



You're standing on it!

Coal-Tar-Based Pavement Sealcoat, PAHs, and the Environment: An Introduction

Barbara Mahler U.S. Geological Survey

What Are PAHs?

(polycyclic aromatic hydrocarbons)

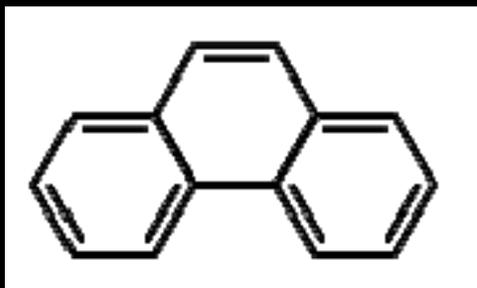
- ❑ Large group of organic compounds
- ❑ Many are carcinogenic, mutagenic, teratogenic, or toxic
- ❑ Produced by combustion of organic matter
- ❑ Urban sources:
 - ❑ Used motor oil
 - ❑ Exhaust
 - ❑ Industrial emissions
 - ❑ Asphalt
 - ❑ Tires
 - ❑ Coal-tar-based pavement sealant



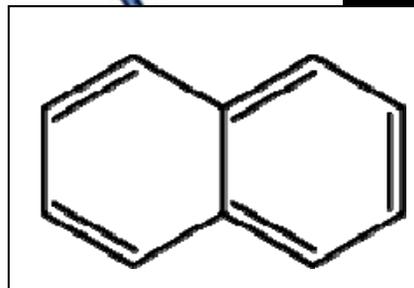
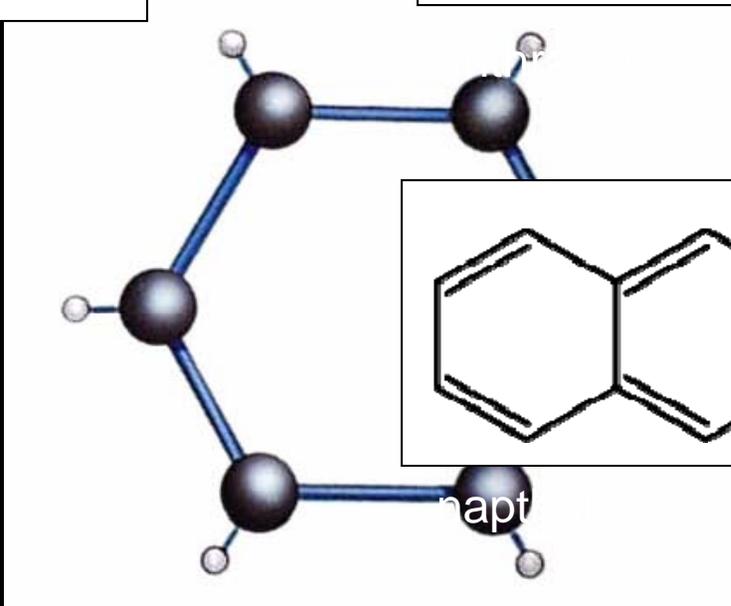
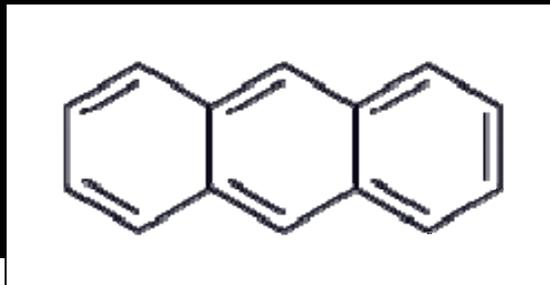
What is the relative importance of these sources?



