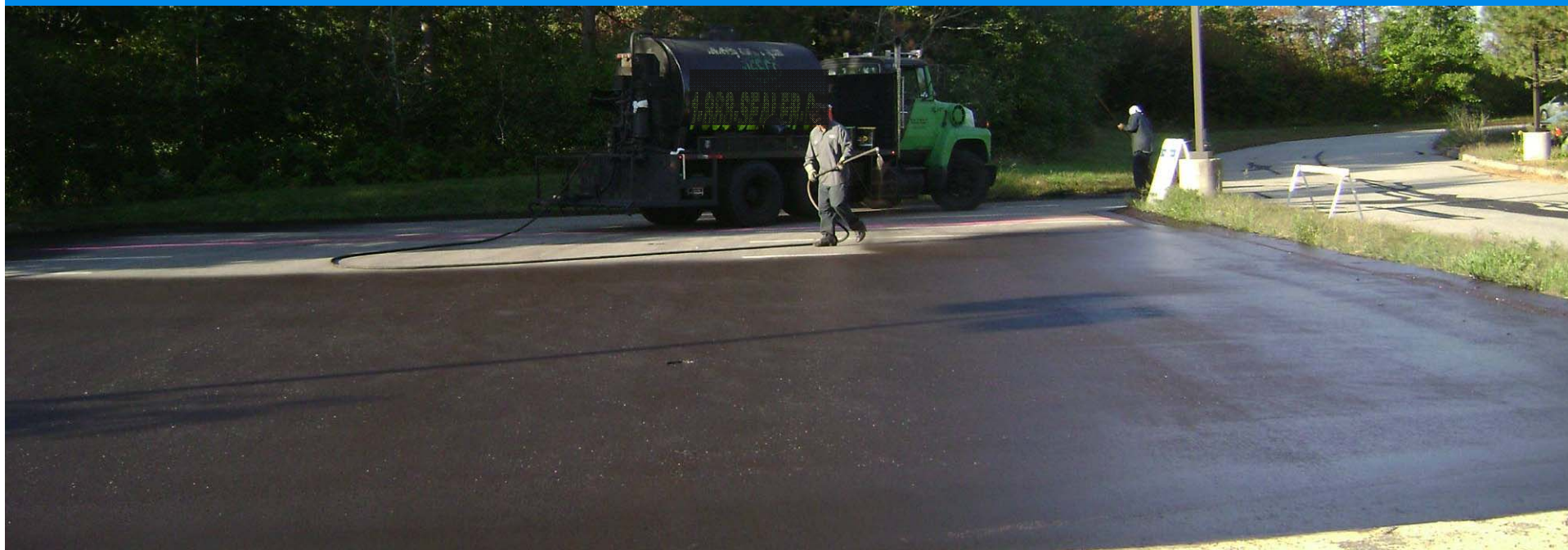


# PAHs And Parking Lots: A Field Study on PAHs Exported From Sealed and Unsealed Parking Lots at the UNH Stormwater Center

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University of New Hampshire Stormwater Center

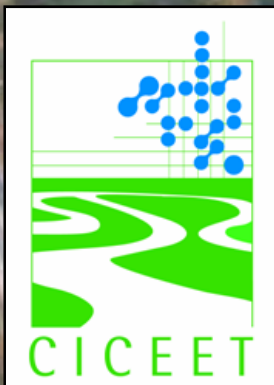


NEIWPC Annual Nonpoint Source Pollution Conference  
May 2010





*Dedicated to the protection of water resources through effective stormwater management*



# Sealcoat – What is it, and why do we care?

Thin, non-permanent layer, applied to enhance appearance

Two common types

- Asphalt-based (asphalt resin, ball clay, silica)
- Coal tar-based (coal tar, ball clay)

Coal tar - High PAHs - 50,000 mg/l total PAHs (City of Austin, 2005)

Asphalt sealant 50 mg/l total PAHs



# Polycyclic Aromatic Hydrocarbons (PAHs)

Class of hydrocarbon compounds created by incomplete combustion of organic material

Some EPA Priority pollutants, some are probable human carcinogens  
(EPA, IRIS database)

Sources include vehicle emissions, industrial process (manufactured gas plants), forest fires, etc .

