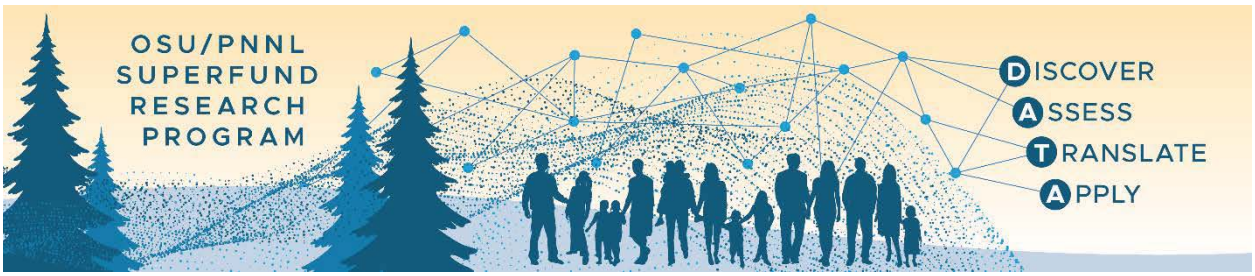
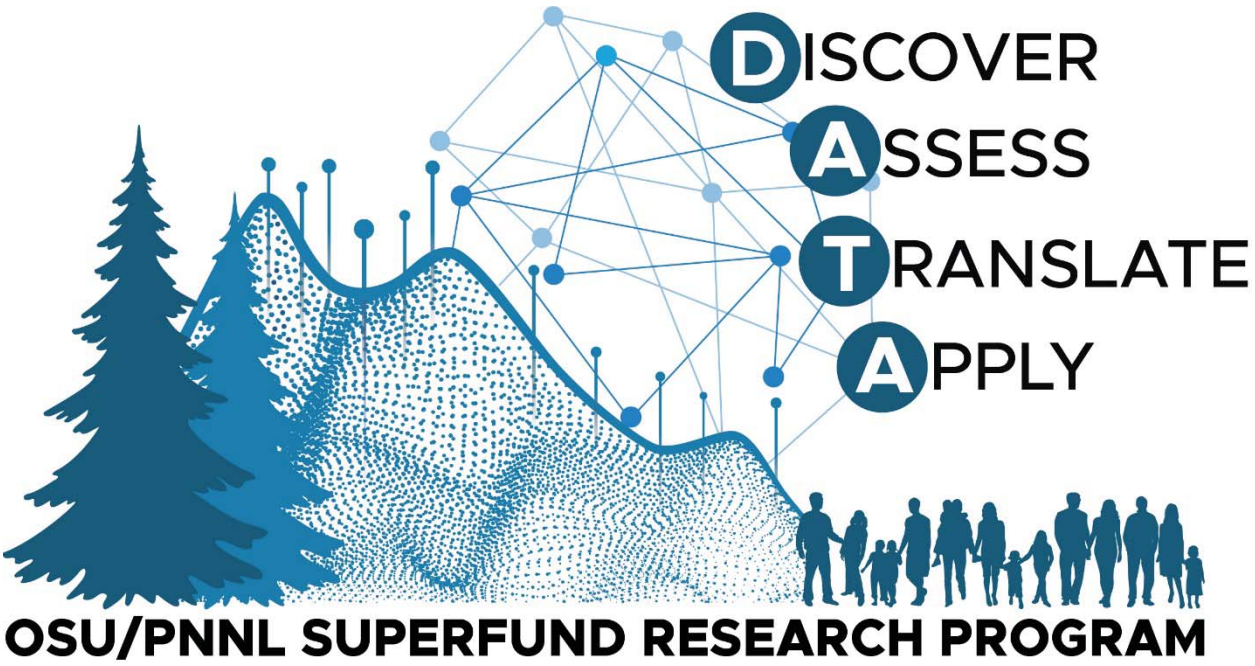


The Research Translation team of the Oregon State University Superfund Research Center has developed the following infographics and fact sheets with collaborators and community partners. These infographics are designed to be used in presentations, or to accompany the return of results to study participants and communities.

Each infographic is developed by a content expert, and reviewed by members of the Center, along with members of the target audience.

These infographics are available for use; the OSU Center asks that attribution be included when using.



