USGS Science on Coal-Tar-Based Sealcoat and Implications for Human and Aquatic Health

Presented by
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NAWQA: Contaminant Trends in Lake Sediment

http://tx.usgs.gov/coring/index.html

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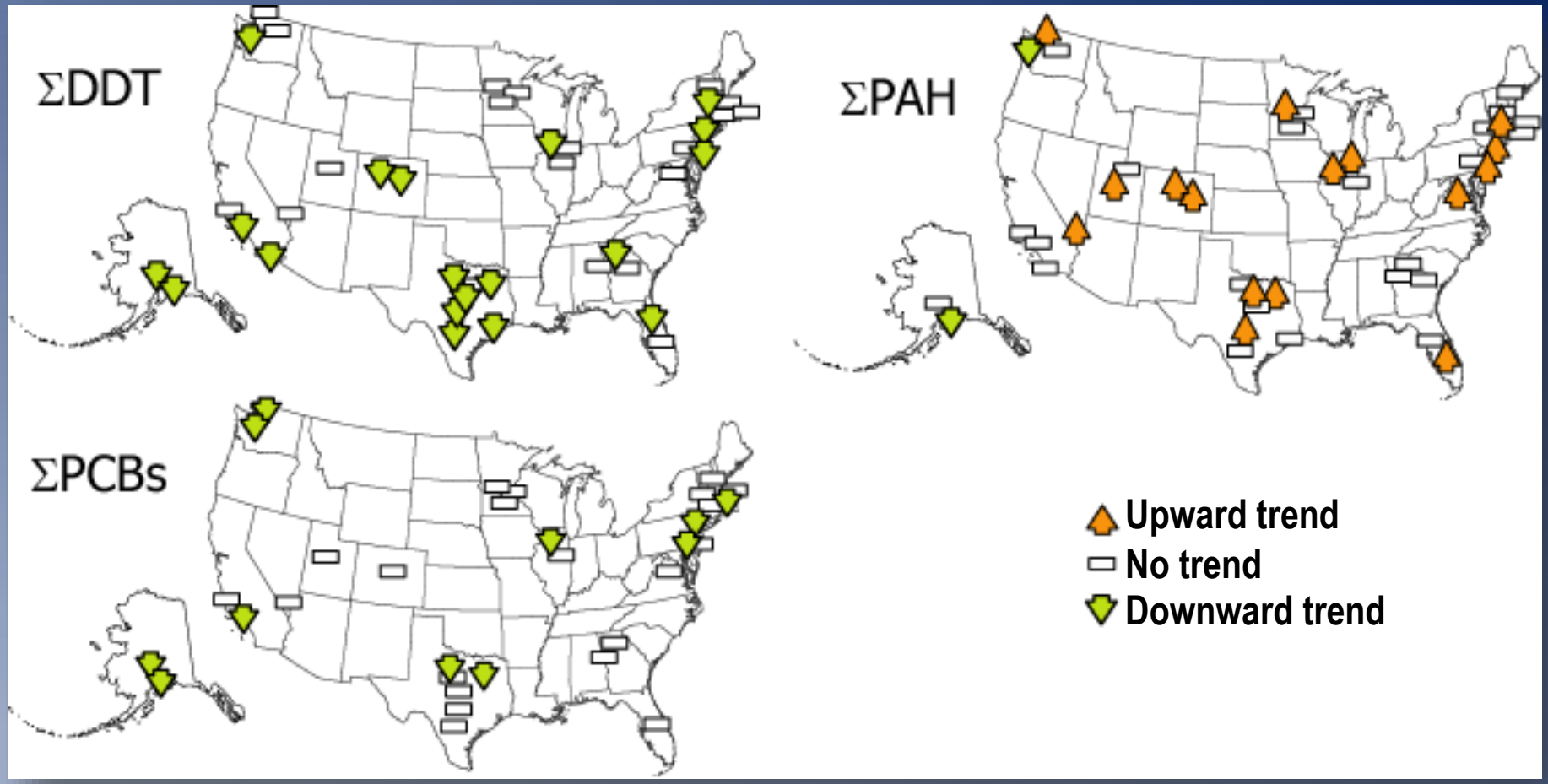
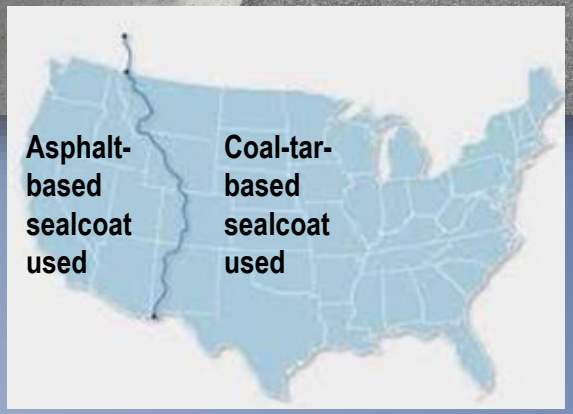


Van Metre et al., 2005, *Env. Sci. Technol.*

City of Austin measures high PAH in stream sediment

PAHs >1,500 mg/kg in some small drainages in residential areas

USGS


Asphalt-based sealcoat used
Coal-tar-based sealcoat used

2. COMPOSITION/ INFORMATION ON INGREDIENTS

Component	CAS NO.	% by Weight
Refined Coal Tar Pitch	65996-93-2	35 ± 5
Water	7732-18-5	50 ± 5
Hydrous Aluminum Silicate	1332-58-7	30 ± 5
Additives	Proprietary	1 ± 0.5

Note: The above components and their percentages are provided for health and safety purposes, ONLY. This document should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

Appearance and odor: Dark brown to black, thick consistency liquid with an aromatic odor.

WARNING STATEMENTS: Skin and eye irritant. Harmful or fatal if swallowed. Carcinogen.

POTENTIAL HEALTH EFFECTS:

Likely Routes of Exposure:

EYE CONTACT: Coal tar - volatiles and mist may cause irritation to the eyes. Eye contact with product will result in irritation, which in the absence of recommended first aid, can result in minor burns to eyes.

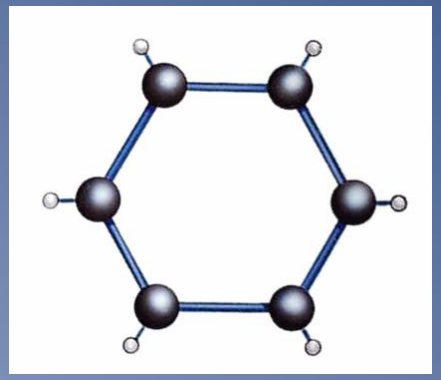
SKIN CONTACT: Coal tar - exposure causes skin irritation characterized by skin itching, burning, swelling, and redness. Photosensitization of the skin may occur. This irritation has a burning sensation somewhat like sunburn and is accentuated by sunlight. Repeated or prolonged contact may contribute to conditions such as dermatitis, tar warts, and rough skin.

INHALATION: Coal tar volatiles - acute effects caused from overexposure may include coughing, sneezing, and swollen or irritated nasal mucus and sinuses. Repeated and/or prolonged contact to high concentrations may result in toxic effects, such as respiratory difficulties, convulsions, and possible cardiovascular collapse may occur.

INGESTION: Coal tar - may cause gastrointestinal tract irritation followed by nausea and vomiting, abdominal discomfort, rapid pulse, etc. In extreme cases, cardiovascular collapse may occur.

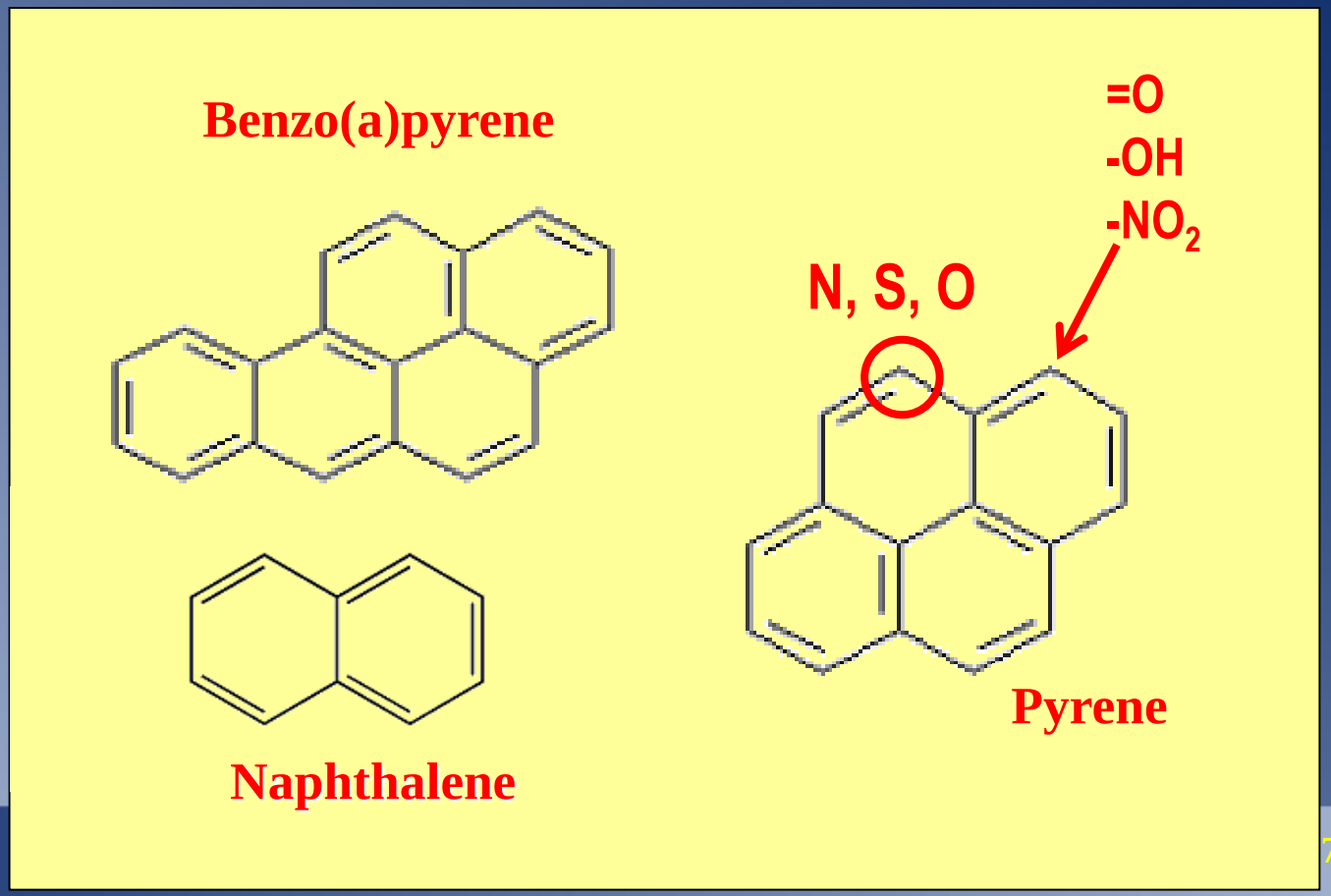
Refer to Section 11 for toxicological information.

