficulties.



Check Your Answers: Benzo[a]pyrene

Compare your ratings to these ones by Jim Luker, an Environmental Professional. (On a scale of 1 to 10, the least risky exposure is a 1, and the most risky is a 10.)

Type of Exposure	Risk	An environmental professional speaks:
Living or working in a building where contaminants are present in the air	9	Exposure is very high if you breathe PAHs close to their source. Tip: If you smell smoke or something burning, that may mean PAHs. Identify the source. If PAHs are coming from outside, close windows that face the source. If an old furnace is the cause, replace it. Use home air filters, especially in bedrooms. If exposed at work, ask your employer about testing the air.
Working in or playing in contaminated dirt	8	Benzo[a]pyrene sticks to soil. You can be exposed by touching soil, or eating with dirty hands. Small children are most vulnerable. Tip: Wear gloves if working in contaminated soil. Wash hands well before eating. Keep children away from contaminated soil.
Ingesting (drinking or cooking with) contaminated water	7-8	Ingesting PAHs can cause cancer and reproductive problems. Tip: Avoid drinking water with PAHs. When you grill food over flame, don't char or blacken the food. Avoid fish and seafood from contaminated waters.
Showering in contaminated water	7	Benzo[a]pyrene does not volatilize, so you probably won't breathe it while showering unless contamination is high. But skin contact may lead to rashes and possible skin tumors. Tip: Have your water tested if you suspect it may be impacted.
Swimming or wading in contaminated water	7	This leads to similar types of exposure as showering. Tip: Avoid touching water that has high levels of PAHs.
Using contaminated water for cleaning or laundry	3	Benzo[a]pyrene does not easily volatilize. It might release vapors into the building if concentrations are very high. Tip: Make sure your laundry room is well-ventilated.
Living or working in a building where the soil beneath the building is contaminated	3	Benzo[a]pyrene does not easily volatilize. Unless contaminated soil itself is blown into the air as dust, you probably won't inhale it. Tip: Avoid directly breathing or touching contaminated dust or soil.
Eating food grown in contaminated soil or with contaminated water	3	PAHs don't accumulate much inside plants unless levels are very high in the soil or water. You are more at risk from contaminated soil on the surface of the plant or fruit. Tip: Wash your food and hands well with soap and water.