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Polycyclic Aromatic Hydrocarbons

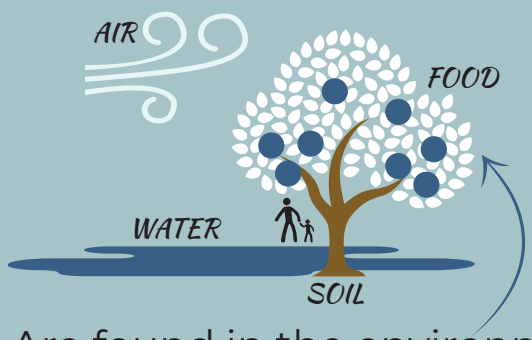
Common environmental pollutants

PAHs....

Are a class of over 1000 chemicals

Have few regulations for outdoor air

Are contributors to pollution



Are found in the environment

Do PAHs affect Human Health?

PAHs are a human health concern, although much is still unknown. The level of concern depends on several factors:

1. **Exposure** *skin, breathing, eating, drinking*
2. **Amount of PAHs**
3. **PAH Types**
4. **Length of Exposure**
5. **Susceptibility** *genetics, age, pregnancy*

In occupational settings, studies have linked exposure to PAHs to certain cancers (lung, skin).

Some PAHs may be related to asthma and chronic obstructive pulmonary disease (COPD)

Sources of PAHs

Oil Spills

Smoke

Exhaust

Food

Environmental Exposures

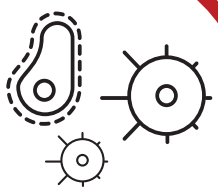
Exposure Biology is challenged with detecting and measuring combined environmental exposures and figuring out the potential human health effects. Each person experiences these exposures every day.

Metals

As
Arsenic

Exhaust

Bacteria & Viruses



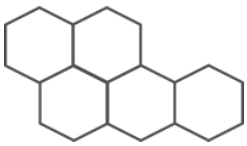
Smoke

Tobacco

Flame Retardants

Pesticides

PAHs



This infographic is adapted from the Exposure Biology Infographic produced by the National Institutes of Environmental Health Sciences. http://www.niehs.nih.gov/research/supported/exposure/bio/

Reducing Exposure to PAHs

Polycyclic Aromatic Hydrocarbons are common environmental pollutants

How to reduce exposure

AVOID

Avoid e-cigarettes and cigarette/cigar smoke

VENTILATE

When cooking or using a wood-fired stove/fire, run fans or open windows. Grill or smoke outdoors.

ROTATE FOODS

Rotate smoked, grilled and charboiled foods with baked, steamed and canned foods.

LIMIT

When possible, limit exposure to gasoline and diesel fumes (vehicles, machinery)

MAINTAIN

If you use a wood stove, make sure the openings and chimney do not leak smoke indoors.

REPLACE

For pest control, consider cedar shavings or blocks instead of naphthalene mothballs.

PROTECT

Wear gloves to avoid skin contact with soot or creosote-treated lumber. Wear a mask if cutting treated lumber.

SUPERFUND RESEARCH PROGRAM http://superfund.oregonstate.edu/all-about-pahs

Oregon State University OSU

Reducir las exposiciones a los HAPs

Los Hidrocarburos Aromáticos Policíclicos son contaminantes ambientales comunes en el ambiente

Formas de reducir la exposición a los HAPs

EVITE

Evite los cigarrillos, cigarrillo electrónicos, o el humo de cigarro.

VENTILE

Cuando cocine o cuando use una estufa de leña/con fuego, prenda ventiladores o abra las ventanas. Use las parrilla o ahúme al aire libre.

ALTERNE

Alternar el consumo de alimentos ahumados, a la plancha o cocidos, por alimentos horneados, al vapor y enlatados.

LIMITE

Cuando sea posible, limite la exposición a los gases de la gasolina y del diesel (vehículos, maquinaria).

MANTENIMIENTO

Si usa una estufa de leña, asegúrese de que las aberturas y la chimenea no tengan fugas de humo.

REEMPLAZE

Para el control de plagas, considere usar madera triturada o bloques de cedro antipolilla en lugar de bolas de naftalina.

PROTÉJASE

Use guantes para evitar el contacto de la madera tratada con su piel. Use también una máscara si corta madera tratada.

SUPERFUND RESEARCH PROGRAM http://superfund.oregonstate.edu/all-about-pahs

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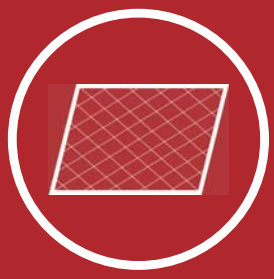
Reducing Exposure to Air Pollution

Indoor Tips



FILTER

Change the filters on your AC and furnace regularly.