Polycyclic Aromatic Hydrocarbons (PAHs)

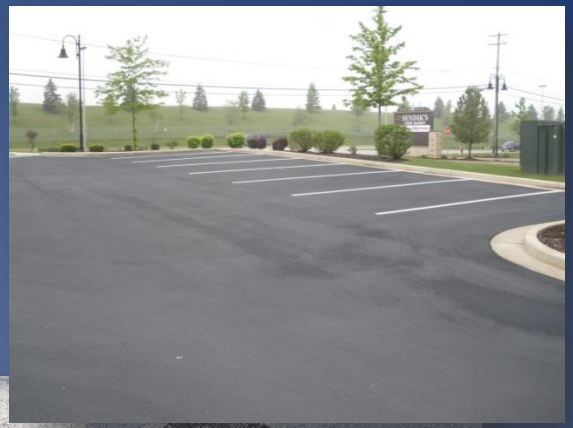


Benzene ring, building block of PAHs

Examples of PAHs



Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous in the urban environment



PAHs in urban sources

All concentrations in mg/kg (means of as many as 6 studies)

Fresh asphalt	1.5
Weathered asphalt	3
Fresh motor oil	4
Brake particles	16
Road dust	24
Tire particles	86
Diesel emissions	102
Gasoline emissions	370
Used motor oil	440

Pavement Sealcoat

Asphalt-based

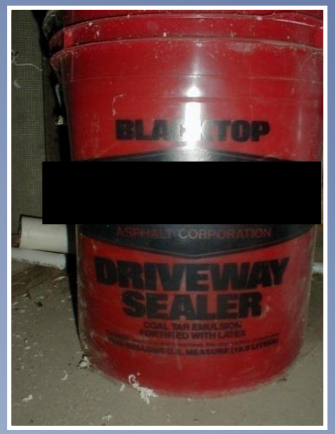
~50

Coal-tar-based

~70,000

Used motor oil

Coal-tar-based sealcoat



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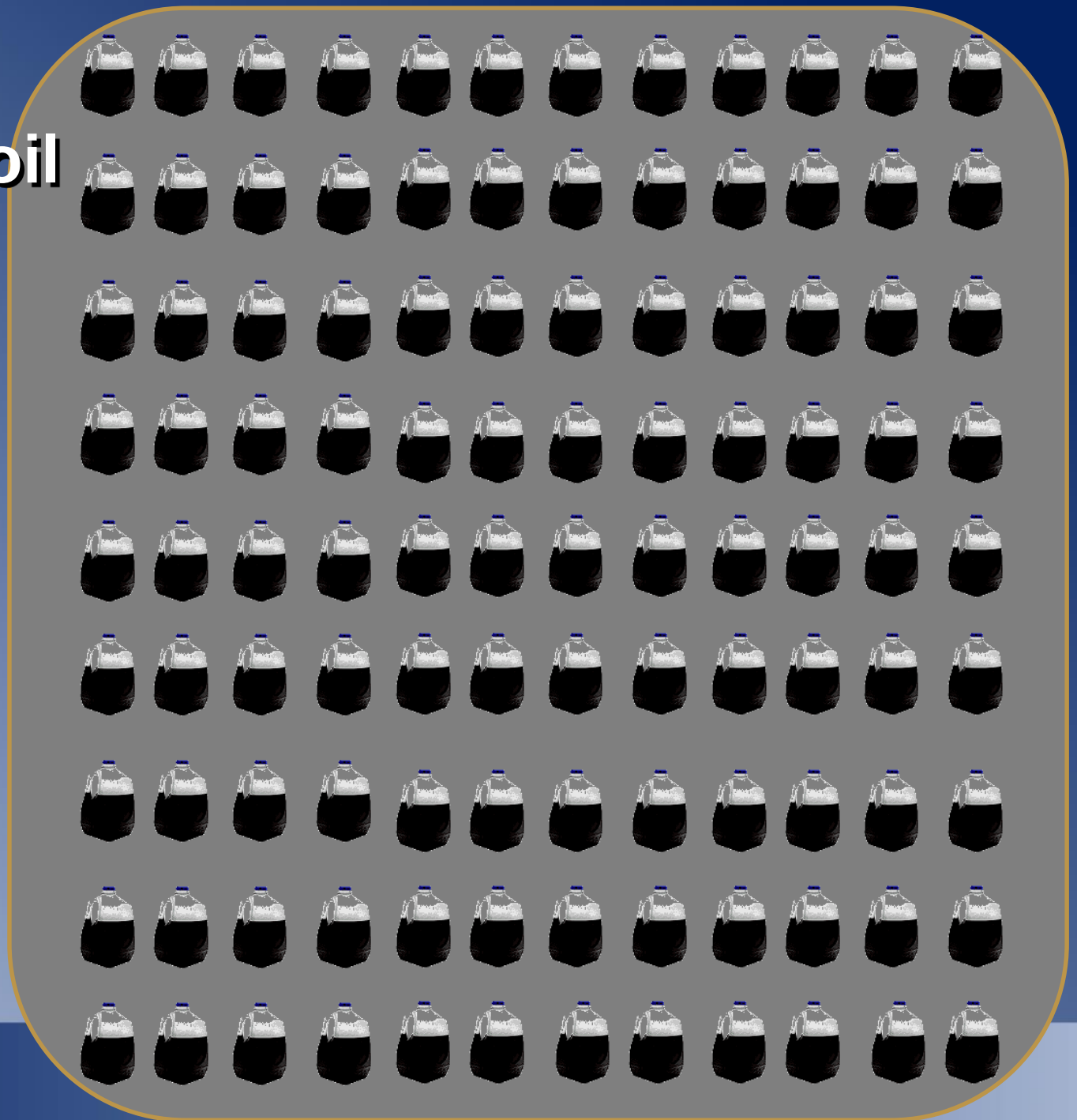

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Coal-tar-based sealcoat use

- 322 million liters (85 million gallons) per year in US (per industry)
- 440 km^2 (170 mi^2) covered in US per year

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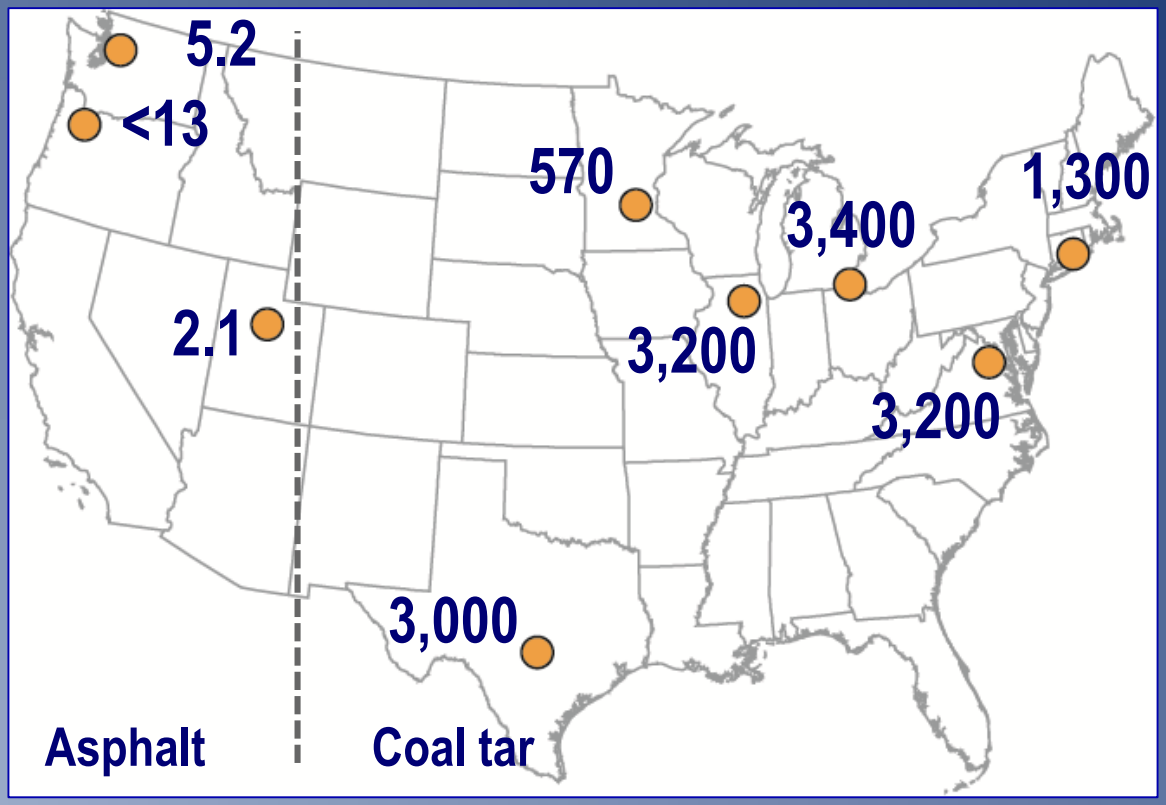
Contaminants in sealcoat are mobile