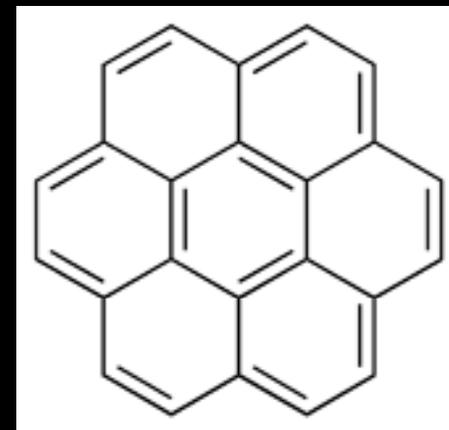
Chemistry of PAHs



phenanthrene

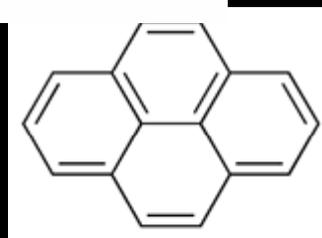


napt



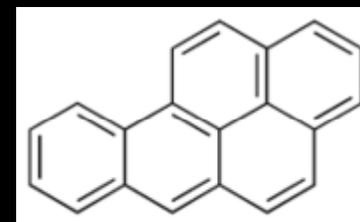
coronene

+



pyrene

=



benzo[a]pyrene

Why be concerned about PAHs?

- PAHs have adverse health effects for biota and humans



Photo courtesy of Jim Negus

Healthy bullhead, Tennessee

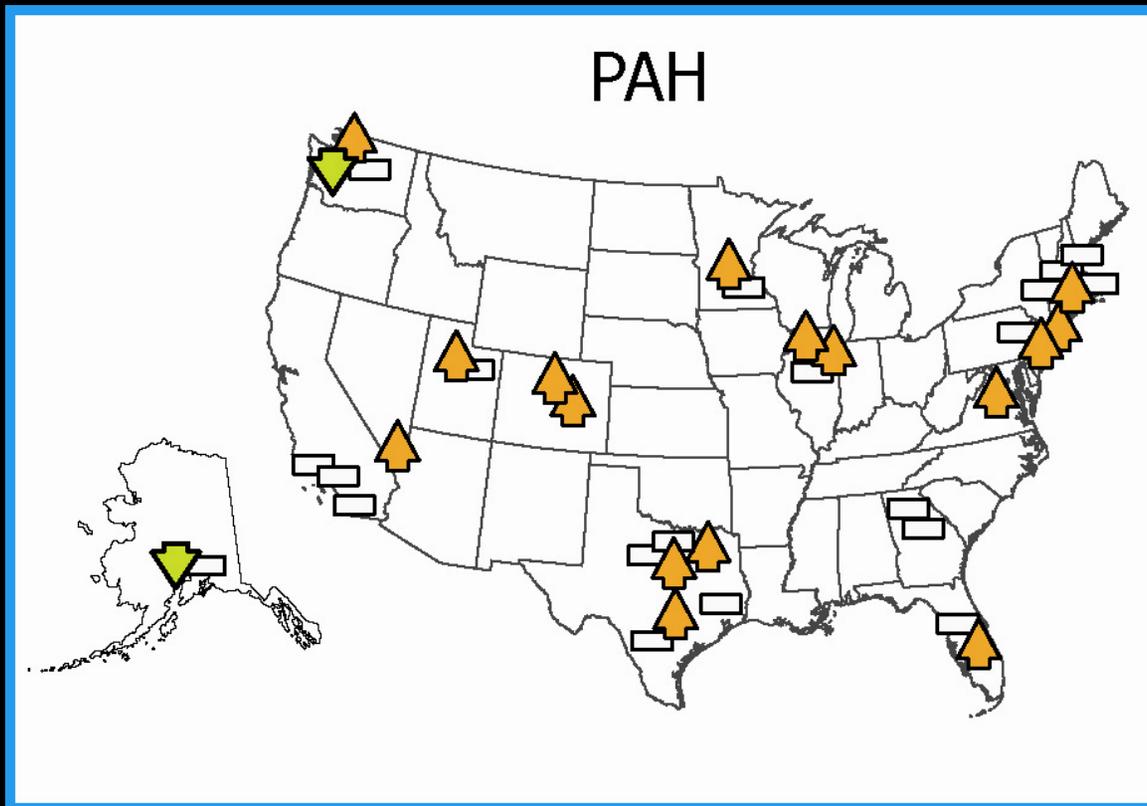


Photo courtesy of Fred Pinckney

A brown bullhead, Anacostia River, Maryland

Why be concerned about PAHs?