MAINTAIN

If you use a wood stove, make sure the openings and chimney do not leak smoke indoors.

RUN AC

In the event of poor air quality days, consider closing windows and running AC.

VENTILATE

When cooking or using a gas or wood-fired stove, run fans or open windows. Grill or smoke outdoors.

Outdoor Tips

CONSULT

Use a weather app or go to AirNow.gov to find the current air quality.

AVOID

Avoid e-cigarettes and cigarette/cigar smoke.

LIMIT

Try to limit exposure to gasoline and diesel fumes (vehicles, machinery).

CALL

Follow burning regulations. Call **541-766-6971** to check current burn bans.

Tips to Avoid Wildfire Smoke

REDUCE

Avoid common activities that might contribute to poor air quality (grilling, burning candles, smoking).

PROTECT

Wear an approved mask to limit the amount of air pollution you inhale.

Appropriate Masks

N95, N100 or P100

Masks should fit well above the nose and beneath the mouth

Change the mask when it gets dirty on the inside, becomes damaged, or becomes difficult to breath through.

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Reducing Exposure to Common Pollutants

Protect

Wear appropriate clothing when working with pesticides and household products.

- Masks
- Gloves
- Boots
- Long-sleeved shirt & pants

Ventilate

When appropriate, open windows or run fans

Avoid or Limit

Cigarettes and e-cigarettes

Second-hand smoke and vehicle exhaust; do not idle vehicles

Store household products and pesticides away from children and pets

Do not reuse product containers

Reduce

Personal Care Product use

Use alcohol-based hand sanitizers (no triclosan)

Couch purchased before **2004**?

- Couch covers reduce exposure to flame retardants

Discard

Expired

- personal care products
- Paints, stains and dyes
- pesticides
- cleaning products

Follow appropriate guidelines with your waste manufacturer

Replace

Where possible, replace old products with less toxic options.

https://www.epa.gov/saferchoice

SAFER CHOICE
Meets U.S. EPA Safer Product Standards

Volatile Organic Compounds

Are pollutants found in the air, food, water and soil.

Are associated with cancer and respiratory effects among others.

Volatile Organic Compounds

VOCs

Are made commercially and occur naturally.

Are found in over 45% of Superfund Sites in the US.

Where are VOCs found?

Volatile Organic Compounds are primarily found in a number of different areas of the environment including, but not limited to:

Fuels & Exhaust

Cars expel the waste that comes from burning fuel.

Solvents & Paint Thinners

VOC's are a common ingredient in many painting products.

Industrial Environments

VOCs can be released from many industrial processes.

Insecticides and Repellants

Used to repel pests on food and in natural areas, many contain VOCs.

Do VOCs affect human health?

More research is needed to understand how VOCs impact human health. The following factors are important to consider.

EXPOSURE

VOCs can enter the body through our skin, the foods we eat, and when we breathe.

AMOUNT

How much a person is exposed to matters.

TIME

How long a person is exposed is important.

SUSCEPTIBILITY

Where you work, your age, and medical conditions may make you more susceptible.

REDUCE EXPOSURE TO VOCs

Increase ventilation when using products that emit VOCs

Use household products according to manufacturers directions

Don't store open containers of paint or household chemicals

For more information:

- **US Environmental Protection Agency |** https://www.epa.gov/indoor-air-quality-iaq/what-are-volatile-organic-compounds-vocs
- **American Lung Association |** https://www.lung.org/clean-air/at-home/indoor-air-pollutants/volatile-organic-compounds
- **LBNL Indoor Environment Group |** https://iaqscience.lbl.gov/voc-summary

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2020. Developed by the Oregon State University Superfund Research Program

Passive Wristband Sampler

Reusable

Multiple colors

Si

Made of silicone

No batteries

Wear continuously

No maintenance

Avoid lotions or perfumes

Sample air & water

What does it detect?

Cannot Detect

Detects

POLYCYCLIC AROMATIC HYDROCARBONS

FLAME RETARDANTS

PESTICIDES

PERSONAL CARE PRODUCTS

POLYCHLORINATED BIPHENYLS

Cannot detect

PARTICULATE MATTER

PHARMACEUTICALS, RECREATIONAL DRUGS

MOLD, BACTERIA, VIRUSES

As Pb Cd

METALS *Arsenic, Mercury, Lead*

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SUPERFUND RESEARCH PROGRAM https://youtu.be/Kmw7BCvcck8

The Zebrafish as a Research Tool

Zebrafish as a research model

- There are thousands of chemicals in our environment.
- We are always exposed to mixtures of chemicals.