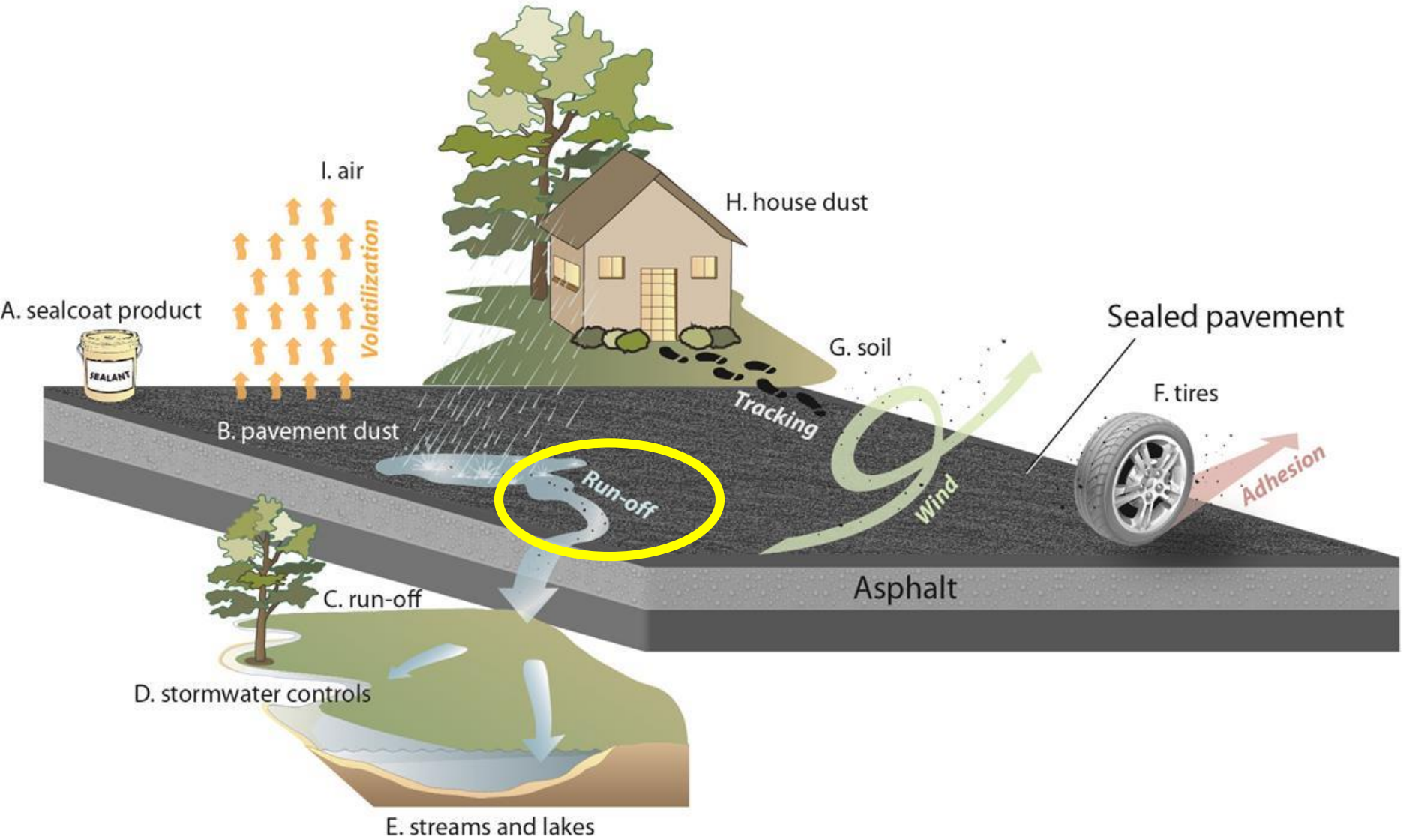
STOP

Sealed pavement dust
Total PAH (mg/kg)



Van Metre et al., 2009, *Env. Sci. Technol.*

Sealcoat PAH transport pathways



Mahler et al., *Environ. Sci. Technol.*, 2012

Fish kill, 17 July 2010

Hodge's Creek, North Carolina

USGS

https://www.youtube.com/watch?v=G5_QJIBYg5c

Mitigate impacts by using BMPs (Best Management Practices) designed to prevent and/or eliminate runoff via controls.

1. Avoid direct connections via effluent filter Strips: Very important during initial "setup/cure" phase.

2. Immediately following initial application is highest risk of runoff. But after initial cure/setup the risk level of runoff drops close to inconsequential/zero risk. But to effectively eliminate the risk, a professional parking lot sweep one to two weeks after application will remove any and all remaining loose particles.

3. Implementation, Enforcement and Education: Suppliers to play lead role in enrolling contractors into the system via an integrated, monitored approach.

WHY IS SEALCOATING NOT RECOMMENDED IF THE WEATHER IS COLD OR IT'S GOING TO RAIN?

For the same reason that exterior painting is not recommended in cold or wet weather, sealcoat is not applied in those conditions because the water in the emulsion won't evaporate. If the water doesn't evaporate, sealcoat particles can't begin the curing process of sticking to each other and the coated surface.

Dried sealcoat does not wash off. If any sealcoat – asphalt-based or refined tar-based – washes off before it dries, it can suffocate fish. The fish are NOT poisoned. Autopsies have shown that the fish die because sealcoat particles cover the fish's gill plates.

Pavement Coatings Technology Council
2308 Mount Vernon Avenue, Suite 134 Alexandria, Virginia 22301

Email: info@pavementcouncil.org

Sealcoat application and runoff sampling

Exposure protocol: Columbia Environmental Research Center

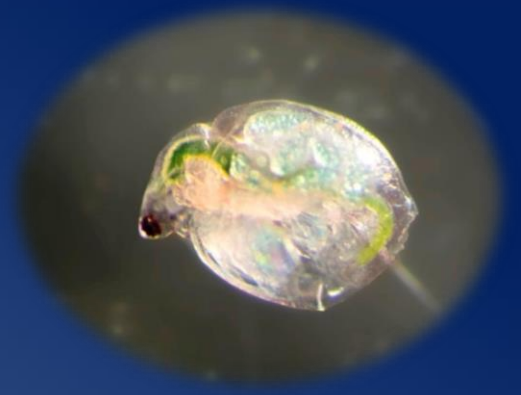
- Tested undiluted and 1:10 dilution of runoff
- 48-h exposure
- Remove surviving organisms to control water for 48-h "recovery"
- Expose half of remaining individuals to 4-h UVR to mimic sunlight