- PAHs are increasing in U.S. lakes



Van Metre and Mahler, 2005, *Environ. Sci. Technol.*, 39:5567-5574.

City of Austin provides the first clues



- Extremely high (~1,500 mg/kg) PAHs in some small drainages
- Compare to Probable Effect Concentration (PEC) of 23 mg/kg

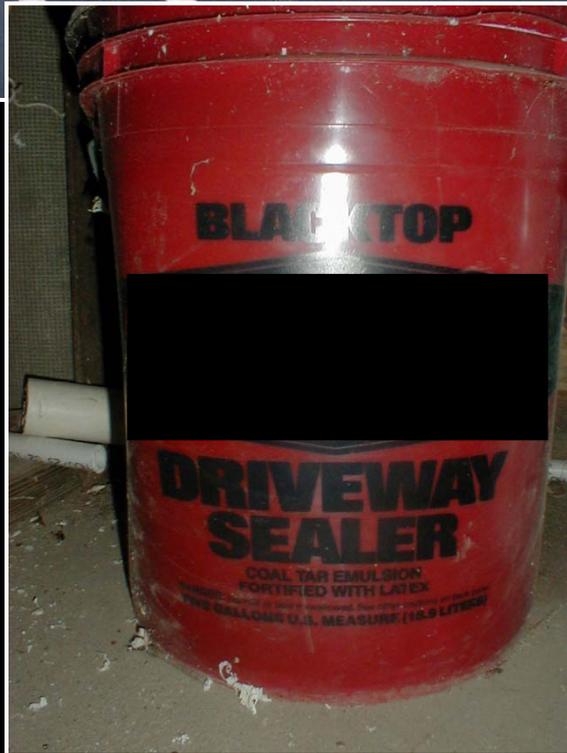
What could be the source?

1,500 mg/kg in creek sediment

- Tire wear particles
 - **175** (mean of 3 studies)
- Road dust
 - **59**
- Brake lining particles
 - **9**
- Air particles, major roadway
 - **104**
- Fresh asphalt
 - **2**
- Weathered asphalt
 - **9**
- Fresh motor oil
 - **7**
- Used motor oil
 - **726**
- Diesel engine
 - **304** (mean of 2 studies)
- Gasoline engine
 - **35**
- Coal-tar-based pavement sealcoat
 - **92,000** (mean of 6 products)

All concentrations in mg/kg

Pavement sealcoat



Two kinds of sealcoat

- Asphalt-based product
- PAH content ~ 50 mg/kg
- West of the Continental Divide



- Coal-tar based product
- PAH content ~92,000
- East of the Continental Divide

Some information about coal tar pitch

- Coal tar pitch is the residue remaining after the distillation of crude coal tar
- The pitch is refined into different grades of viscosity, of which RT-12 (used for pavement sealer) is the most viscous
- Various referred to as refined coal tar, coal tar emulsion, RT-12, refined coal tar pitch emulsion, etc.
- CAS # 65996-93-2 → “coal tar pitch”

MATERIAL SAFETY DATA SHEET

Date last revised: 10-01-93

Doc Code: MSDSGSFD

I. General Information

Chemical Name & Synonyms

Dispersion of refined coal tar and mineral fillers in water.

Trade Name & Synonyms

[REDACTED]

Hazardous Materials Identification System (HMIS)

HEALTH	FLAMMABILITY	REACTIVITY	PERSONAL PROTECTION
2	0	0	C

Proper DOT Shipping Name

None

DOT Hazard Classification

None

Manufacturer

[REDACTED]

Manufacturer's Phone

[REDACTED]

Manufacturer's Address

[REDACTED]

Chemtrec Phone

[REDACTED]

II. Hazardous Ingredients

Ingredient	CAS NO.	Percent	Exposure Limit
Refined Coal Tar	65996-93-2	31 - 34	0.2 mg/m ³ OSHA PEL Coal tar volatiles benzene soluble fraction 8 hr work shift avg.