- Humans and zebrafish share >70% similar genes.
- 84% of human disease genes are also in zebrafish.

- Humans and zebrafish have many of the same organs.
- Zebrafish develop very quickly – from a single cell to swimming fish in 5 days.

Zebrafish as a chemical screening tool

- Zebrafish are small and easy to use, allowing us to rapidly assess thousands of chemicals.
- Some chemicals can affect DNA and cell signaling to change the way animals develop.
- Changes in zebrafish development identifies chemicals that may be hazardous to humans. We measure dozens of effects in these chemical screens.

Can Evaluate

- Which chemicals may pose a higher risk than others to human health
- Effects of individual and real-world mixtures of chemicals.

Cannot Evaluate

- The actual effect of a chemical on the human body
- The precise amount of a chemical that may cause a harmful effect in humans

2020. Developed by the Oregon State University Superfund Research Program

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OSU/PNNL SRP

How can we predict Chemical Hazards?

The Oregon State University Superfund Research Program utilizes unique technologies to discover and assess chemical hazards in our environment to improve human health.

DISCOVER → **ASSESS** → **TRANSLATE** → **APPLY**

There are tens of thousands of chemicals in commerce.

We have safety information on **<1%** of them.

Our Center approaches this problem with a variety of tools.

Our tools move us away from animal testing and toward advanced, predictive toxicology.

We hope to identify toxic chemicals *before* people are exposed to them.

DISCOVERY TOOLS

We use samplers to detect over 1,530 chemicals in our environment.

Our zebrafish model helps us understand how some chemicals cause disease.

ASSESSMENT TOOLS

Using the zebrafish model, we can assess which chemicals pose a greater risk to human health.

Our human lung cell model can evaluate the toxicity of chemicals to human cells.

TRANSLATION TOOLS

Computer programs look at changes at the cellular level and predict what this will mean for human health and disease.

We use this information to predict toxicity in humans, so we can do less animal testing.

APPLICATION TOOLS

We apply all this information to help reduce exposures to harmful chemicals.

One way we do this is by finding new ways to remove these chemicals from our environment through remediation.

2020. Developed by the Oregon State University Superfund Research Program

Assessing Exposure, Evaluating Health

How do we know what we are exposed to, and if it might be harmful?

A public health assessment and a health study are two strategies that use different data to answer different questions.

Public Health Assessment

This tool identifies potential health risks from environmental exposures.

Health Study

This tool looks at current patterns of health and disease in a community.

Do chemicals in our environment have potential to harm us?

How much pollution is in our environment?

What health effects are being seen?

Can chemicals in the environment get into our bodies?

What are we being exposed to? (blood/urine sampling)

- Uses existing environmental data
- Helps prevent future harmful health effects (illness, etc.)
- Predicts community health risk
- Cannot link exposure directly to health effects
- Existing data may be limited

- Provides individual data
- For a population, links exposures to harmful health effects
- Identifies community risk for health concerns
- Requires waiting until people are sick
- Many people needed to identify increased disease rates

Summary

Public health assessments can predict risks to people's health. A health, or exposure, study can be done once people are already sick, with the same disease.

www.healthoregon.org/ehap

2020. Collaboratively developed by Oregon Health Authority and the Oregon State University Superfund Research Program.

Available Data to use for Public Health Assessments and Health studies

Regulatory agencies collect many types of data. This data can be used to assess what people might be exposed to, and if that could impact their health.

Environmental Data	Researchers and agencies often sample the soil, water and air around our communities.
Estimated Exposure Data	Using environmental data, researchers and agencies can estimate which chemicals, and how much, people might be exposed to.
Human Risk Data	If researchers know what people might be exposed to, they can estimate how that could impact their health.
Personal Sampling Data	Samples (blood, urine, wearable sampling devices) determine what people in the study are exposed to, in comparison to others.

	Public Health Assessment	Health Study
Environmental Data	✓	✓
Estimated Exposure Data	✓	✓
Human Risk Data	✓	
Personal Sampling Data		✓
Who does the assessments?	Agencies	Researchers

2020. Collaboratively developed by Oregon Health Authority and the Oregon State University Superfund Research Program.

Reduce exposure to Flame Retardants

Oregon State University

Not all flame retardants are harmful, but some are endocrine disruptors. These are chemicals that mimic normal hormones.