Very commonly associated with impaired waters: impacts to benthic, fish, humans  
(NOAA, national status and Trends, 2008)

Recent studies (2005, USGS, City of Austin, TX)

Investigating high PAHs in a stream

In Austin, Tx. Concentrations in creek

Higher near sealed lots

– guilt by association?



Barton Springs, Austin Tx

# Current Status

## Coal tar based sealant is banned in:

Austin Tx, District of Columbia

Several towns and cities in Minnesota (White Bear Lake, Centerville)

## Proposed bans:

State of Minnesota

Other States?



There is a need for additional independent studies on the impact of coal tar based sealant.

# Field Facility at the UNH WEST EDGE LOT

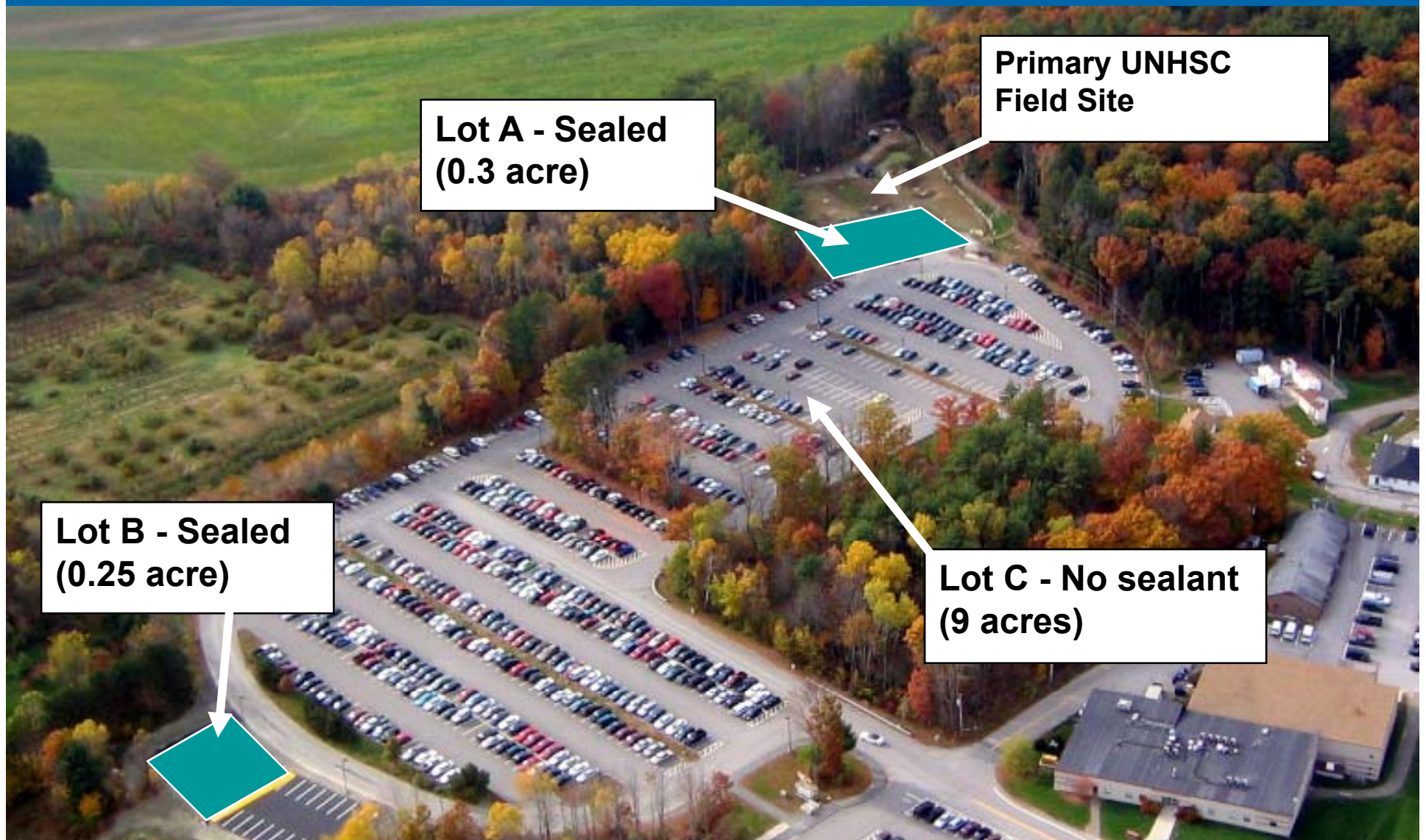
UNH SC  
RESEARCH  
FACILITY

Watershed  
Boundary



# UNHSC Study

## Controlled field experiment



**Lot A - Sealed  
(0.3 acre)**

**Primary UNHSC  
Field Site**

**Lot B - Sealed  
(0.25 acre)**

**Lot C - No sealant  
(9 acres)**

# Sampling

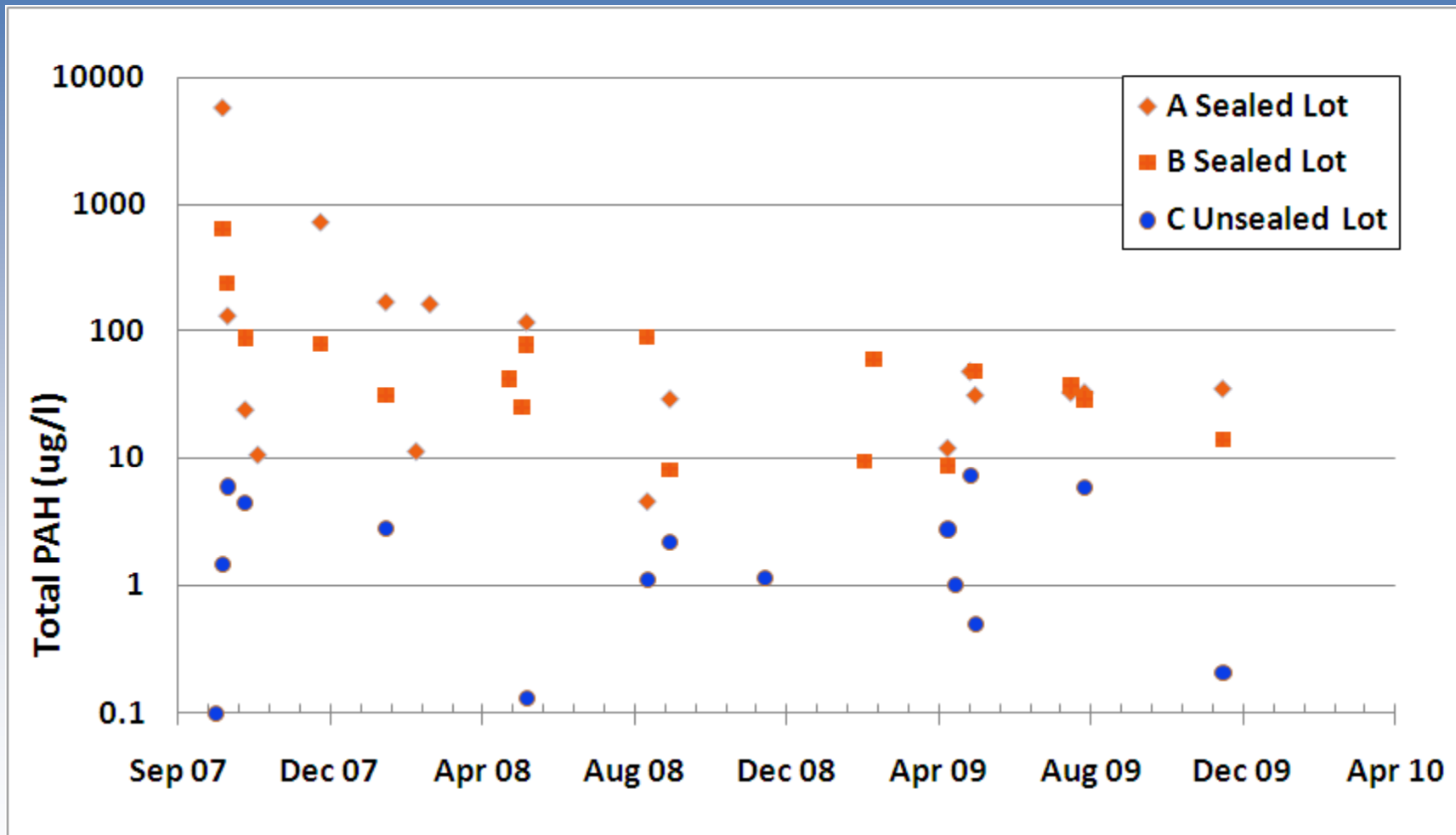
Objective – Measure mass of PAH in each pathway

