PAHs & Coal Tar Pavement Sealants: Austin’s Perspective

Springfield, Missouri
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City of Austin, Texas
Three Key Questions We Ask About Pollutants

- Does it enter the environment at significant concentrations, above recognized effect levels?
- Does it have known effects on our environment?
- Can its use be effectively reduced or eliminated?
Relevant Sealant Studies Performed

• Austin’s ban based upon over 1100 samples, at over 300 sites, in 58 watersheds

• SEALANT MOBILITY STUDIES:
  - National Lake Cores
  - Wash off Study
  - Wear off Study
  - Pavement Sweepings Study
  - Indoor Dust Study

• SEALANT AQUATIC TOXICITY STUDIES:
  - Lab Toxicity Study
  - Field Toxicity Study
  - Amphibian Toxicity Study
Key Findings

- Coal tar sealant products analyzed had a median PAH concentration of 70,000 ppm.
- Typical asphalt-based sealants had a median of 700 ppm.
- Other alternative products have even lower PAH concentrations.
- PAH loading from coal tar sealed lots was 2x as high as asphalt sealed lots.
- Probable effects from PAHs in nearly 35% of Austin’s streams.
- Mean annual loss of coal tar sealants was found to be 3.1% per year.
Key Aquatic Toxicity Findings

• Coal tar sealants are significantly toxic to aquatic organisms

• Coal tar sealants degrade local aquatic communities resulting in decline of diversity, abundance and sensitive species
What are pavement sealants?

- Coal tar sealants are surface finishes for parking lots and driveways
- Coal tar-based, Asphalt-based
- Protection, beautification
Tracing the source

<table>
<thead>
<tr>
<th>Total PAHs, ppm</th>
<th>Scrapings</th>
<th>Pking Lot Dirt</th>
<th>Tributary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Pool</td>
<td>500</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Barton Springs</td>
<td>5000</td>
<td>500</td>
<td>50</td>
</tr>
<tr>
<td>Above Pool</td>
<td>5000</td>
<td>500</td>
<td>50</td>
</tr>
</tbody>
</table>

Median: 25%-75% Non-Outlier Range
Outliers
What are PAHs?
(polycyclic aromatic hydrocarbons)

- Chemicals produced from combustion of organic materials.
- Sources include exhaust, fuel spills, barbeque, smoking.
- Many are carcinogenic and toxic.

Benzo(a)pyrene
Phenanthrene

Phenanthrene
Does it enter the environment at significant concentrations, above recognized effect levels?
Trends: PAHs Are Increasing

Van Metre and Mahler, ES&T, 2005
High PAHs in Austin stream sediments

<table>
<thead>
<tr>
<th>Creek</th>
<th>Date</th>
<th>Total PAHs, mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Bouldin Crk.</td>
<td>Mar-98</td>
<td>352</td>
</tr>
<tr>
<td>Waller Crk.</td>
<td>Aug-00</td>
<td>3,481</td>
</tr>
<tr>
<td>Onion Crk.</td>
<td>Sep-94</td>
<td>1,417</td>
</tr>
<tr>
<td>Barton Crk. Above Barton Springs</td>
<td>Nov-94</td>
<td>161</td>
</tr>
</tbody>
</table>

PEC = 22.8 mg/kg

<table>
<thead>
<tr>
<th>Effects from PAHs in Sediment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low, effects not expected</td>
<td>53%</td>
</tr>
<tr>
<td>Possible Effects</td>
<td>35%</td>
</tr>
<tr>
<td>Expected Effect</td>
<td>13%</td>
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Sealant product analysis
Typical PAH Concentrations

- Road Dust - 30 ppm
- Tire Particles - 150 ppm
- Used motor oil - 730 ppm
- Asphalt Sealant scrapings - 720 ppm
- Dirt adjacent to CTS lots - 3,000 ppm
- Coal tar Sealant scrapings - 22,700 ppm
- Highest stream sediment value - 3,500 ppm

Mahler et al. 2005
The Wash-off Study

- Sample artificial runoff from 13 parking lots
- Analyzed particles and water for PAHs
Parking lot wash off study

USGS/COA data
**Product**
- Coal Tar Sealant
- Asphalt Sealant

100 : 1 (PAH Concentration)

**Run-Off**
- Coal Tar Sealant
- Asphalt Sealant

6 : 1 (PAH Concentration)

**Scrapings**
- Coal Tar Sealant
- Asphalt Sealant

30 : 1 (PAH Concentration)

**Load**
- Coal Tar Sealant
- Asphalt Sealant

2 : 1 (mass PAH/unit area)
Parking Lot Sealcoat: An Unrecognized SOURCE of URBAN PAHs

Verifying Ballast-Water Treatment Performance
Microarray Analysis of Toxicogenomic Effects of Peracetic Acid on P. aeruginosa

PUBLISHED BY THE AMERICAN CHEMICAL SOCIETY
Key Findings

• Mean PAH concentration in coal tar lot runoff 65x higher than unsealed.

