PAHs and Parking Lots: A Field Study of PAHs Exported from Sealed and Unsealed Parking Lots

EPA's Stormwater Pollution Prevention Series:
Stormwater, Coal-Tar Sealcoat and Polycyclic Aromatic Hydrocarbons

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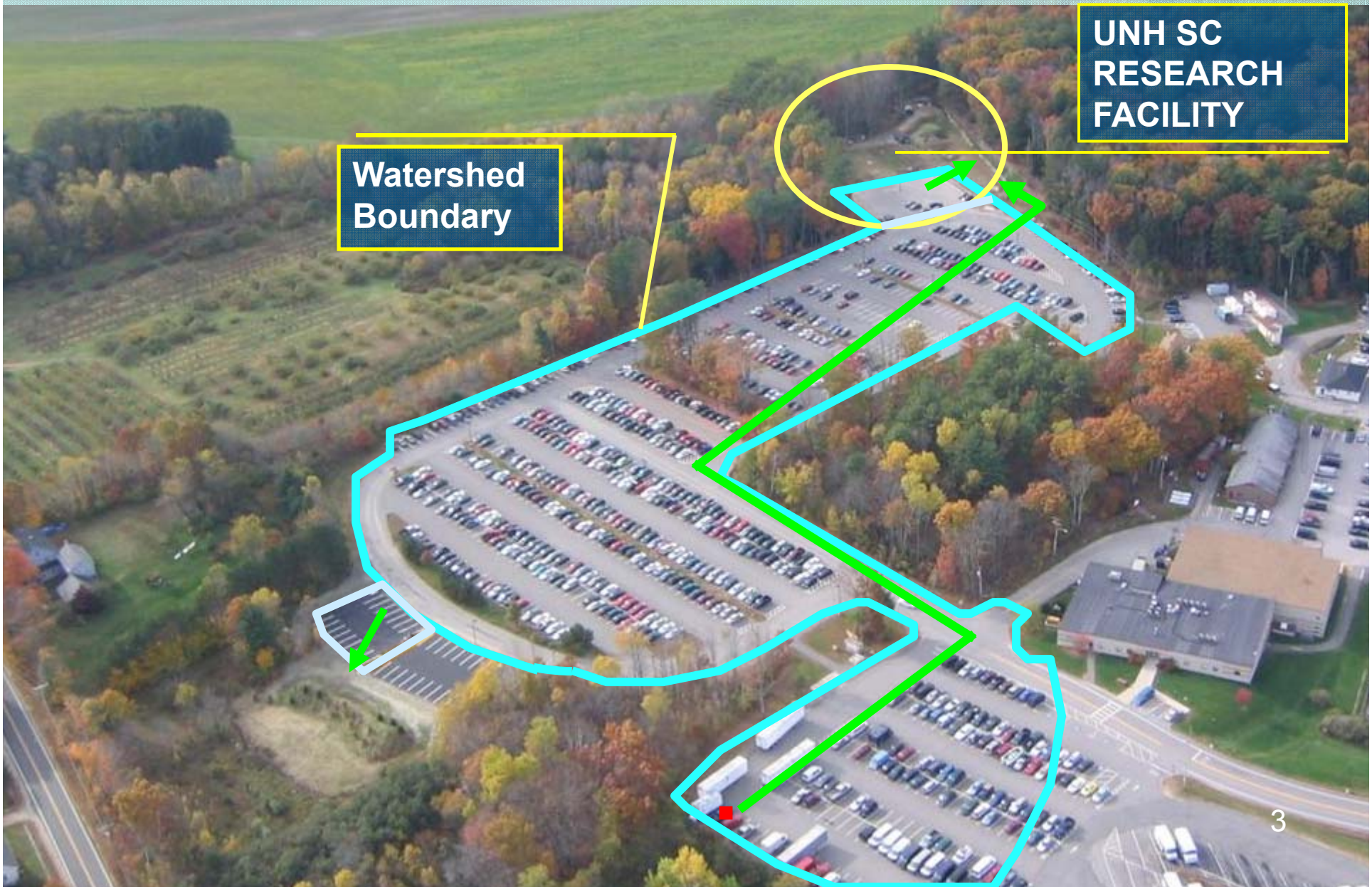
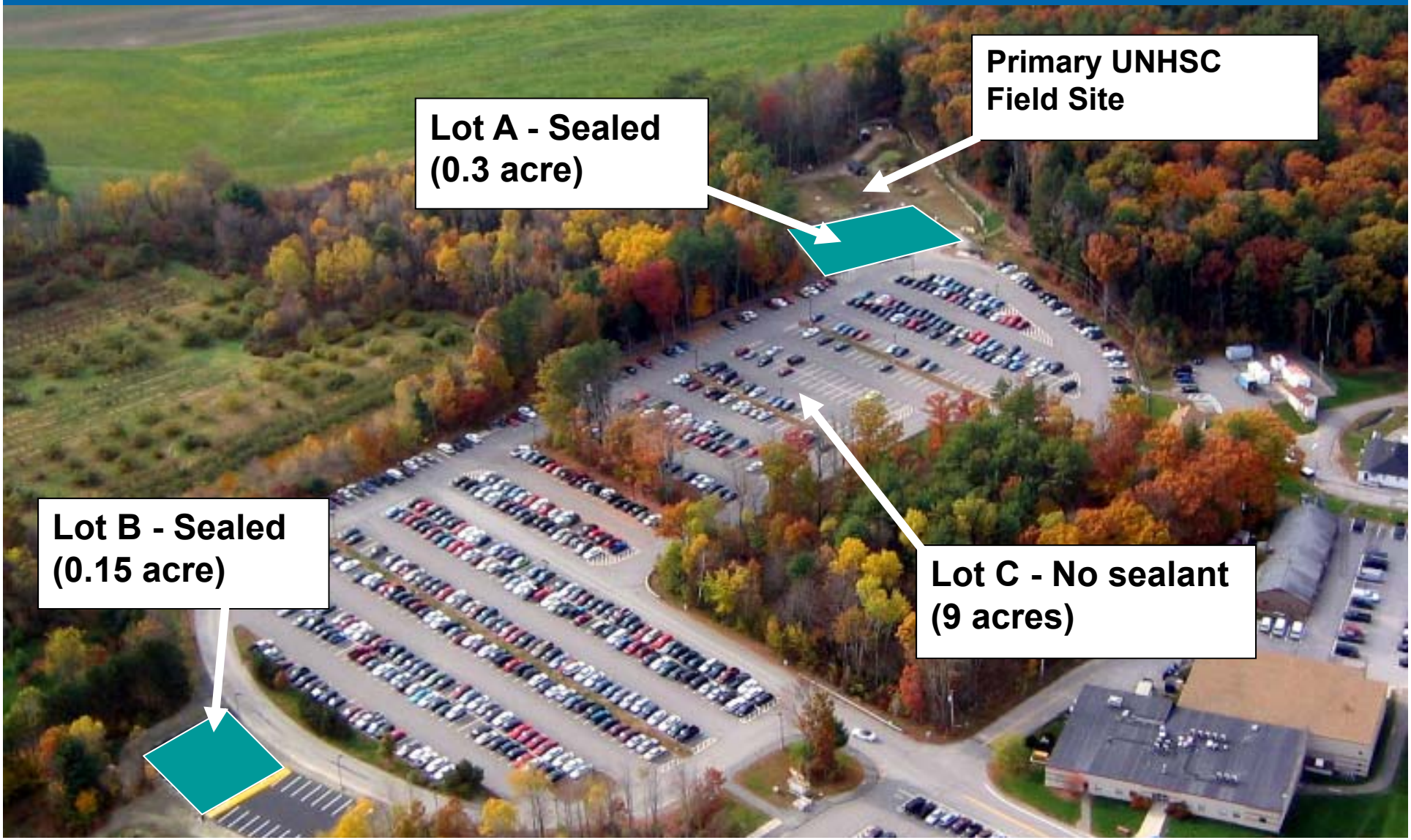
UNIVERSITY OF NEW HAMPSHIRE
STORMWATER CENTER