III. Physical Data

Boiling Point (°F) IBP 212°F	Specific Gravity (H ₂ O=1) 1.2
Vapor Pressure (mm HG.) Not Determined	Percent Volatile by Volume Not Determined
Vapor Density (Air =1) >1	Evaporation Rate (butyl acetate=1) <1
Solubility in Water Dispersible, not soluble.	pH 7.4

Appearance & Odor

Viscous brown black liquid with musky coal tar smell.

IV. Fire & Explosion Hazard Data

Flash Point (Test Method)

Auto Ignition Temperature

http://ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s048coal.pdf - Windows Internet Explorer

http://ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s048coal.pdf

File Edit Go To Favorites Help

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1 / 2 200% Find

SUBSTANCE PROFILES

Coal Tars and Coal Tar Pitches*

Known to be human carcinogens
First Listed in the *First Annual Report on Carcinogens* (1980)

Carcinogenicity

Coal tars and coal tar pitches are *known to be human carcinogens* based on sufficient evidence of carcinogenicity in humans. Numerous studies, mostly case reports, have found that occupational exposure to coal tars or coal-tar pitches (coal-tar distillates) is associated with skin cancer, including scrotal cancer; workers in these studies have included patent-fuel (coal-briquette) workers, pitch loaders, workers in electrical trades, and optical-lens polishers. A 1946 study in the United Kingdom found that patent-fuel workers were 500 times as likely as other workers to die of scrotal cancer. In addition, there have been many case reports of skin cancer among patients using therapeutic coal-tar preparations. Occupational exposure to coal tar or coal-tar pitches also has been associated with cancer at other tissue sites, including the lung, bladder, kidney, and digestive tract. Excesses of lung cancer were found in several epidemiological studies of workers exposed to coal-tar fumes in coal

ether, ethanol, methan
Low-temperature coal t
black, viscous liquids th
percentage (40% to 5
temperature coal tars (f
1985). Coal tars are hig
may be released from fi
with air (HSDB 2003).

Coal-tar pitches are
during the distillation o
methyl and polymethy
(IARC 1985).

Use

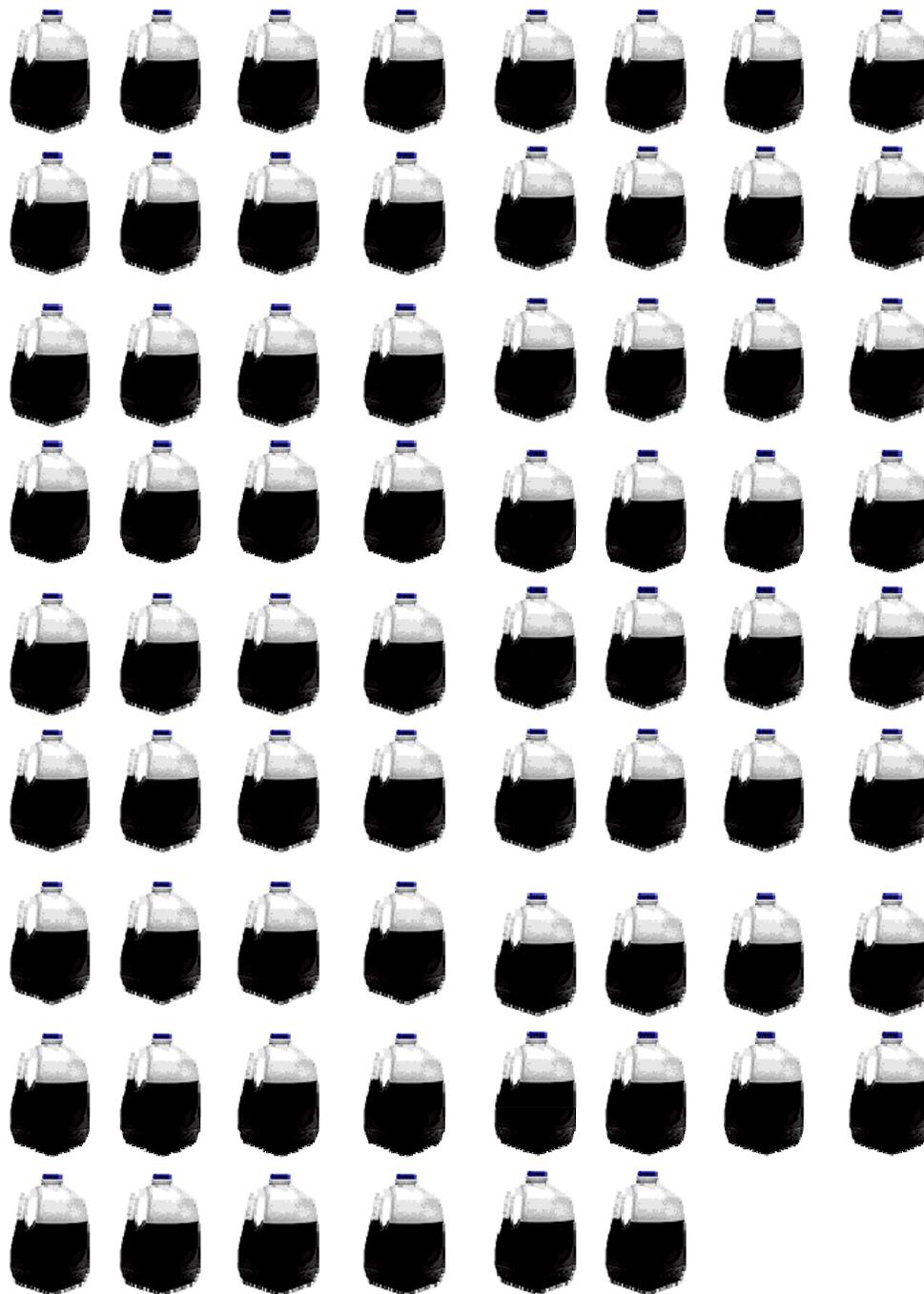
Coal tars and coal-tar
consumer products.
production of refined ch
coal-tar pitch, and cruc
distillation of crude coa
hearth furnaces and blas