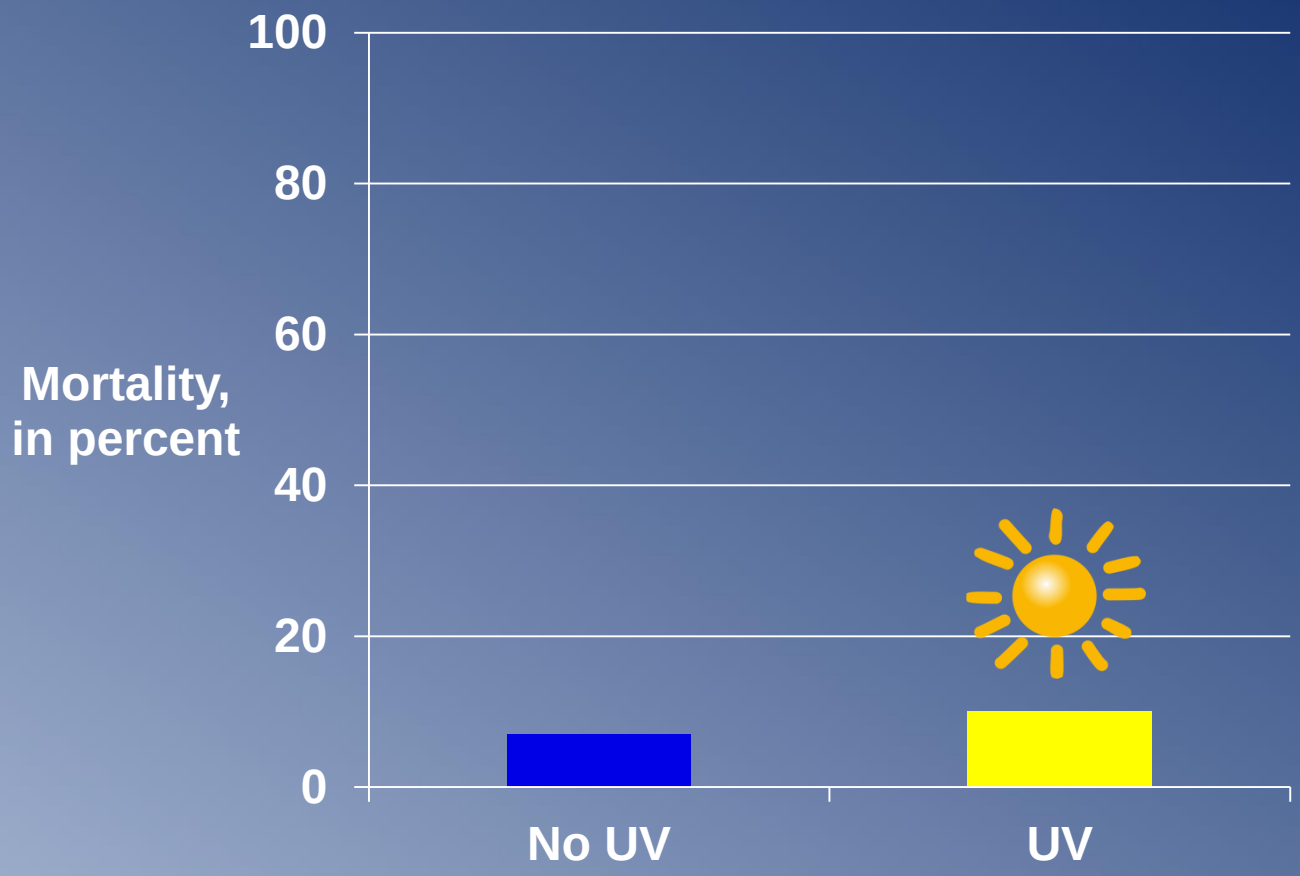
Ceriodaphnia dubia

Pimephales promelas

Mortality, *Ceriodaphnia*

Runoff from unsealed asphalt pavement





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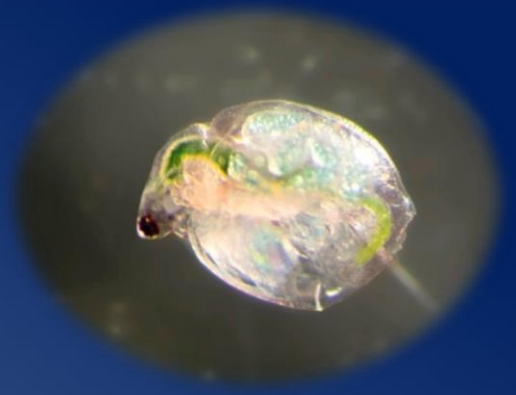
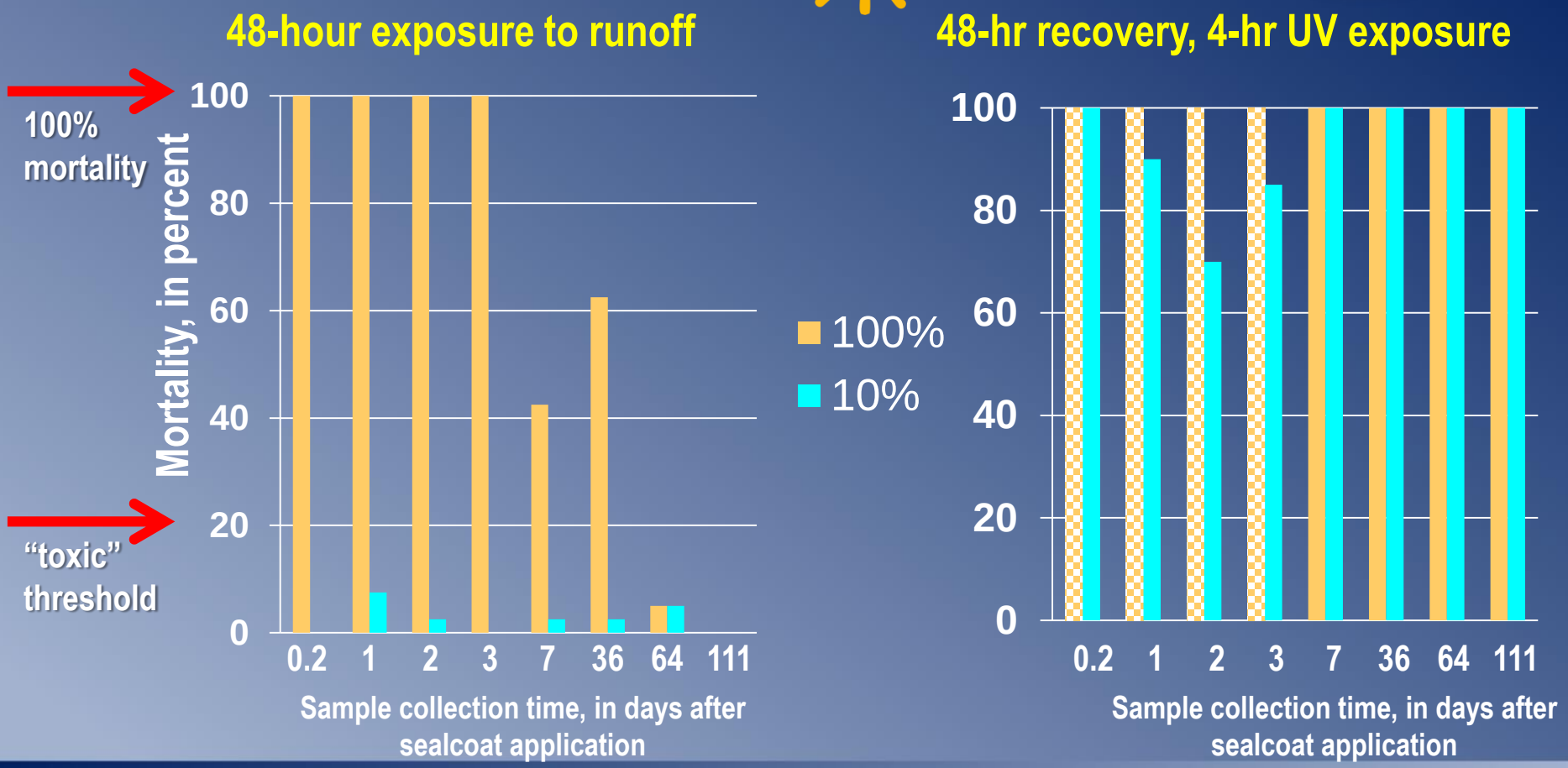
Mortality, *Ceriodaphnia*

Runoff from coal-tar-based sealcoated pavement





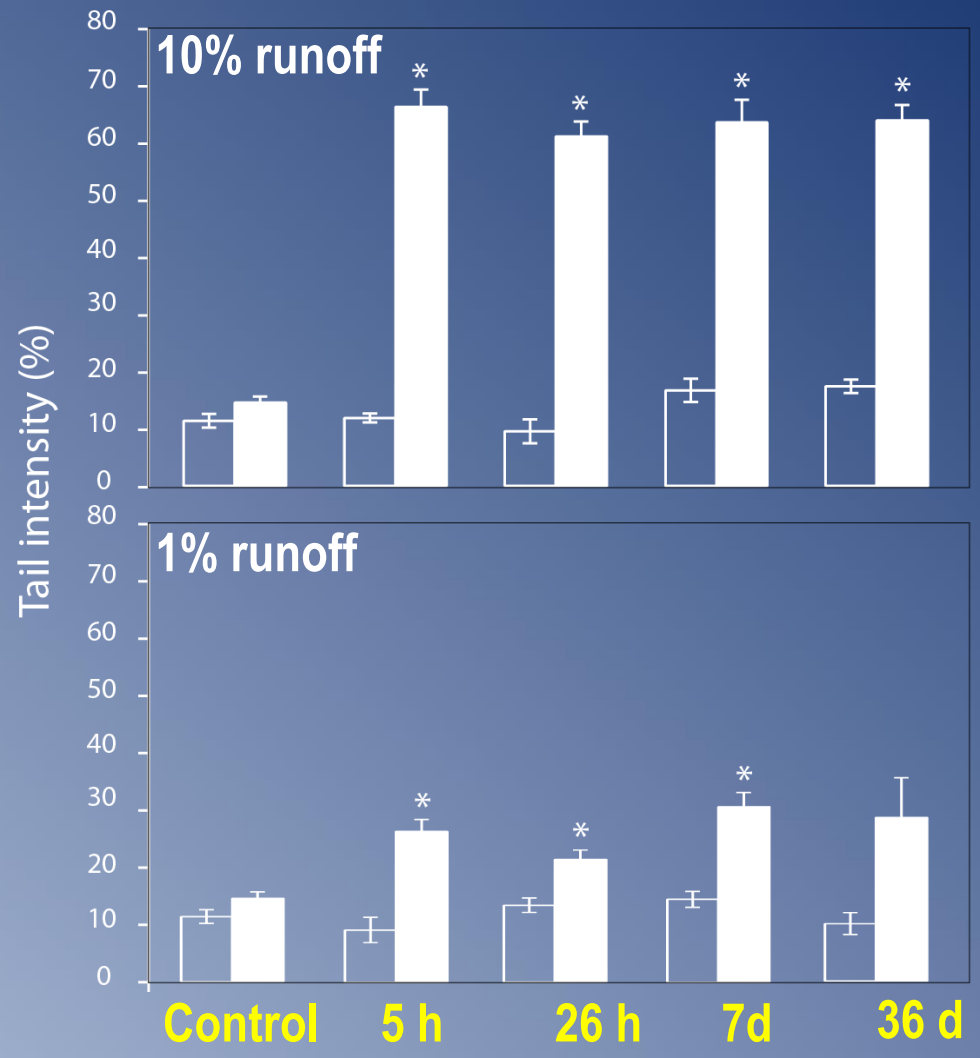
Mahler et al., 2015, *Env. Sci. Technol.*