Dedicated to the protection of water resources through effecti stormwater management

Field Facility at the UNH WEST EDGE LOT



UNHSC Study
Controlled field experiment



Where do

Where does it go?

Abrasion/Plow/Tire tracking

Solar/temperature weathering

Stormwater

Wind

Sampling

Objective – Measure mass of PAH in each pathway

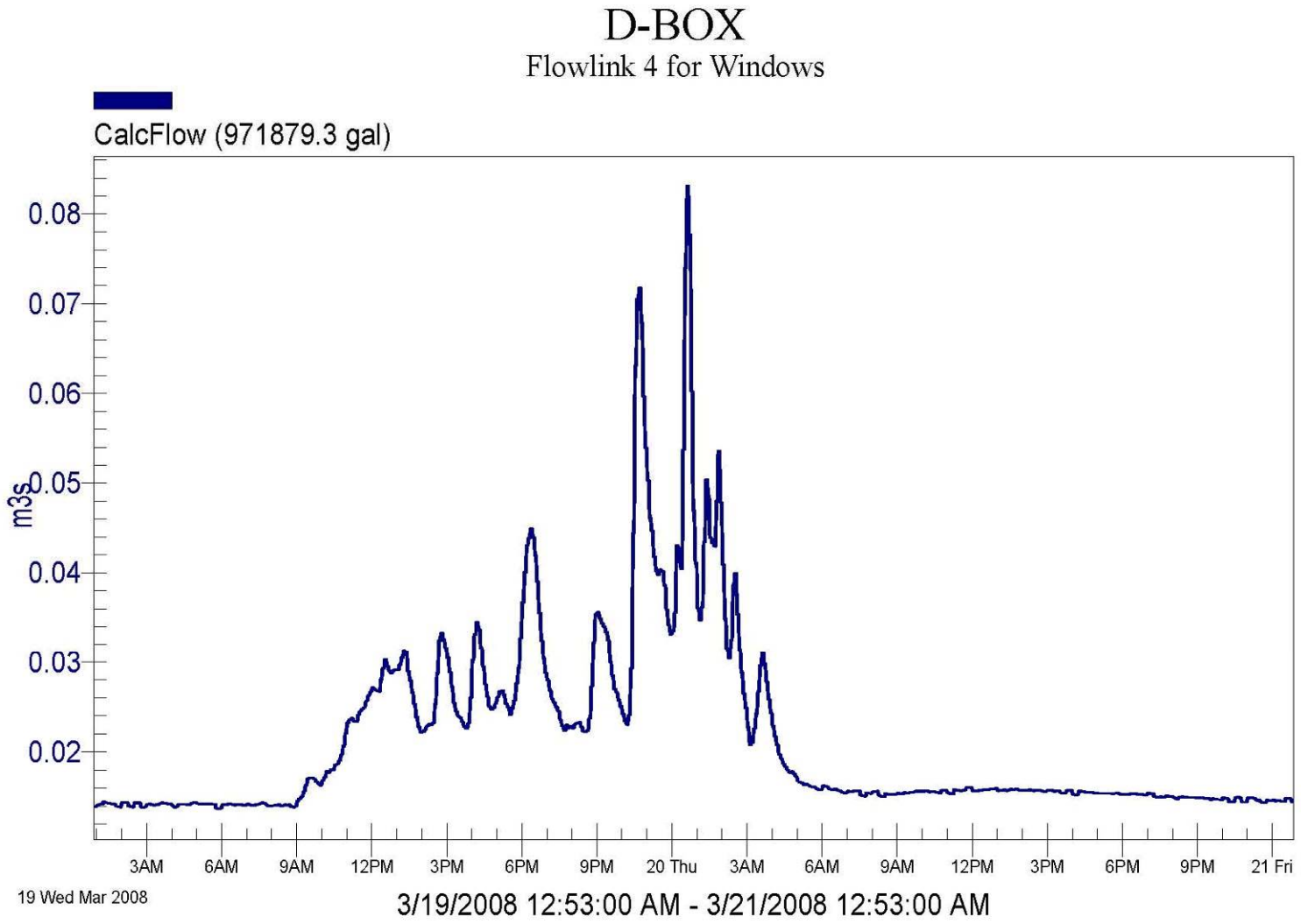
- Stormwater runoff (24 storms, 11/07-12/09)
- Downstream sediments Swale, stormwater devices
- Adjacent surface soil
- Pavement dust
- Air