8.50 x 11.00 in

Done Unknown Zone

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Coal-tar sealcoat



Used motor oil

Environmental relevance

- Are concentrations elevated?
- Does it stay on site or is it mobile?
- How extensive is use?



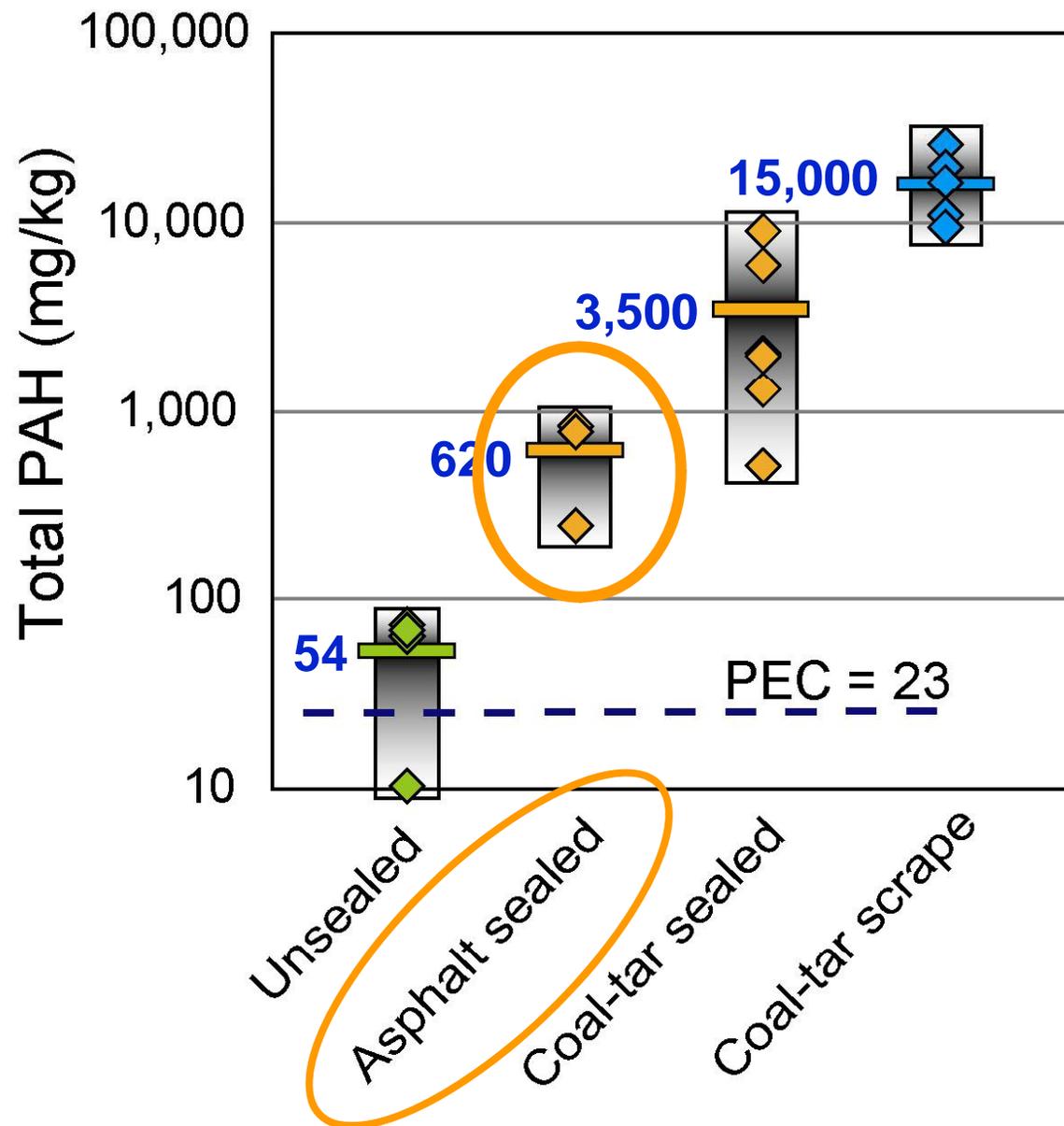


USGS - City of Austin Joint Study

- ❑ Sampled runoff from 13 parking lots
- ❑ Analyzed particles and water for PAHs