- **Stormwater runoff  
(24 storms, 11/07-12/09)**
- **Downstream sediments  
Swale, stormwater devices**
- **Adjacent surface soil**
- **Pavement dust**
- **Air**



**All samples analyzed for PAHS, GC/MS, subset analyzed for PAHs/homologs/SIMs**

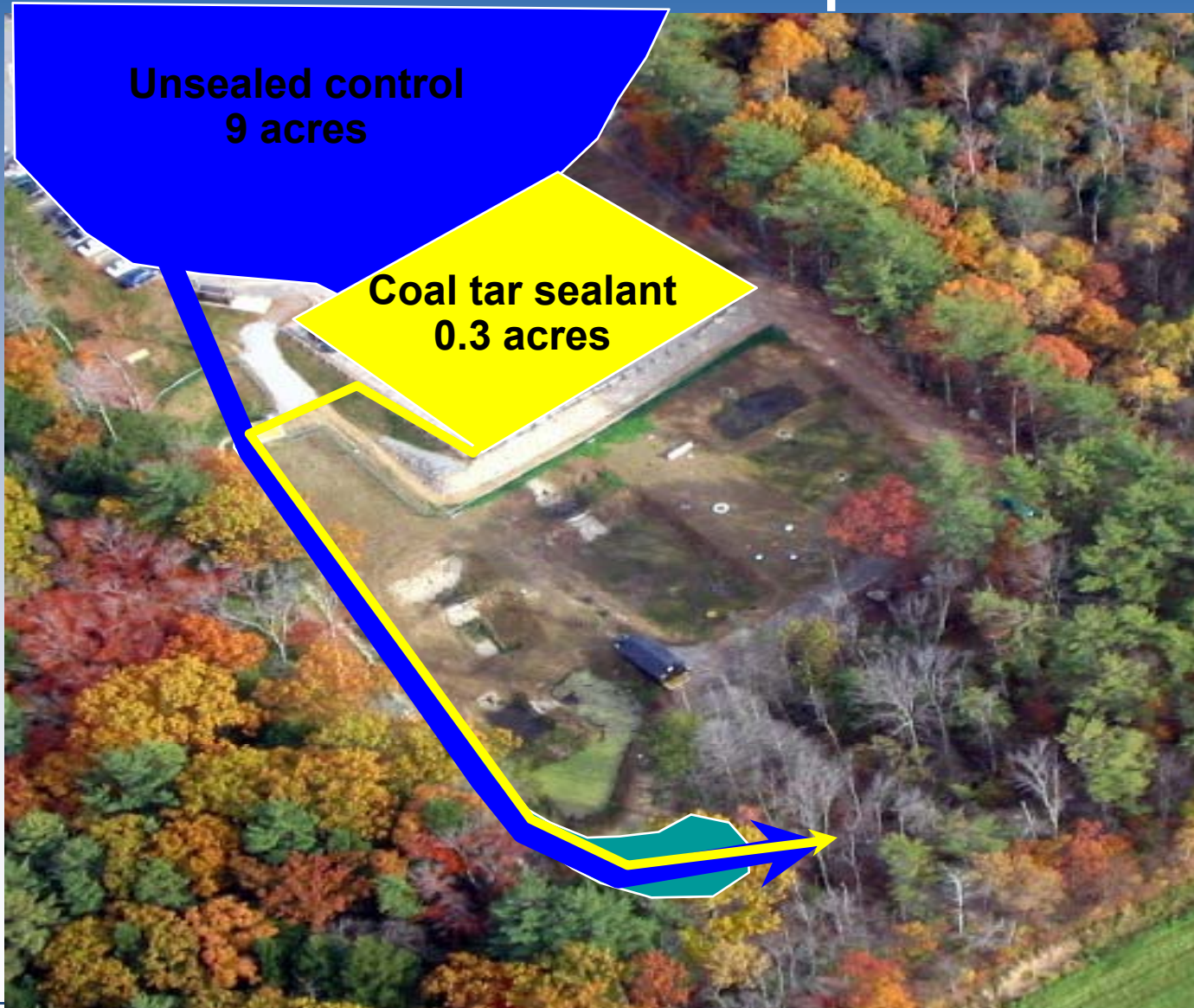
# PAH ( $\Sigma$ 16) Concentrations Unfiltered Composite Stormwater Samples