SILVERADO
R40 8511

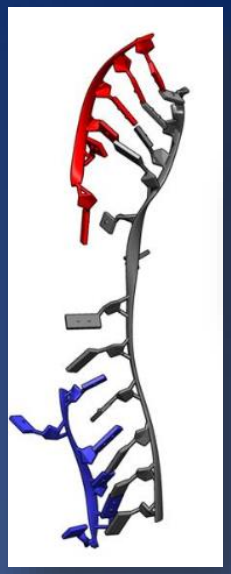
DNA damage

More damage

Less damage



Sample collection time



EXPLANATION

No UVA exposure

With UVA exposure

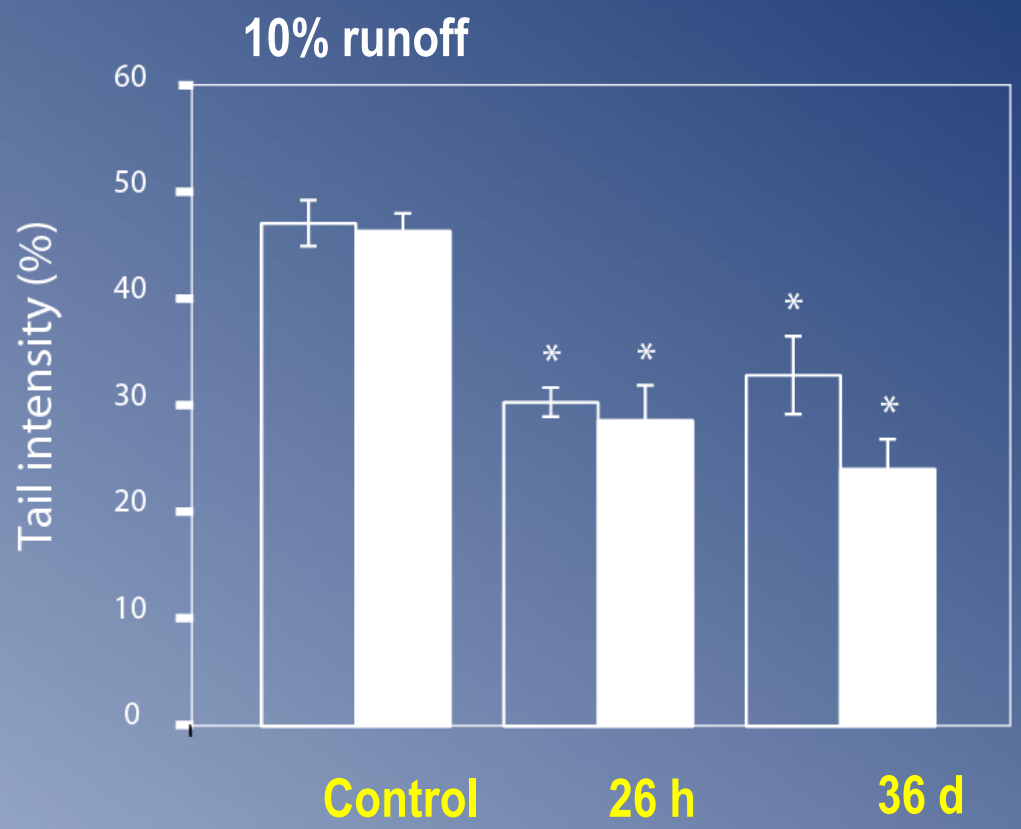
* = significantly different from control

USGS

DNA Repair:
Base excision repair capacity

More repair

Less repair



EXPLANATION

No UVA exposure

With UVA exposure

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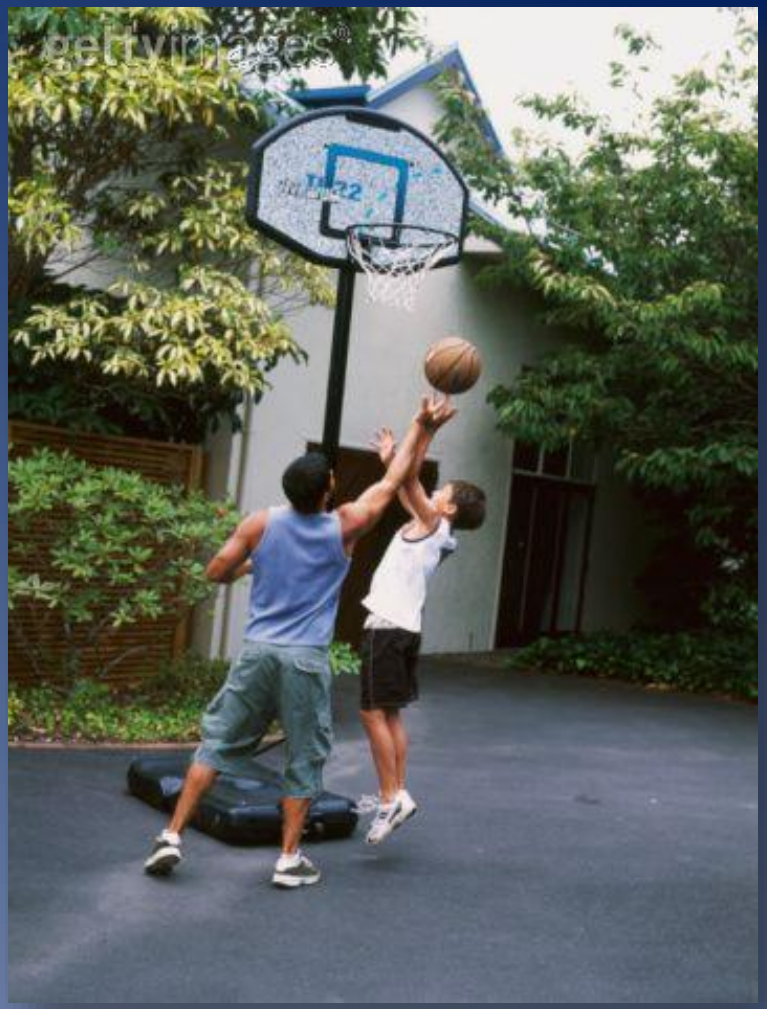

Photos from Jupiter Images and Corbis Images, Inc.

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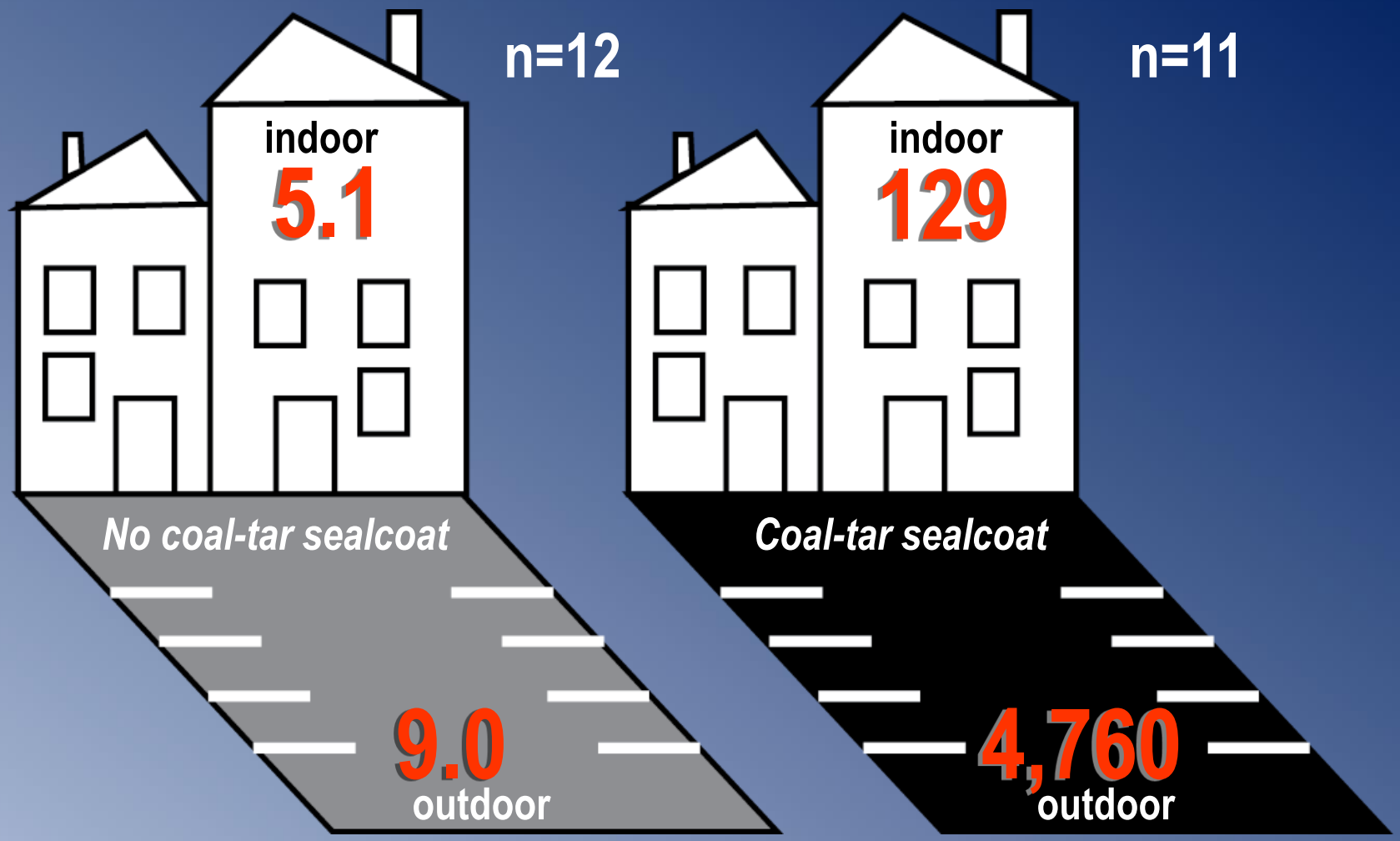
Photo courtesy of CLEARCorps Durham, NC

Austin, Tex.: 23 ground-floor apartments sampled

USGS

Median ΣPAH_{16} [μg/g] in indoor and parking lot dust



USGS

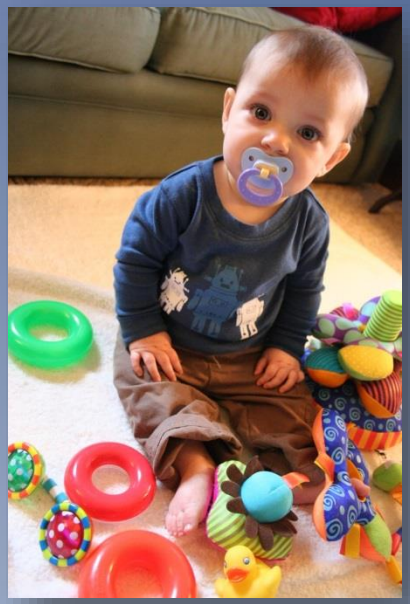
Mahler et al. , 2010, *Env. Sci. & Technol.*