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

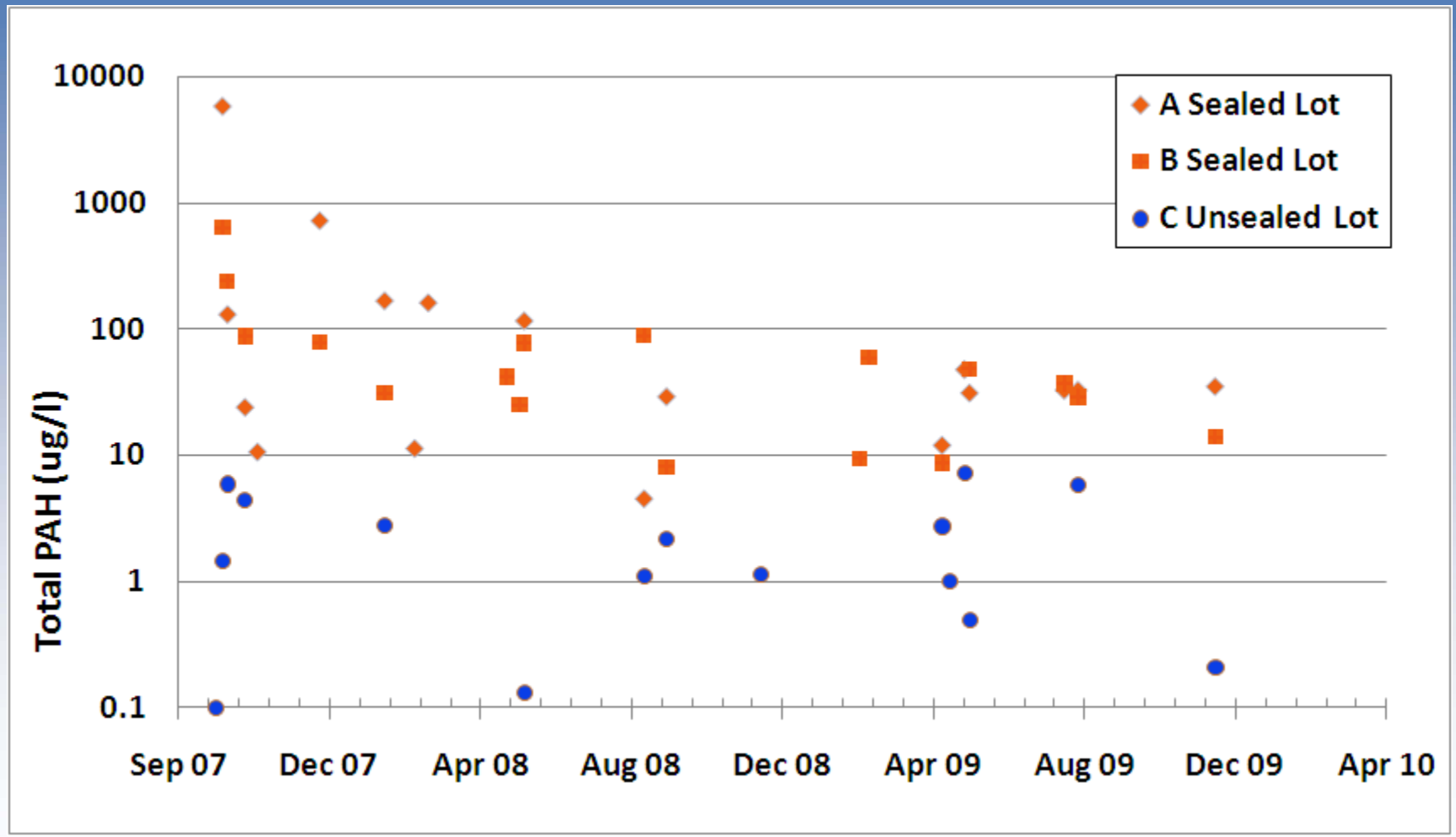
Real Time

Automated Samplers

Stormwater Sampling

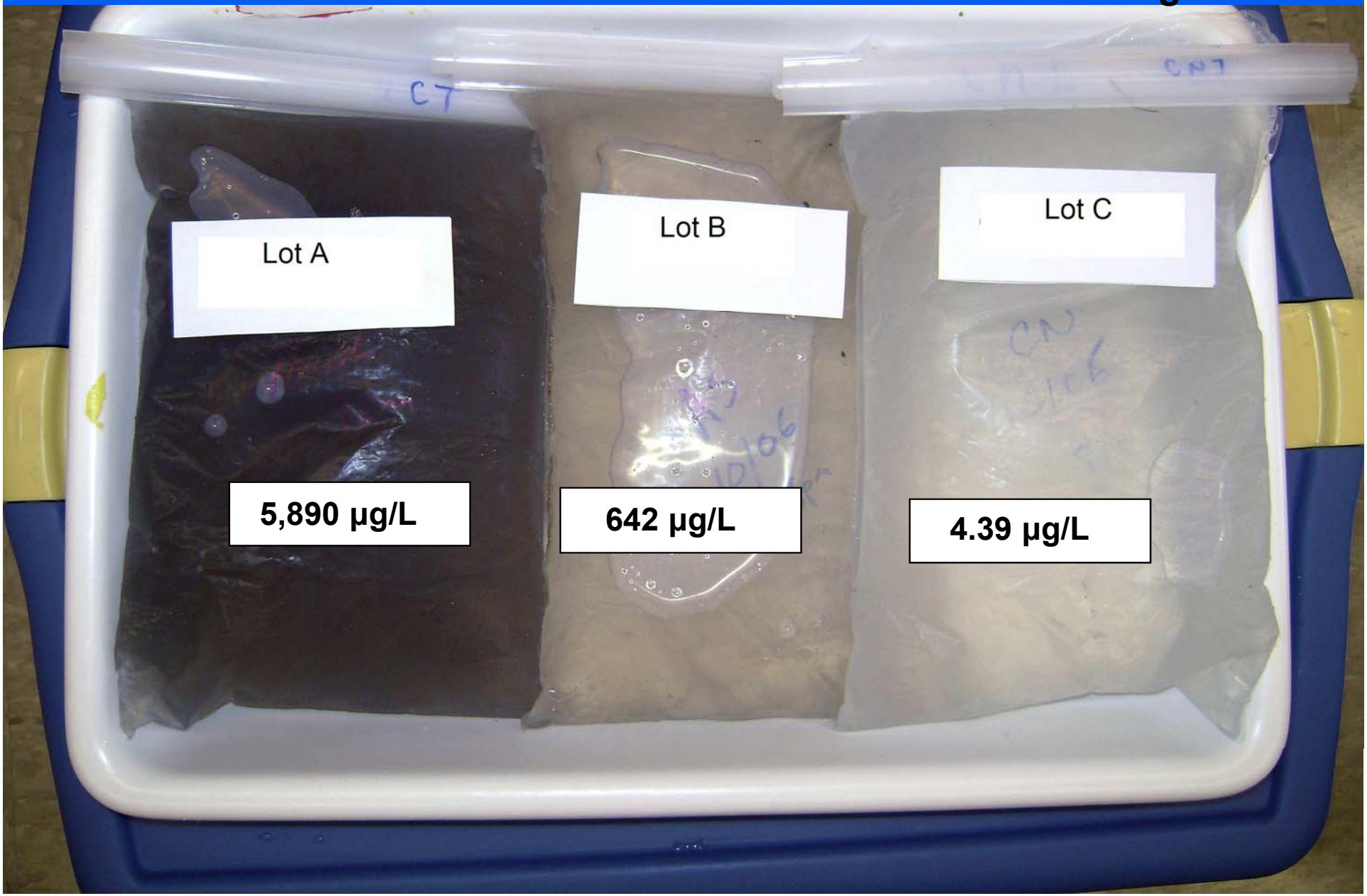


PAH (Σ 16) Concentrations
Unfiltered Composite Stormwater Samples



“First Flush ” samples collected during the first rain event

EPA Surface Water Quality Criteria for total PAHs = 300ug/l



How often does washoff occur?
- not known-

Sealant manufacturer (Neyra[1]) specifies:

1. Apply coating when pavement temperature is a least fifty (50) degrees F. and air temperature is fifty (50) degrees F. and rising.
2. Apply coating during dry weather and when rain is not anticipated within eight (8) hours after application is completed.

UNHSC Sealant applied on October 5, rained approximately 24 hours after application

Date	Min Temp (F)	Max Temp (F)	Precipitation (in)
October 5, 2007	50.1 (6:33)	83.2 (15:56)	0
October 6, 2007	57.16 (7:15)	79.8 (13:38)	0.58 (19:00)

[1] Neyra Contractor Application Specifications for Tarconite. Section 02785. Pavement Sealing Specification.

Mass of PAHs Exported in Stormwater

	Total Mass of PAHs (Kg)		
	C-Unsealed 9 acre	**A-Sealed** 0.3 acre	**B-Sealed** 0.15 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
Total per lot	**1.23**	**1.41**	**0.54**
Total per acre	**0.13**	**4.39**	**3.98**