**“First Flush ” samples collected during the first rain event**  
**EPA Surface Water Quality Criteria for total PAHs = 300ug/l**



# Sediment Samples





**Sample locations, concentrations in mg/kg**

**Pre sealant - Oct 2007**

**9 months after sealant June 2008**

**12 months after sealant Oct 2008**

**30 months after sealant April 2010**

**1.58**  
**95.7**  
**89.6**  
**9.96**



**3.08**  
**51.2**  
**58.3**  
**27.8**



**1.3**  
**10.9**  
**4.62**  
**3.6**



**0.4**  
**27.1**  
**4.18**



**0.69**  
**1.61**  
**4.32**



**4% of watershed sealcoated**

NOAA Effects Range Median = 44.7 mg/kg



## Stormwater sediments ( $\Sigma 16\text{PAH}$ ):

<b>Unsealed</b>	<b>&lt;5 mg/kg</b>
<b>4% of area sealed</b>	<b>100 mg/kg</b>
<b>100% sealed</b>	<b>1,000 mg/kg</b>

**Concentrations increase when coal tar sealant is applied to watershed surface**

# Mass of PAHs Exported in Stormwater

	Total Mass of PAHs (Kg)		
	C-Unsealed 9 acre	A-Sealed 0.3 acre	B-Sealed 0.25 acre
1. Oct-Dec 07	0.05	0.59	0.09
2. Dec-June 08	0.18	0.27	0.06
3. July-Dec 08	0.1	0.18	0.15
4. Jan-June 09	0.4	0.16	0.12
5. July-Dec 09	0.5	0.21	0.12
<b>Total per lot</b>	<b>1.23</b>	<b>1.41</b>	<b>0.54</b>
<b>Total per acre</b>	<b>0.13</b>	<b>4.27</b>	<b>2.16</b>

Wear: Approximately 25% of sealant remaining on A lot, 50% remaining on B lot.