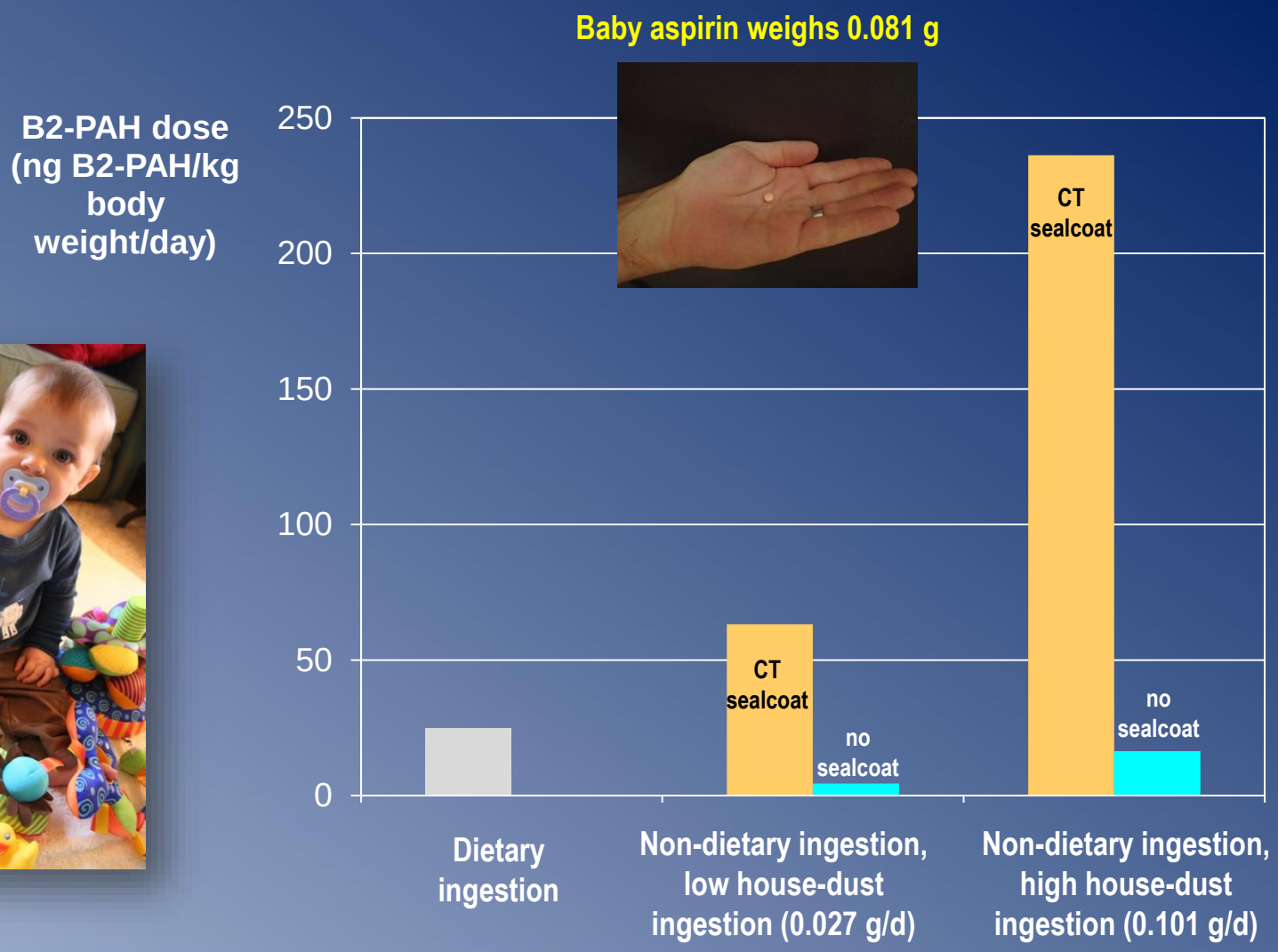
"Coal tars and coal tar pitches are known to be human carcinogens…"

National Institute of Environmental Health Sciences, USA

USGS

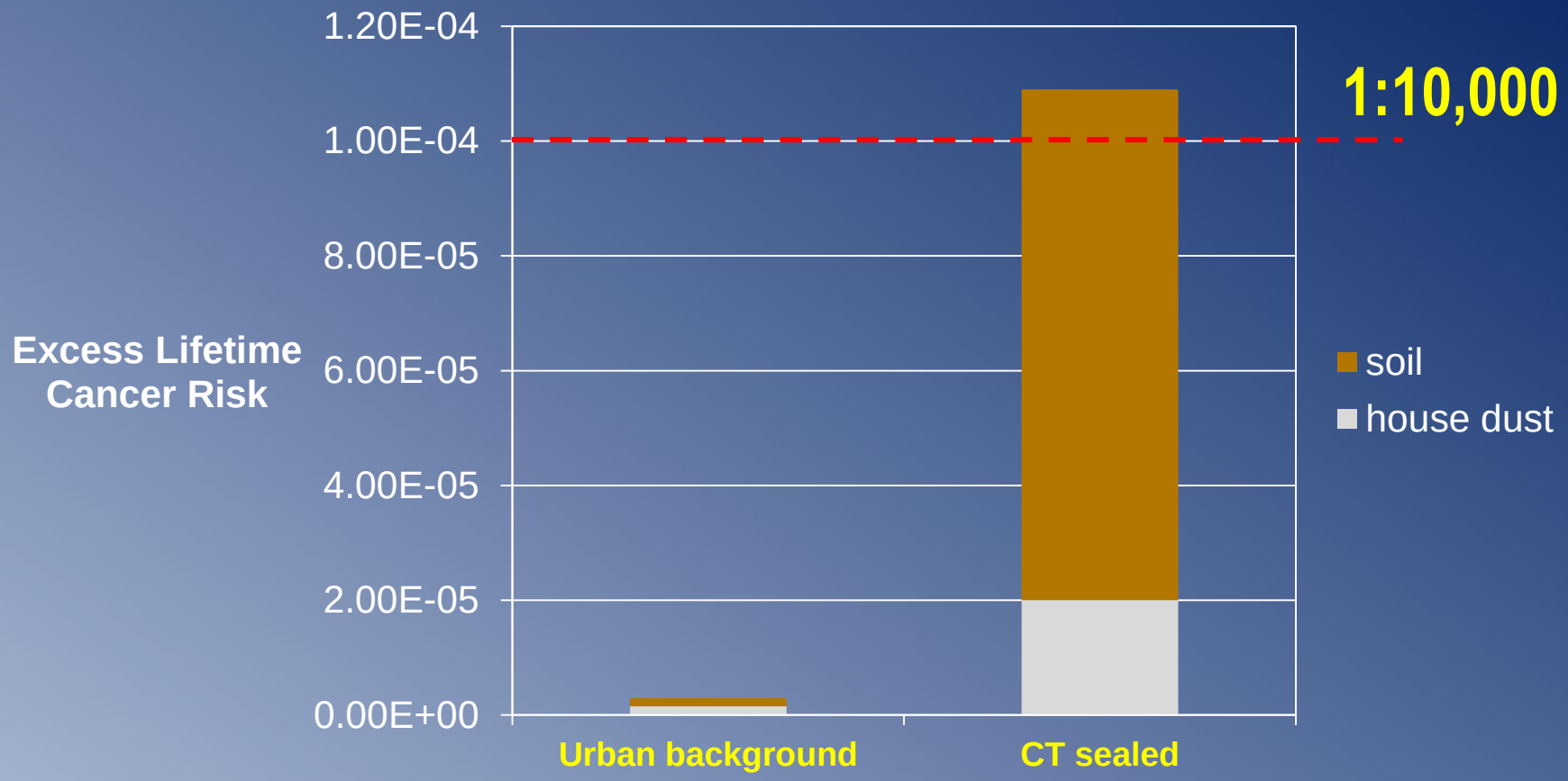
Sealcoat and pre-school ingestion of PAHs





Williams et al., 2012, Environ. Poll.

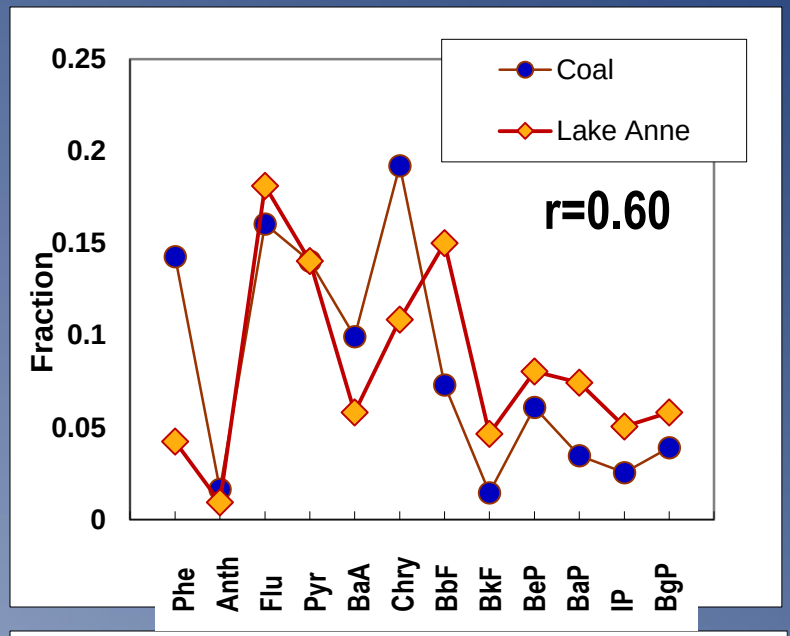
Coal-tar sealcoat contributes to a 38-fold increase in excess lifetime cancer risk (central tendency)