PAHs in Parking Lot Runoff Particles

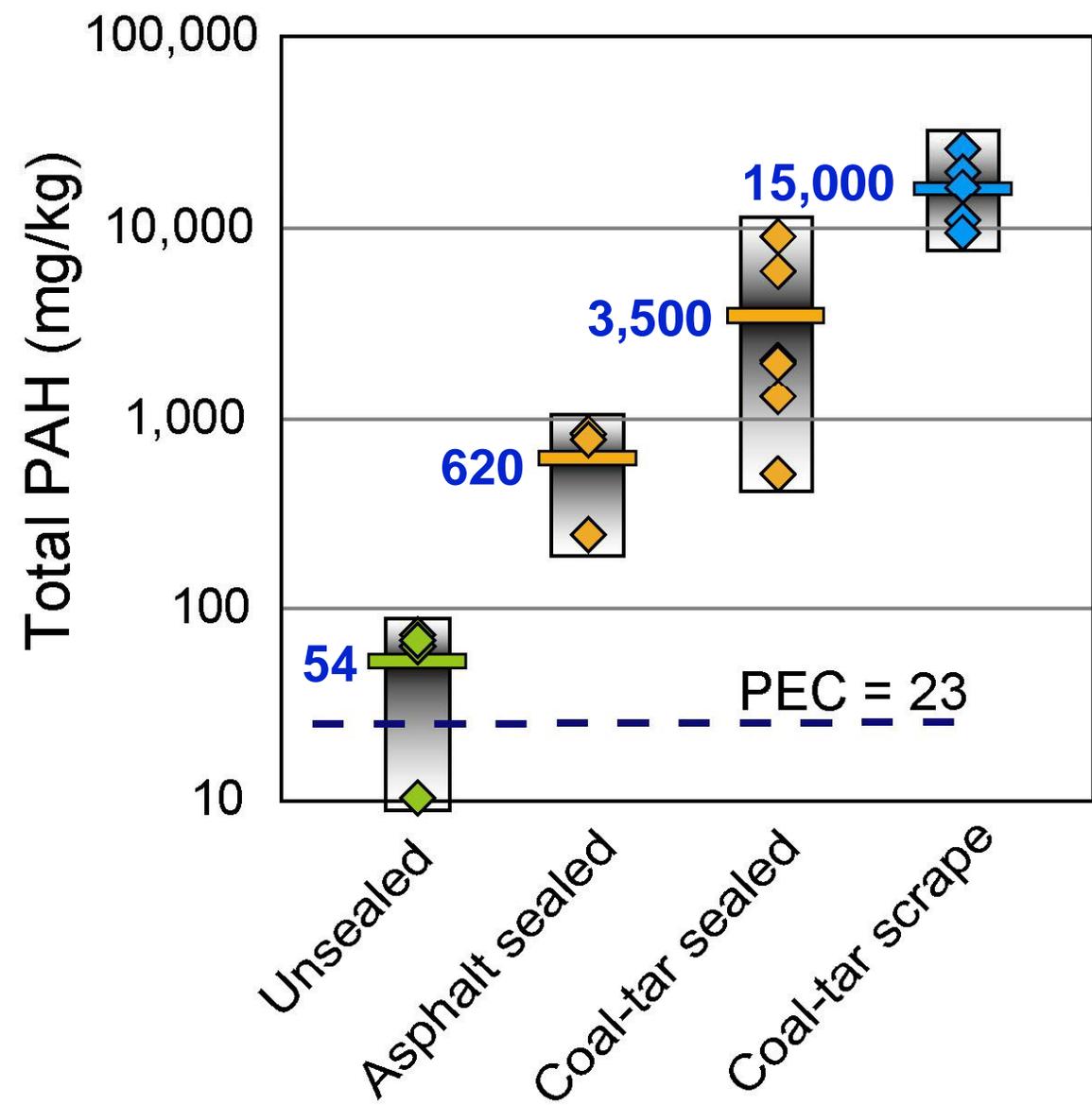


Reilly Site, MN
3,000 max
Black River, OH
1,100

Superfund Sites

Applied
over coal-
tar-
sealcoated
pavement

PAHs in Parking Lot Runoff Particles

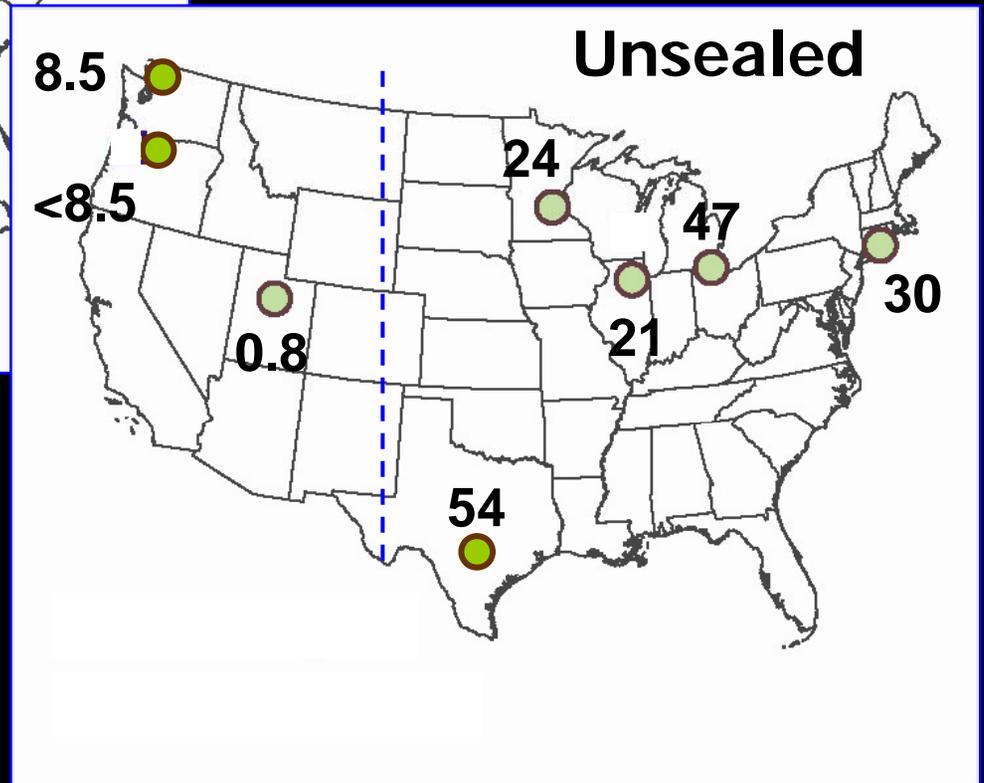
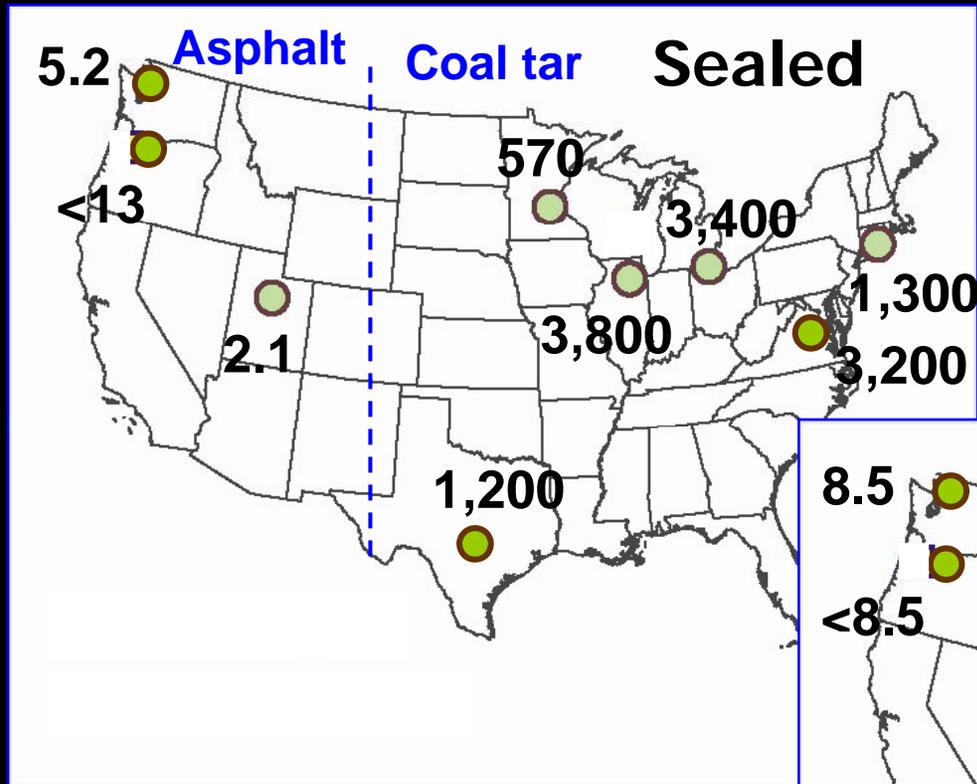


Used Oil
730 mg/kg

Tires
80-200 mg/kg

Asphalt
2-10 mg/kg

9 U.S. Cities: Pavement Dust PAH (mg/kg)



Sealcoat use is extensive

Some examples ...

- Sealcoat industry estimates 20,000 tons (~4,800,000 gallons) of CT-based sealcoat applied in Texas annually
- Principal applicator in Springfield, MO, estimates 200,000 gallons applied annually in Springfield area.
- 1,400,000 gallons applied annually to New York Harbor watershed
- Area covered:
 - 4 watersheds in Texas: 1-2% total area
 - 1 watershed in Illinois: 4% of area
 - 42% of parking lot area
 - 89% of driveway area



Sealcoat: Presentations and posters at the NWQMC

- Stormwater treatment and management
- Source apportionment to U.S. lakes
- Public policy and decision making



Poster Session

- Volatility from the pavement surface
- Contribution to PAHs in house dust