# Mass Balance – Stormwater

## B Lot:

**Mass of PAHs applied: 9 kg**

**1,000 liters applied**

**(by volume estimates, and contractors estimate)**

**Concentration (dried) 18,000 mg/kg => 9 kg PAHs**

**50% remaining on lot: 4.5 kg lost**

**Mass in stormwater runoff: 0.5 kg**

**Verified by volume: 1,000 liters applied**

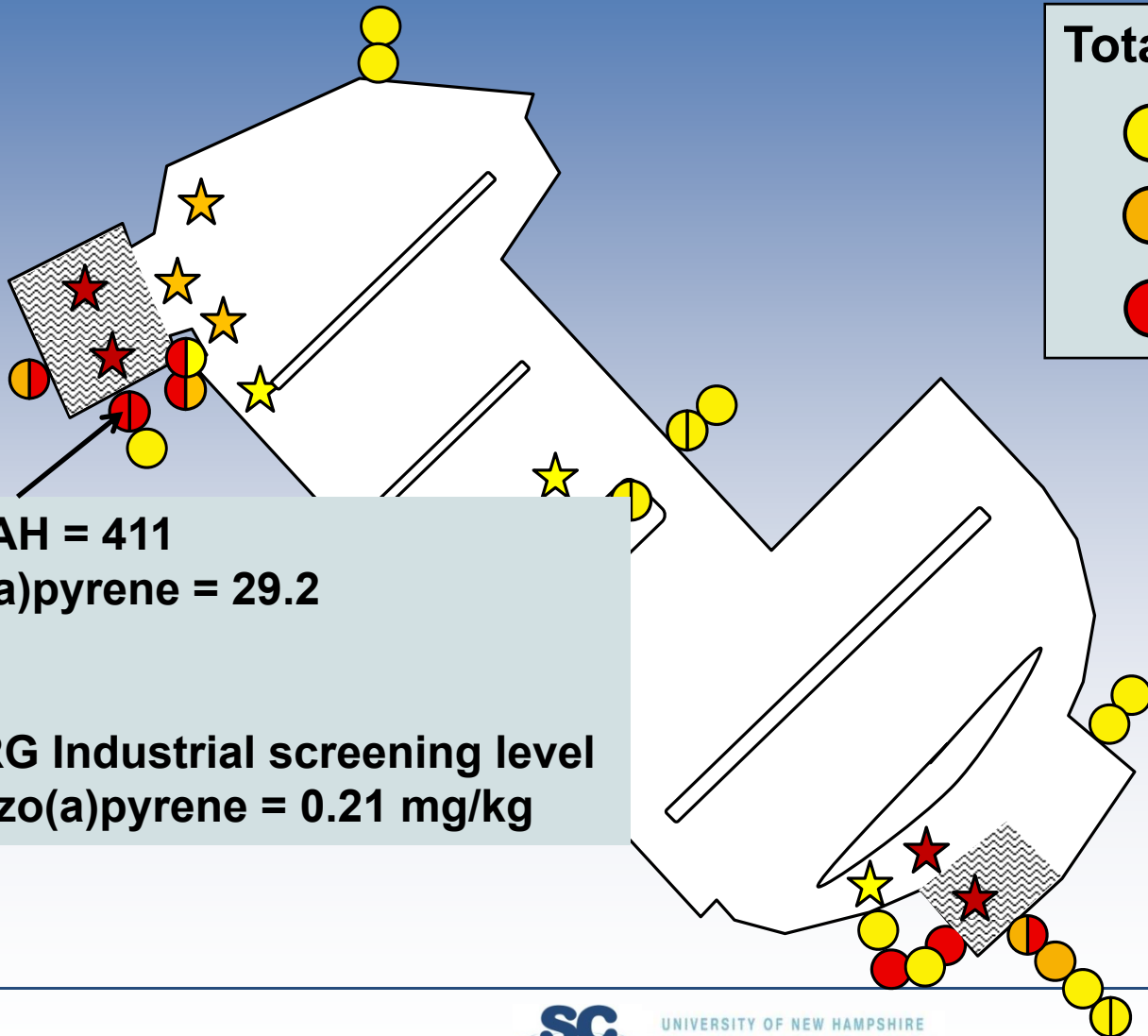
**volume of sealant particles in tree filter**

**less than 100 liters.**

**Where did the rest go?**



# PAH Concentrations in Surface Soil ● and Dust ★



## Total PAH (EPA 16)

- <10 mg/kg
- 10-100 mg/kg
- >100 mg/kg

Total PAH = 411  
Benzo(a)pyrene = 29.2

EPA PRG Industrial screening level  
for benzo(a)pyrene = 0.21 mg/kg



Sunapee NH, March 2010

# Conclusions

## **Stormwater**

PAHs from sealed surfaces at least an order of magnitude higher than from unsealed control during first two years. Concentrations decrease with time. Not the only primary pathway for PAH transport from sealed sites.

## **Surface Soil**

PAHs in adjacent surface soil up to 400mg/kg, Benzo(a)pyrene up to 29mg/kg.

## **Stormwater sediments**

PAHs <5 mg/kg in unsealed areas,  $\approx$  100mg/kg in structures receiving flow from mixed surfaces,  $\approx$  1,000mg/kg in fully sealed watershed.

## **Application Matters**

Best management practices could reduce 'first flush' concentrations, but contractors should not be relied upon to enforce.

# QUESTIONS?

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or search “UNH stormwater”