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

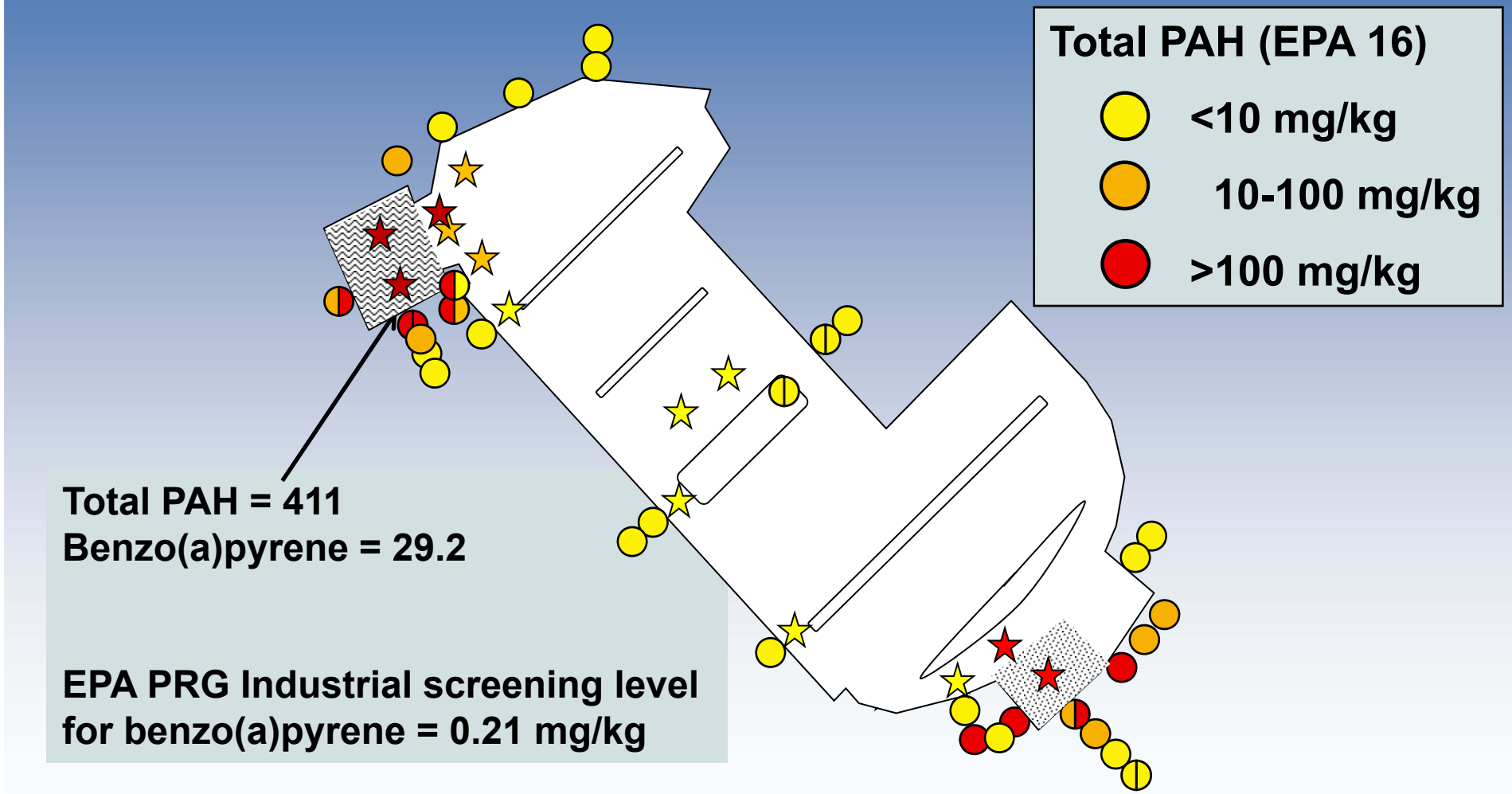
50% remaining on lot: 4.5 kg lost

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.

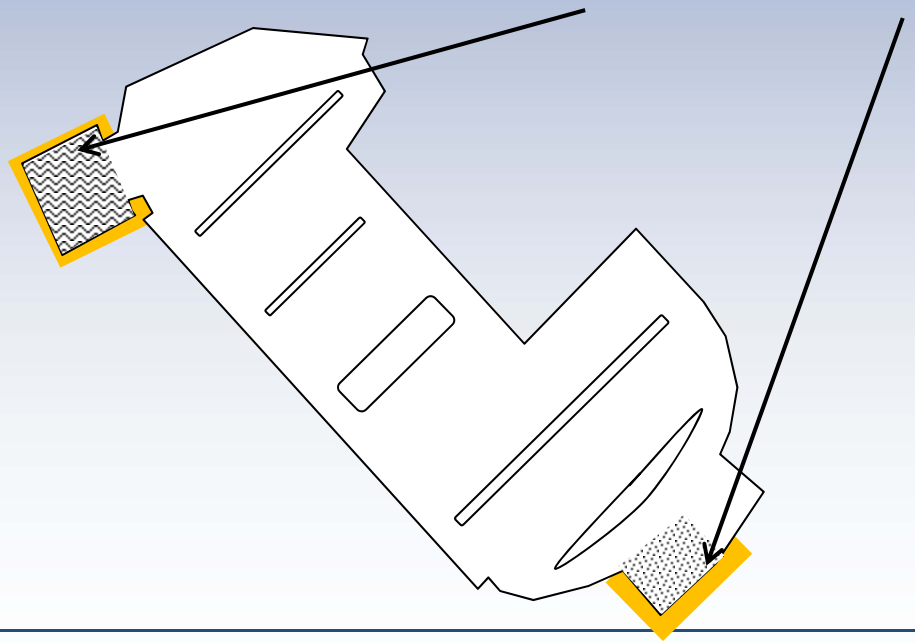
Where did the rest go?