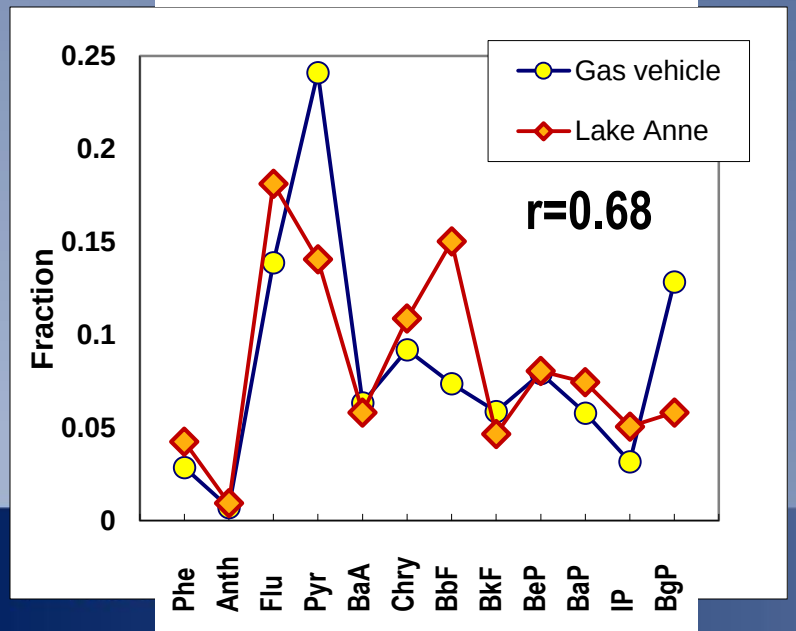


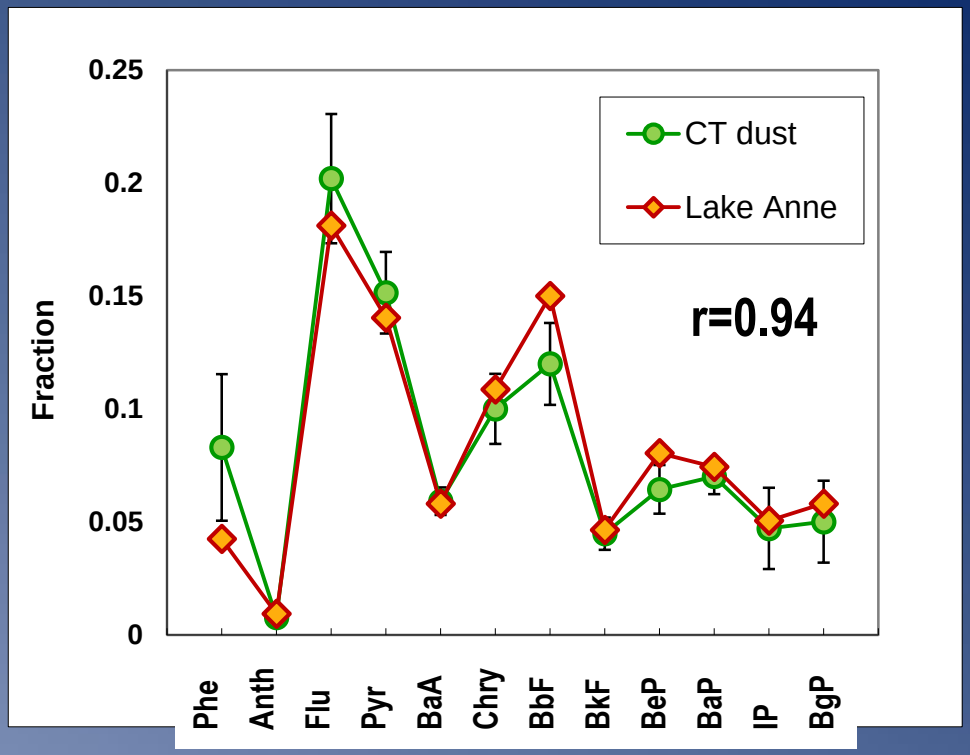
Williams et al., 2012, *Env. Sci. Technol.*

Van Metre et al., 2005, *Env. Sci. Technol.*

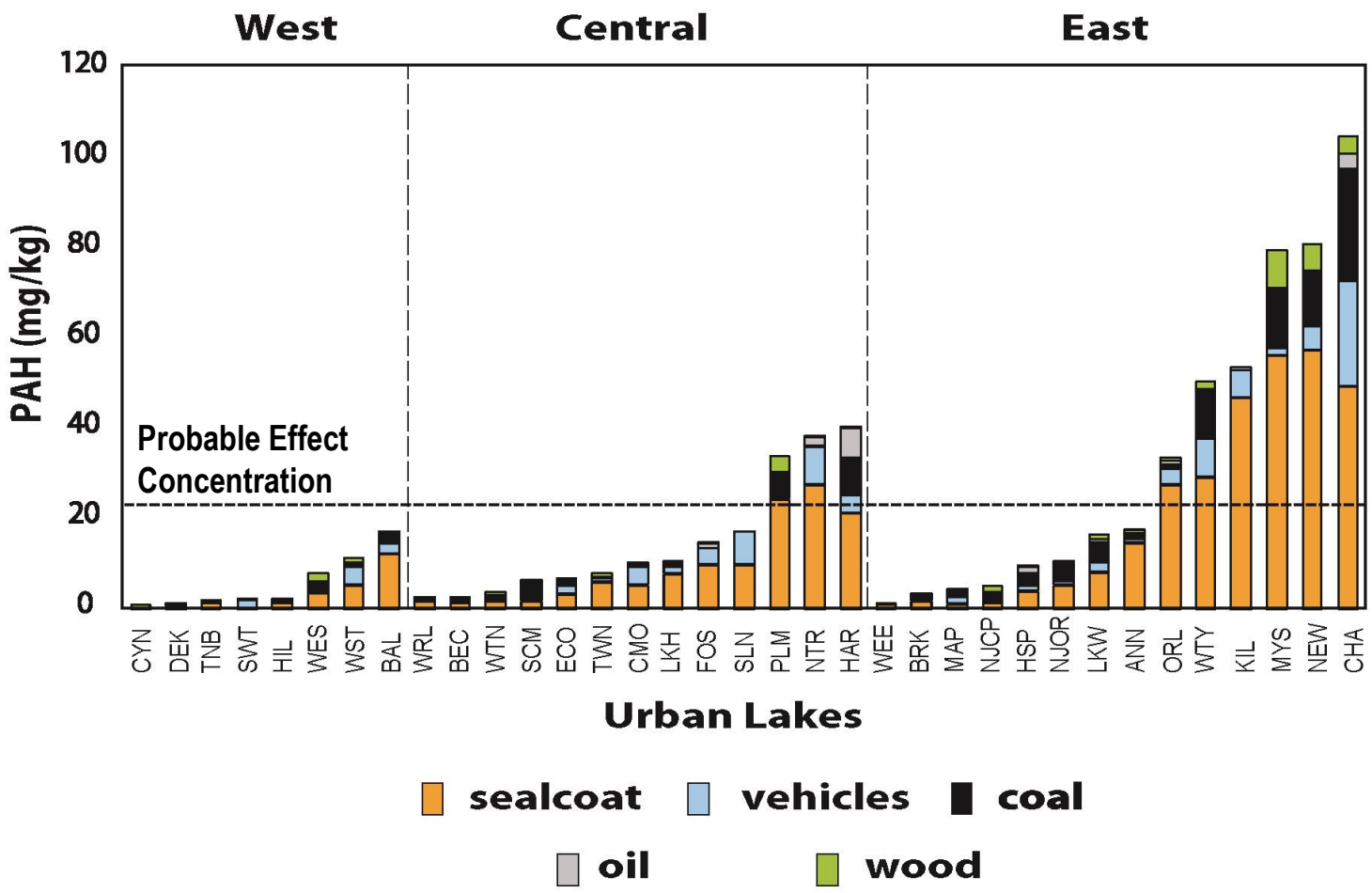
Environmental Forensics: PAH fingerprints