• Asphalt sealed lots had mean PAH concentrations 10x higher than unsealed.

• PAH loading from coal tar sealed lots was 2x as high as asphalt sealed lots.
USGS Dust Sampling

- Swept several square meters of at least 3 sealed and 3 unsealed lots in a small urban watershed in each city
- Composited by lot type; sieved at 0.5 mm
Sealed Parking Lot Dust

Coal tar

Asphalt

570

3,800

3,400

1,280

Unsealed Parking Lot Dust

Asphalt

Coal tar

Dust samples

Scraping samples

Total PAH (mg/kg)
Photographic Wear off Study

- Utilized digital photography and computer statistical analysis to non-destructively determine presence of sealant
- Over 150 photos of a random sampling of drive isles and parking stalls
- Age of sealant varied from 0 to 5 years
- 3.2 % mean annual loss of sealant for coal tar sealed lots
USGS Indoor Dust Study

Levels exceeded standard 36% of time
High PAHs in Austin stream sediments

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**Low, effects not expected from PAHs in Sediment (<TEC)** 53%

**Possible Effects from PAHs in Sediment (>TEC)** 35%

**Expected Effect from PAHs in Sediment (>PEC)** 13%
Estimated Releases of BaP (kg/yr) from Major Sources to the NY Harbor

- Coal Tar Sealant: 38%
- Tire Wear: 23%
- Wood Htg: 12%
- Motor Leaks: 12%
- Other: 15%
Does it have known effects on our environment?
Lab Study: Survival results, no UV
Lab Study: Survival results with UV

<table>
<thead>
<tr>
<th></th>
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<th>Asphalt</th>
</tr>
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<tbody>
<tr>
<td>Control</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>UV Low</td>
<td>10</td>
<td>84</td>
</tr>
<tr>
<td>UV Med</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>UV High</td>
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Field study: Adjacent parking lot study
Field Study: Results
Taxa Loss vs. Normalized PAH increase

\[ y = 10.971 \ln(x) - 65.578 \]
\[ R^2 = 0.894 \]
Can its use be effectively reduced or eliminated?
Support for a ban

• City conclusions are based upon over 1100 samples over a 10 year period
• More than 660,000 gallons of coal tar sealant are applied annually in Austin area – equivalent to more than 400,000 pounds of PAHs per year.
• Concentrations of PAH’s are increasing dramatically in Town Lake and over 13% of Austin streams have PAH hot spots that exceed the PEC
City response to PAH research

- Council resolution to staff to evaluate potential regulation of coal tar-based sealants - June 2003
- Voluntary ban requested - April 2004
- Councilmember Leffingwell requests mandatory ban - October 2005
- Ban passed by City Council - November 2005
Support for a ban

• USGS analysis indicates sealants may represent majority of PAH load in streams studied

• Furthermore, USGS estimates PAH load from parking lots could be reduced by 89-95% if all lots were unsealed.
Economic Impact

- Economic impacts to the industry are mitigated by the availability of a less toxic alternative, asphalt-based sealants
- No significant difference in price of alternative
The Ban

- Use prohibited in the City Limits and ETJ
- Sale prohibited unless intended application outside ETJ
- Enforcement will be complaint driven initially, then move into our existing permitting process
- Fines up to $2,000
ATTENTION!
COAL TAR SEALANT
USE IS BANNED IN AUSTIN AND ITS PLANNING JURISDICTION (ETJ). FINES UP TO $2,000 PER DAY WILL BE ENFORCED.

FOR MORE INFORMATION CALL 512-974-2550
Nationwide Cessation of Coal Tar Sealant Sales

• In 2007, both Home Depot and Lowes ended the retail sale of coal tar pavement sealants
• Based upon a sustainable business model
• Problem product + suitable replacement + similar cost = change
Challenge to Austin’s Ban

- A sealant company sought to have the State of Texas overturn the ban
- State reviewed 100’s of pages of technical and legal arguments
- State ruled in favor of ban in June 2007
- TCEQ’s Executive Director said, “the city ordinance at issue in this case is effective and efficient to control PAH contamination from coal tar sealants in Austin’s lakes and creeks.”
Alternatives

- List maintained on City’s website
- Mitigation of ban violations have used HMA, Carbonplex, or complete removal
Summary

• PAHs are a high-profile pollutant of growing concern nationwide, due to increasing concentrations in waterways

• City and USGS have discovered a major source of PAHs; Austin’s ban provided an unprecedented opportunity to eliminate a significant pollutant threat to our local water resources

• After inspecting hundreds of lots over 4 years, there have been less than 10 violations
Contact Information

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