PAH Concentrations in Surface Soil and Dust

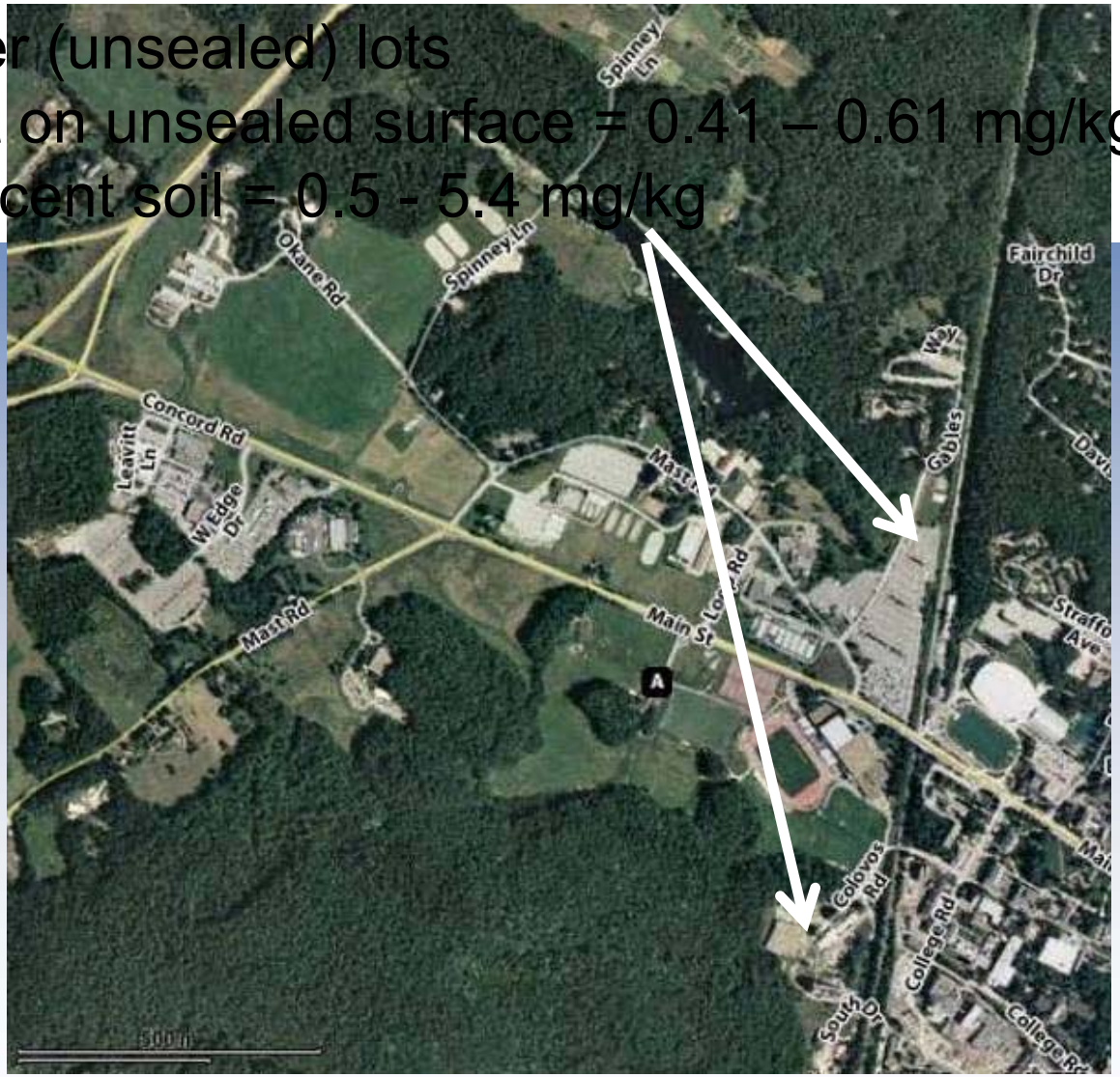


Mass of PAHs in Adjacent Surface Soil

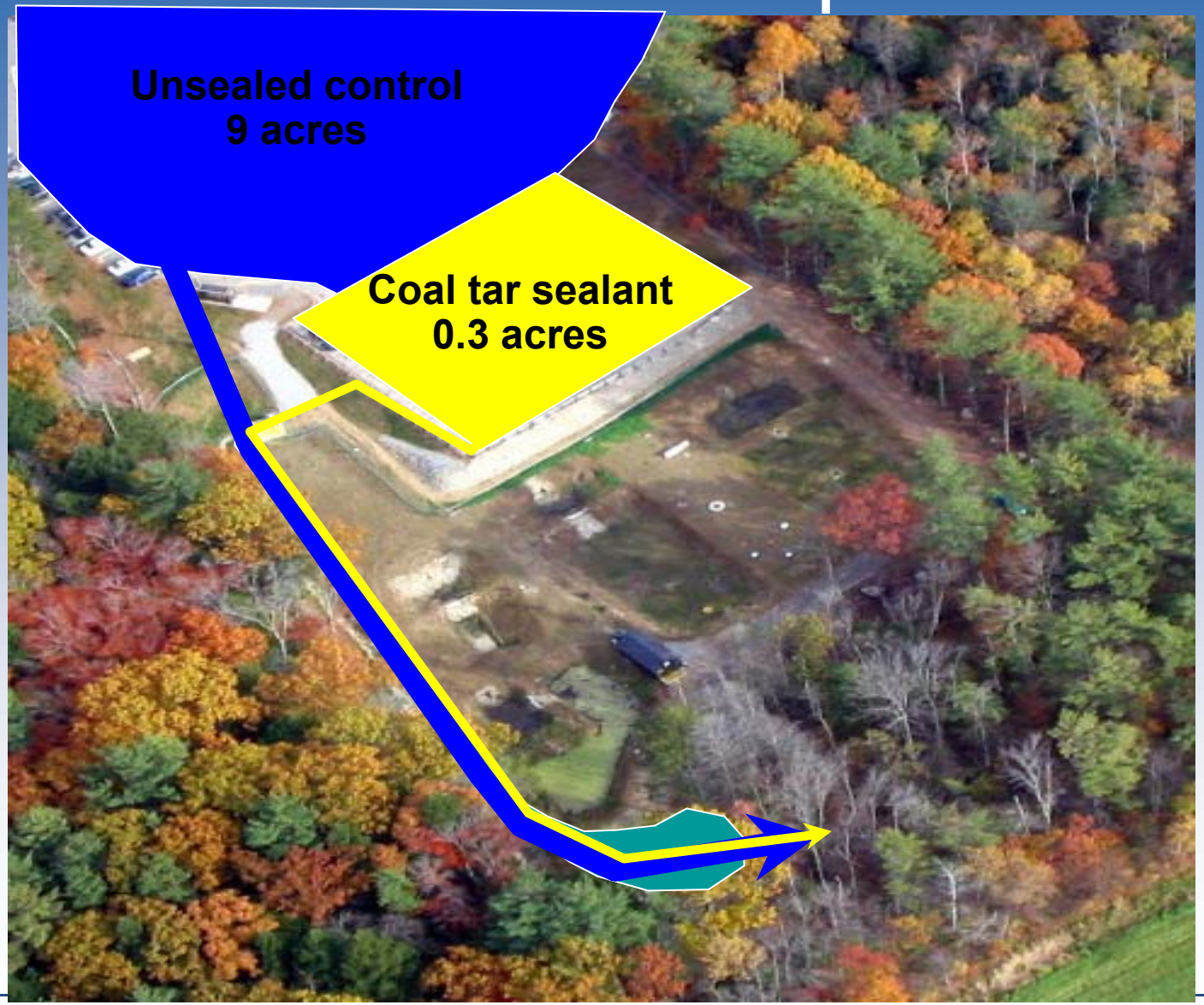
	C-Unsealed 9 acre	A-Sealed 0.3 acre	B-Sealed 0.25 acre
Concentration (mg/kg)	0.25-6.01	0.63-411	3.1-219
No. of Samples	11	12	10
		1.4 kg PAH	**1 kg PAH**