Vacuum frequently

Vacuuming can reduce the amount of flame retardants in your home.

Think about your furniture

Old couches (from 2004 or earlier) often contain flame retardants. Consider a couch cover.

Reduce use of air fresheners

Limiting or eliminating air fresheners in the home can reduce flame retardant exposure.

Sources of Flame Retardants

Developed by the Oregon State University Superfund Research Program

Proposed changes to Portland Harbor Superfund

Oregon State University

Background

The Oregon State University Superfund Research Program studies polycyclic aromatic hydrocarbons at Superfund sites. We prepared this fact sheet to clarify the proposed changes to Portland Harbor.

The United States Environmental Protection Agency (EPA) evaluates the toxicity of chemicals through a standard process. In January of 2017, based on current research, benzo[a]pyrene (BaP) was updated and is now considered to be 7 times less toxic for humans through ingestion and skin contact than previously thought. For Portland Harbor, the risk assessment considered risk for both adults and children. The new value is considered protective of human health.

What is Benzo[a]pyrene?

BaP is a polycyclic aromatic hydrocarbon (PAH). PAHs are pollutants found in the air, water, soil and food. The primary source of PAHs is from burning carbon-containing compounds, such as wood, petroleum and fuel. They are also found in gasoline and diesel exhaust, soot and cigar / cigarette smoke.

BaP is a carcinogen. This means that continued, high exposure increases cancer risk. The EPA update also includes a non-cancer risk factor.

What does this mean?

The change in benzo[a]pyrene toxicity may impact the planned clean-up of the Portland Harbor Superfund site. In addition to changing the toxicity of BaP, the change will affect six additional carcinogenic PAHs, for a total of 7 PAH toxicity values changed.

BaP is used as a standard for 6 other carcinogenic PAHs.

How it works: BaP is assigned a factor of 1. The other 6 PAHs are assigned a value relative to BaP. This value shows if they are considered more or less carcinogenic than BaP. This graph shows the relative potency of these 7 PAHs at current levels (dark blue bars), and at the proposed new levels (light blue bars)

OSU Research on BaP and potency factors

Mechanism-based classification of PAH mixtures to predict carcinogenic potential. By S. Tilton et. al. 2015. *Toxicological Sciences* 146(1): 135-145. Results indicate that using BaP to evaluate carcinogenicity of other PAHs is insufficient.

Polycyclic aromatic hydrocarbons as skin carcinogens: Comparison of benzo[a]pyrene, dibenzo[*def,p*]chrysene and three environmental mixtures in the FVB/N mouse. By L. Siddens et al. 2012. *Toxicology and Applied Pharmacology*. 264(3): 377-386. This study showed that the carcinogenicity of DBC and two of the mixtures was greater than would have been predicted using published Relative Potency Factors.

Want the papers? *Contact us*: diana.rohlman@oregonstate.edu

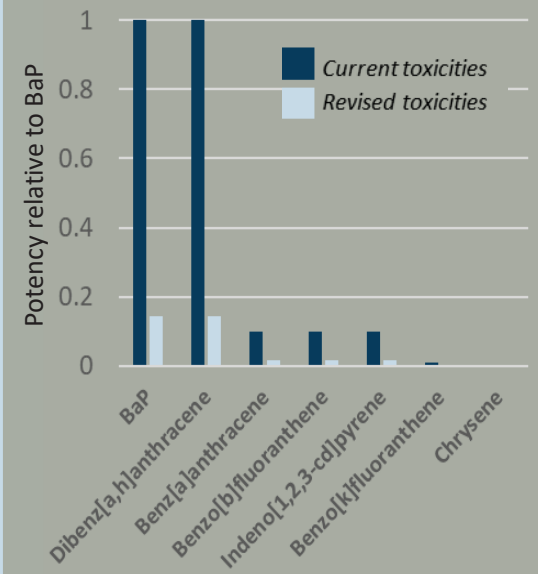
What changes?

- ~$35 million saved
- ~17 fewer acres remediated
- Reduced toxicity values for 7 carcinogenic PAHs
- Other PAHs unchanged

PAHs can be man-made and can occur naturally.

Common Sources of PAHs

Old vs New toxicity values



Values based off published 1993 EPA document: https://www.epa.gov/sites/production/files/2015-11/documents/pah-rpfs.pdf.