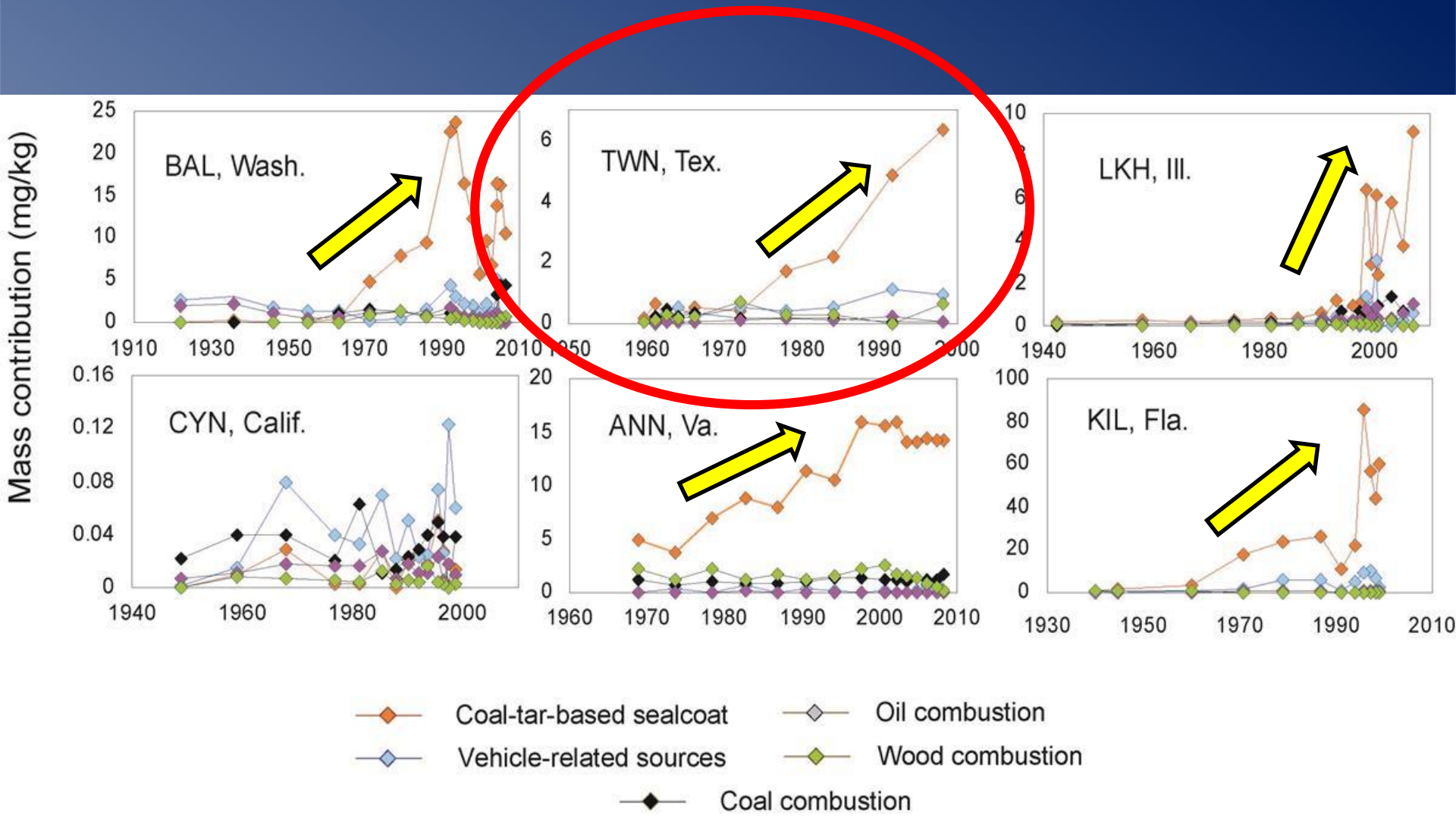


PAH sources to U.S. urban lakes



Van Metre and Mahler, 2010, *Sci. Total Environ.*

PAH trends in new urban lakes



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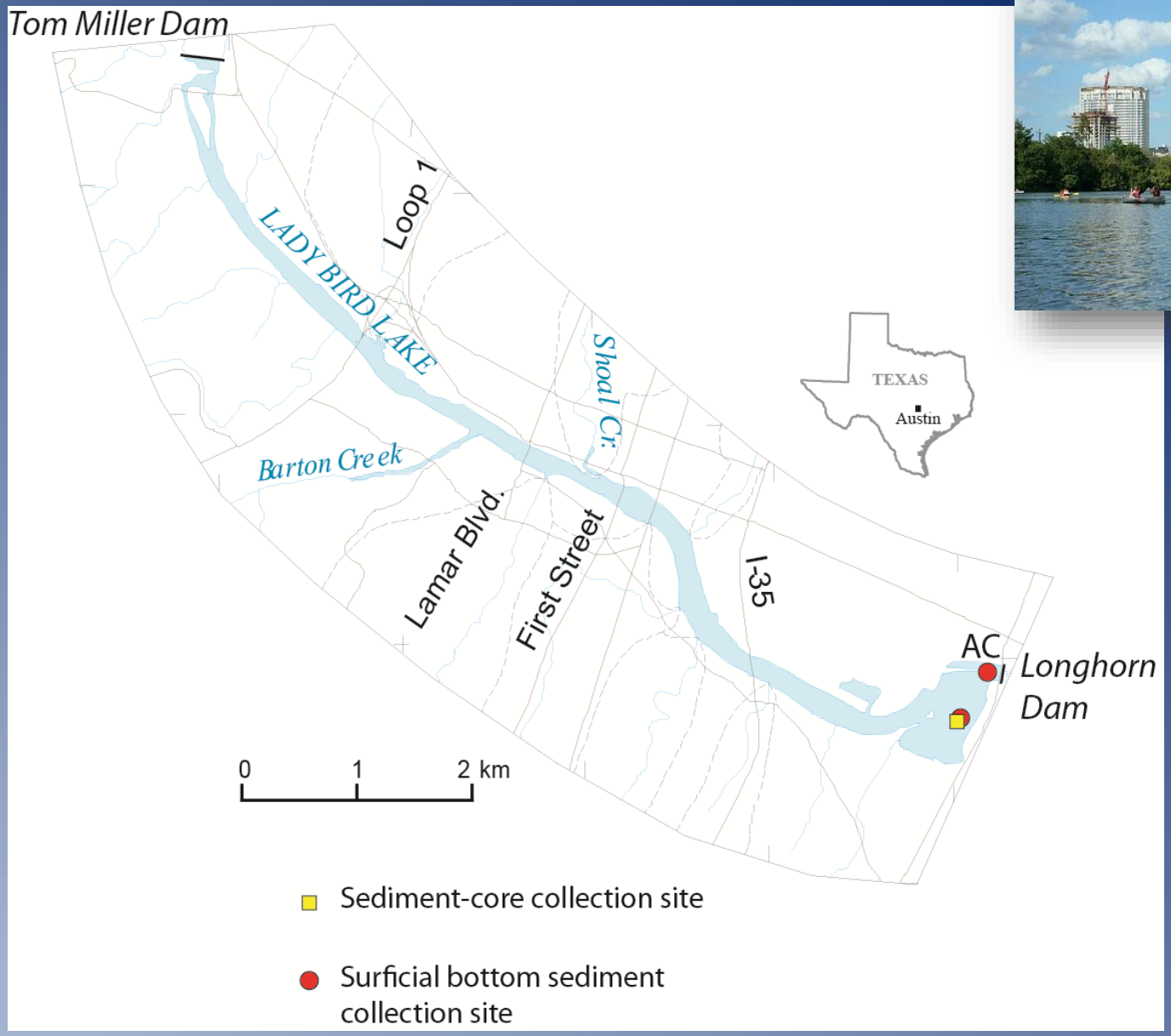
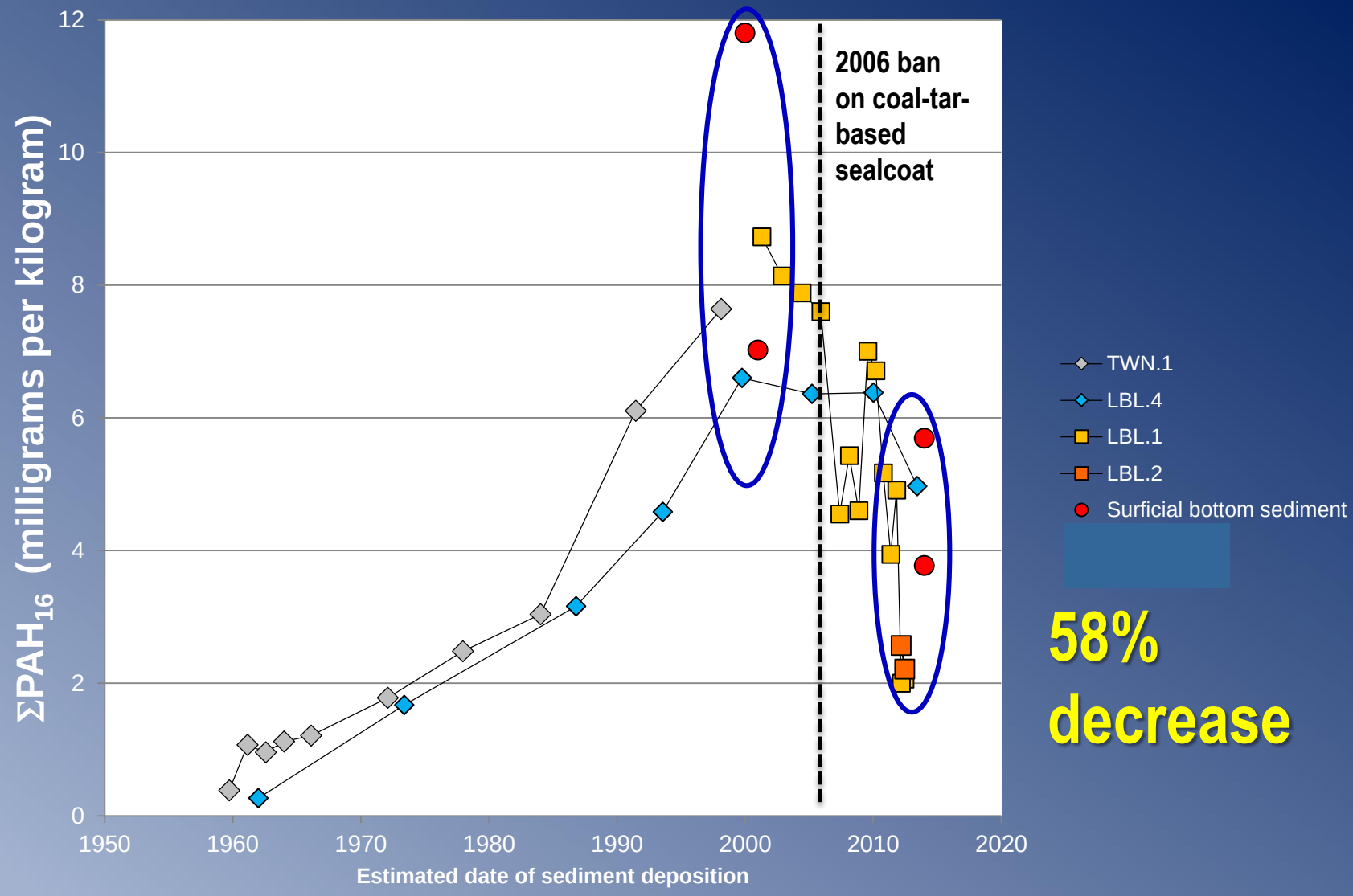

Tom Miller Dam
Loop 1
LADY BIRD LAKE
Shoal Cr.
Barton Creek
Lamar Blvd.
First Street
I-35
TEXAS
Austin
AC
Longhorn Dam
0
1
2 km
Sediment-core collection site
Surficial bottom sediment collection site

PAH concentrations in Lady Bird Lake: Before and after the ban



58% decrease

Van Metre and Mahler, 2014, *Environ. Sci. Technol.*

PAHs and Coal-Tar-Based Pavement Sealcoat

http://tx.usgs.gov/sealcoat.html

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