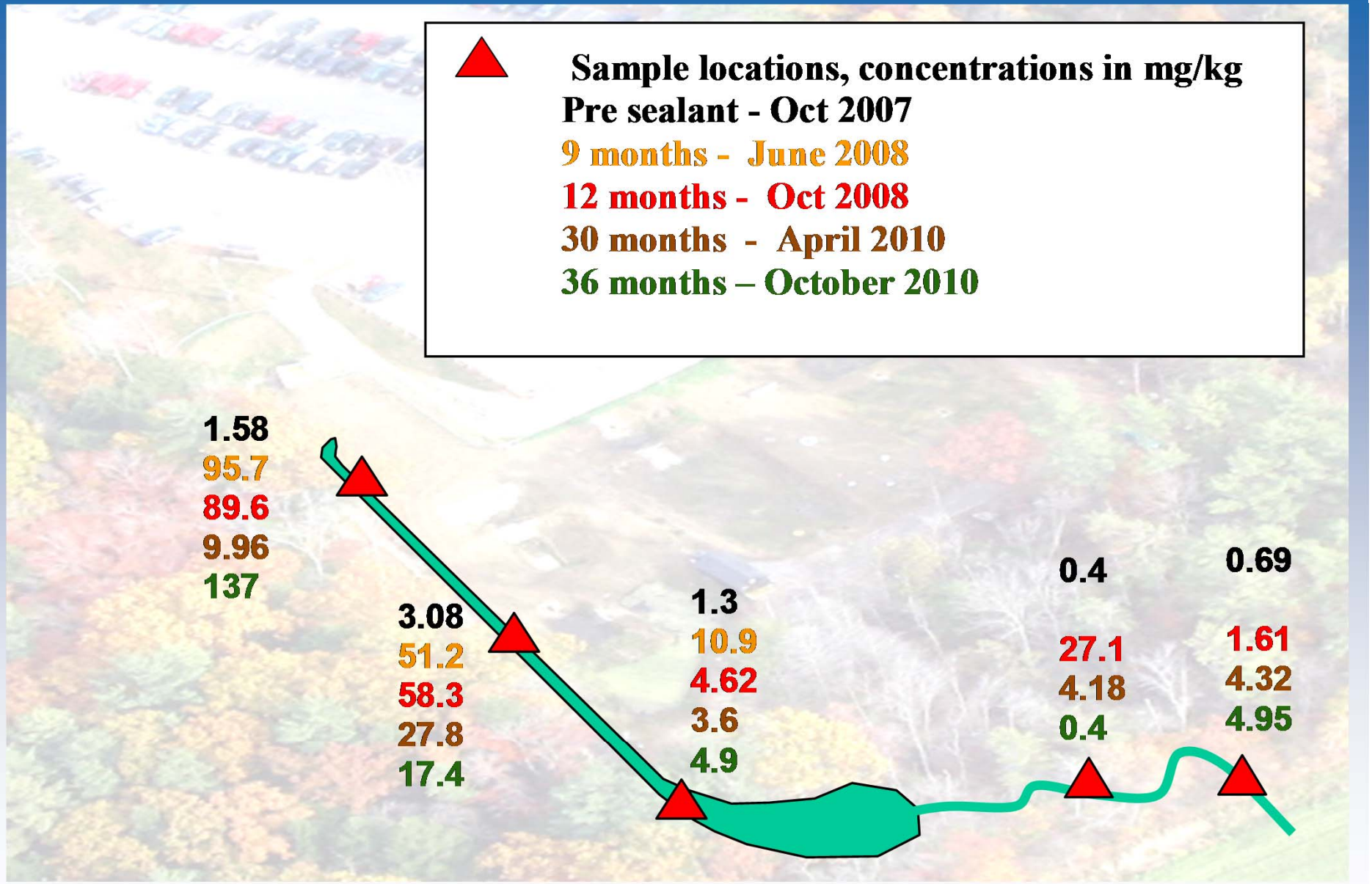


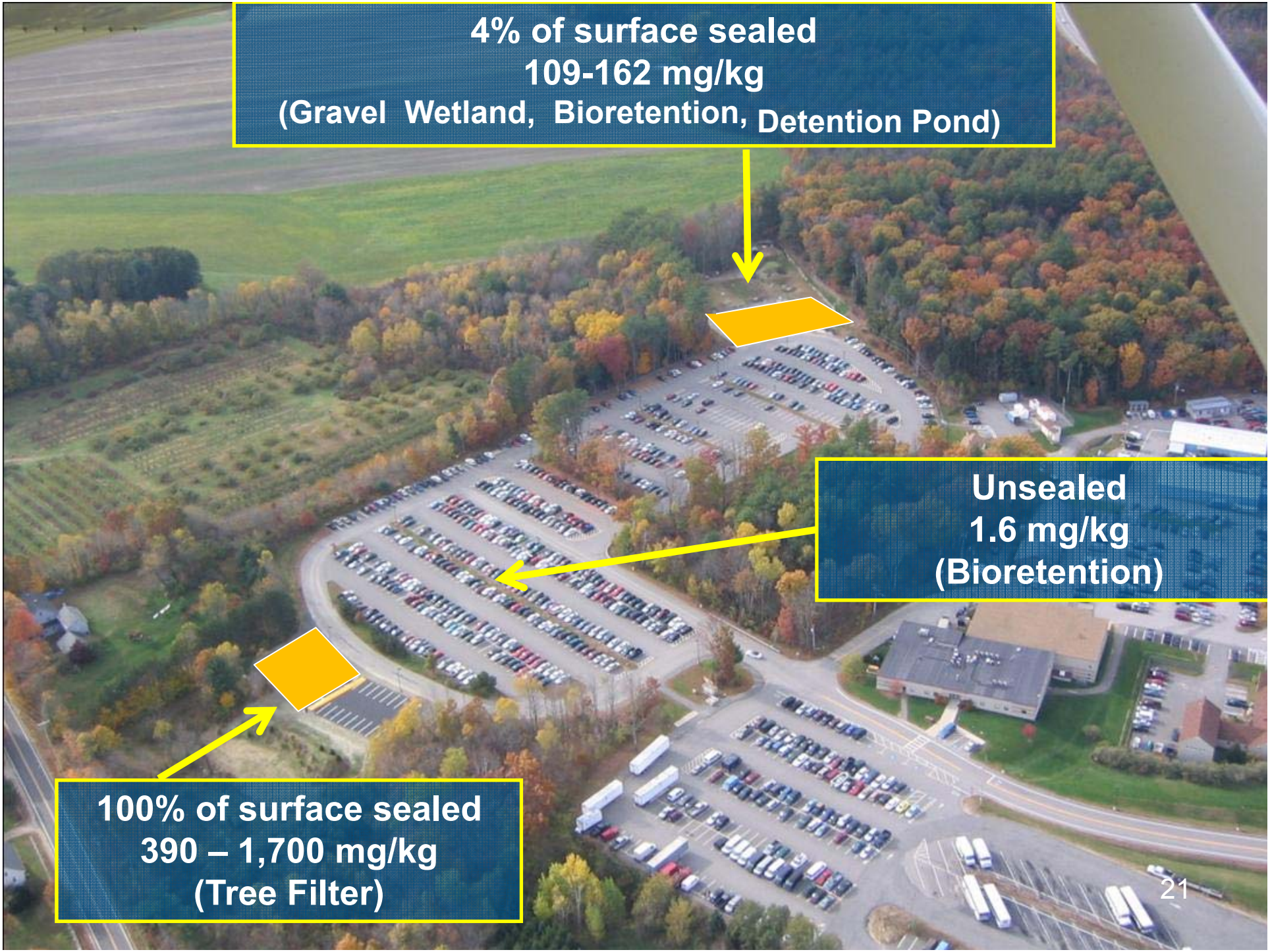
Other (unsealed) lots
Dust on unsealed surface = 0.41 – 0.61 mg/kg
Adjacent soil = 0.5 - 5.4 mg/kg



Sediment Samples




Sample locations, concentrations in mg/kg
Pre sealant - Oct 2007
9 months - June 2008
12 months - Oct 2008
30 months - April 2010
36 months – October 2010
1.58
95.7
89.6
9.96
137
3.08
51.2
58.3
27.8
17.4
1.3
10.9
4.62
3.6
4.9
0.4
27.1
4.18
0.4
0.69
1.61
4.32
4.95


4% of surface sealed
109-162 mg/kg
(Gravel Wetland, Bioretention, Detention Pond)
Unsealed
1.6 mg/kg
(Bioretention)
100% of surface sealed
390 – 1,700 mg/kg
(Tree Filter)

Stormwater sediments (Σ16PAH):

Unsealed	**<5 mg/kg**
4% of area sealed	**100 mg/kg**
100% sealed	**1,000 mg/kg**

Concentrations increase when coal tar sealant is applied to watershed surface

UNHSC Study Results

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 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, ≈ 100mg/kg in structures receiving flow from mixed surfaces, ≈ 1,000mg/kg in fully sealed watershed. Still elevated 4 years after application.

UNHSC FACT SHEET

Did you know...?

- Coal tar-based sealcoat contains chemicals called PAHs (polycyclic aromatic hydrocarbons) that harm fish and, with prolonged exposure, pose a risk of cancer to humans.
- Coal tar-based sealcoat is banned in several municipalities in the U.S., including Austin, Texas., Washington, D.C., and Minneapolis/St. Paul, Minn., and there is a proposal for banning it in Washington state.
- Dust with elevated levels of PAHs can get tracked into your home and may end up in your carpet.
- You can tell if a product contains coal tar by looking at the materials list. Words like "coal tar," "refined coal tar," "refined tar," "refined coal-tar pitch" or similar terms should appear on the product container.
- Got any leftover sealcoat in your garage or basement? You can dispose of old containers of sealcoat at your town's annual hazardous waste disposal day.

Find more information at:

www.unh.edu/erg/unhsc/
http://tx.usgs.gov/coring/allthingssealcoat.html

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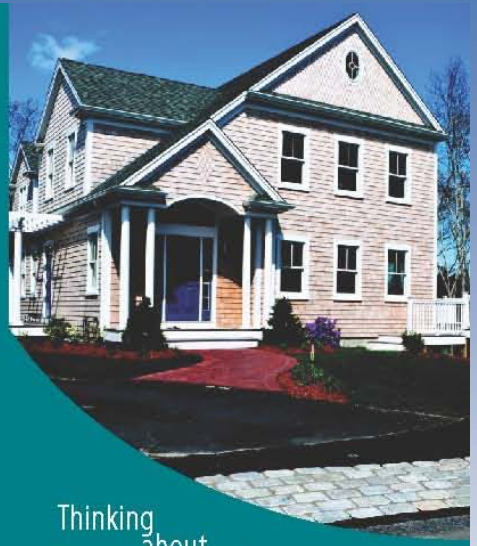

Thinking about Sealcoating your Driveway?

Get the Facts!

QUESTIONS?

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http://www.unh.edu/unhsc/

or search “UNH stormwater”

Sea Grant
Northeast Sea Grant Programs

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY