

PUBLIC NOTICE

In accordance with the Statutes of the State of Illinois and the Ordinances of the City of Highland Park, the next meeting of the Natural Resources Commission of the City of Highland Park is scheduled to be held at the hour of 6:30 p.m. on Tuesday, November 10, 2015 at the City of Highland Park City Hall, 1707 St. Johns Avenue, Highland Park, Illinois, during which it is anticipated there will be a discussion of the following:

CITY OF HIGHLAND PARK
NATURAL RESOURCES COMMISSION
TUESDAY, NOVEMBER 10, 2015
HIGHLAND PARK CITY HALL
1707 ST. JOHNS AVENUE
HIGHLAND PARK, ILLINOIS
6:30 P.M.

MEETING AGENDA

I. Call to Order

II. Roll Call

III. Approval of Minutes: October 14, 2015

IV. Business from the Public

V. New Business

- A. Consideration of Amendments to the City of Highland Park Ethics Guideline
- B. Presentation and Discussion on Coal Tar and Other Sealants Polluting Stormwater
- C. Consideration and Approval of the 2016 Award for Meritorious Service to the Highland Park Environment Recipient(s)

VI. Old Business

- A. Discussion on the 2016 Environmental Movie Series

VII. Other Business

- A. Commissioner Comments
- B. Administrative Items

VIII. Adjournment

**MINUTES OF A REGULAR MEETING OF
THE NATURAL RESOURCES COMMISSION OF THE CITY OF HIGHLAND
PARK, ILLINOIS**

MEETING DATE: October 14, 2015

MEETING LOCATION: Presession Conference Room, Highland Park City Hall, 1707 St. Johns Avenue, Highland Park, Illinois

CALL TO ORDER

At 6:32 p.m., Chairwoman Coyle called the meeting to order and Karen Brunetti called the roll.

ROLL CALL

Members Present: Coyle, Ross, Hannick, Pagoria, Rheinstrom, Wagenius, Stone, Theodosakis and Dotson

Members Absent: Matthews and Stumpf

The Chairwoman declared that there was a quorum of the Commission present.

Staff Present: Karen Brunetti

MINUTES

A. Regular Meeting of the Natural Resources Commission—September 9, 2015

Vice Chair Ross moved to approve the minutes of a regular meeting held on September 9, 2015. Commissioner Wagenius seconded the motion. Commissioner Rheinstrom abstained. On a voice vote, Chair Coyle declared that the motion passed (5-0).

BUSINESS FROM THE PUBLIC

There was no business from the public.

NEW BUSINESS

A. Approval of a Resolution Setting the 2016 Commission Regular Meeting Dates

Commissioner Wagenius moved to approve the resolution setting the 2016 commission regular meeting dates. Commissioner Rheinstrom seconded the motion. On a voice vote, Chair Coyle declared that the motion passed (6-0).

B. Consideration and Approval on 2016 Work Action Plan

Chair Coyle led a discussion on the 2016 action plan action items. Commissioners requested that several action items be moved to different quarters. Specifically: Action Item 1 moved to second and third quarter, Action Item 2A moved to fourth quarter, Action Item 2B moved to first and second quarter, Action Item 2C moved to third quarter, Action Item 4A moved to first and second quarter, Action Item 4B moved to first quarter and Action Item 5B moved to second and third quarter.

Commissioner Hannick requested that enhancement to the community gardens in Highland Park be added to the action item list with both herself and Commissioner Pagoria as the commission leads.

Commissioner Rheinstrom move to approve as amended. Ross seconded. On a voice vote, Chair Coyle declared the motion approved (6-0).

OLD BUSINESS

- A. Update on Lighting Code Amendments and Bird Friendly Building Code
Staff Liaison Brunetti provided an update on the Plan Design Commission's consideration of the lighting code amendments and bird friendly building code which took place at their October 6, 2015 regular meeting for an initial pre-application review.

Commissioners were encouraged to attend the public hearing when the item is scheduled for the Plan Design Commission. Vice Chair Ross and Commissioner Wagenius expressed interest in attending and in providing educational background material for residents in attendance.

OTHER BUSINESS

- A. Commissioner Comments
Vice Chair Ross expressed interest in an accelerated replacement of street lights to energy efficient fixtures and bulbs owned and maintained by ComEd. Ross suggested he will look into it further and see if the City can participate and if so, will work with staff and the sustainability consultant to move the concept forward. Council Liaison Kim suggested that there may be some statement or commitment that the City can sign on to with ComEd.

Commissioners Pagoria and Wagenius stated they will be ready to add stormwater management on the agenda for November regarding coal tar sealants. Chair Coyle suggested they investigate coal tar and all other sealants as well.

- B. Administrative Items

None.

ADJOURNMENT

Commissioner Wagenius motioned to adjourn the meeting. Commissioner Ross seconded

the motion. Chairwoman Coyle adjourned the meeting at 7:25 p.m.

Respectfully Submitted,

Karen Brunetti, Assistant to the City Manager

MINUTES APPROVED BY THE NATURAL RESOURCES COMMISSION ON

- WITH NO CORRECTIONS _____
- WITH CORRECTIONS _____
(SEE MINUTES OF [_____] MEETING FOR CORRECTIONS)

DRAFT

Memorandum



To: Members of the Natural Resources Commission

From: Karen Brunetti, Assistant to the City Manager

Date: November 6, 2015

Re: Agenda Items for the October 14th Meeting of the Natural Resources Commission

NEW BUSINESS:

A. Consideration of Amendments to the City of Highland Park Ethics Guidelines

The City Council will be entertaining modifications to the City's Ethics Guidelines. The commission's feedback is welcome. Below is an overview of the proposed changes and attached is a document with highlighted changes that are being considered. The Guidelines will be included on the December 14, 2015 for formal Council consideration.

Council members have emphasized the importance that all elected officials, appointed officials and staff should be impartial, transparent, and responsible to the City; protect the welfare of residents; conduct work in a manner that prevents impropriety; and maintain the highest level of ethics and integrity. The Guidelines were updated with those priorities in mind. The Guidelines were updated in an effort to clarify the intent of the policy and increase the obligation for an individual to disclose or recuse oneself from City matters.

The Guidelines were originally adopted in November 2007, updated in 2012 and reviewed by the City Council this year. The Council expressed an interest in clarifying several provisions of the Guidelines, most notably the following:

1. Section 6, Disclosure and Recusal was expanded to add that both disclosure and recusal is required if a non for profit business entity is an applicant and the direct relationship of the applicant includes the official's spouse/domestic partner. Under the current Guidelines, an official would not have to recuse themselves if an organization appeared before the board for action and the applicant is the spouse or child of the official. The Mayor and Council members have recused themselves in the past under these circumstances although they had no obligation to do so. Under the proposed Guidelines, the official would have to disclose and recuse in the example provided.

2. For circumstances requiring disclosure but not recusal, the Guidelines were modified to add that if a family member resides with the official and has an indirect relationship with the applicant, then the relationship should be disclosed. For example, if an application appears before the Council and the official's spouse or child is an employee of that organization but has no direct benefit from the application, then disclosure would be required but the official would not have to recuse themselves from any action on the application. Also, if a council member's teenager works as a lifeguard for the Park District and the Park District is seeking zoning action from the City, the official would disclose the matter, but would not have to recuse themselves from the vote.
3. The Permitted Conduct, Section 8, was expanded from City Council members to all officials which is defined as any member of any City commission (including the Council).
4. Section 10 was added requiring an organizational interest disclosure statement that would have to be completed by every official serving on the City Council or land use related commission.

The commission is being asked to provide feedback, if any, that will be forwarded to the City Council for their formal consideration on December 14, 2015.

B. Presentation and Discussion on Coal Tar and Other Pollutants in Stormwater

Commissioners Wagenius and Pagoria will provide a presentation on this item. Barbara Mahler with the U.S. Geological Survey presented on coal tar sealants on October 15 in Barrington which was attended by Commissioner Pagoria; that presentation is linked below and attached are the presentation slides. Attached is an article regarding coal tar sealants from the U.S. Geological Survey.

The links below provide information about coal tar sealants. The first link is to a page geared for cities in Minnesota; it's also relevant to Highland Park. This first page includes a sample municipal ordinance and a link to page with background information provided by the Minnesota Pollution Control Agency.

Minnesota League of Cities Information

<http://www.lmc.org/page/1/FONL-coaltar.jsp>

Illinois bill on coal tar sealant from Sierra Club

<http://www.scribd.com/doc/258071608/2015-Illinois-Proposed-Ban-of-Coal-Tar-Pavement-Sealers>

USA Today article (2013)

<http://www.usatoday.com/story/money/business/2013/06/16/toxic-driveways-cities-states-ban-coal-tar-pavement-sealants/2028661/>

Chicago Tribune article (2013)

http://articles.chicagotribune.com/2013-03-28/news/ct-met-coal-tar-industry-pushback-20130328_1_coal-tar-asphalt-based-sealants-pavement-coatings-technology-council

Village of Winnetka Coal Tar Ordinance:

[http://library.amlegal.com/nxt/gateway.dll/Illinois/winnetka_il/title9publicpeaceandwelfare/chapter916nuisances?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:winnetka_il\\$anc=JD_9.16.020](http://library.amlegal.com/nxt/gateway.dll/Illinois/winnetka_il/title9publicpeaceandwelfare/chapter916nuisances?f=templates$fn=default.htm$3.0$vid=amlegal:winnetka_il$anc=JD_9.16.020)

[http://library.amlegal.com/nxt/gateway.dll/Illinois/winnetka_il/title5businesslicensesandregulations/chapter574pavementsealantapplicators?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:winnetka_il\\$anc=JD_Chapter5.74](http://library.amlegal.com/nxt/gateway.dll/Illinois/winnetka_il/title5businesslicensesandregulations/chapter574pavementsealantapplicators?f=templates$fn=default.htm$3.0$vid=amlegal:winnetka_il$anc=JD_Chapter5.74)

October 15, 2015 Presentation on Coal Tar Sealants in Barrington, Illinois:

<http://www.viddler.com/v/b63b7a27>

C. Consideration and Approval of the 2016 Award for Meritorious Service to the Highland Park Environment Recipient(s)

The deadline for the submittal of nominations is on November 10 at 4:00 p.m. Nominations will be forwarded to the commission under separate cover for consideration. Hard copies of the nomination applications will be brought to the meeting for review.

The Commission will consider and approve the winner for the award at this meeting and the recognition ceremony will be arranged at the Commission meeting in December. Attached is the award criteria for your reference as well as a list of previous recipients.

OLD BUSINESS:

A. Discussion on the 2016 Environmental Movie Series

As part of its annual work plan, the commission has agreed to co-host an environmental movie series. It is recommended this year that the series be planned a year-out to ensure dates and movies have been locked in and reserved. This will assist in promotion of the events and ease the coordination with multiple agencies.

The series are recommended to be shown in the Highland Park Public Library auditorium on Sunday afternoons from 2:00-4:00 p.m. The following are available dates in 2016 during this Sunday time frame:

- January 24, 2016
- February 14, 2016
- March 13, 2016
- April 10, 2016
- All Sundays May and on into the year are available as of November 1, 2015

The following are recommended films to show as part of this series:

1. Main Film: Terra Blight

(http://store.cinmaguild.com/mm5/merchant.mvc?Screen=PROD&Store_Code=nontheatrical&Product_Code=2421#Trailer). Synopsis: *Terra Blight* is a fascinating, eye-opening documentary that examines America's consumption of technology and the global problem of e-waste. The documentary traces the life cycle of computers from creation to

disposal, and uncovers how these products are disposed of and where exactly they wind up. *Terra Blight* brings us to one such landfill in Ghana, where young boys scavenge through mountains of broken computers, keyboards and laptops (including, ironically, computers that once belonged to the Environmental Protection Agency) searching for copper and other metals. The documentary also shows us a possible solution to the problem, taking us inside a new high-tech facility in the United States where e-waste is efficiently recycled.

- a. Short Film, same day: Losing the Dark (<http://darksky.org/resources/losing-the-dark/>)
2. Earth Month (April) Main Film: Wild Things (<http://www.thewildnetwork.com/film>). Synopsis: Filmmaker David Bond is a worried man. His kids' waking hours are dominated by a cacophony of marketing, and a screen dependence threatening to turn them into glassy-eyed zombies. Like city kids everywhere, they spend way too much time indoors - not like it was back in his day. He decides it's time to get back to nature – literally.
 - a. Short Film, same day: Nature RX (<https://www.youtube.com/watch?v=Bf5TgVRGND4>)
 - b. Short Film, same day: Look Up (<https://www.youtube.com/watch?v=Z7dLU6fk9QY>)
 3. Bike Month (May) to feature several film shorts or the main film: Comes With Baggage (<http://www.comeswithbaggagemovie.com/>). Synopsis: *Comes With Baggage* is a lighthearted history of bicycle travel in the Americas, that makes you want to sell your possessions, quit your job and escape on a bike. Past and current footage, along with interviews of bike pioneers, makers and historians are combined to give a unique perspective on where bicycles can take you, both physically and spiritually.
 - a. Short Film: The Man Who Lived on His Bike: <https://vimeo.com/35927275>
 - b. Short Film: Groningen: The World's Cycling City <https://vimeo.com/76207227>
 - c. Short Film: Interview with Enrique Penalosa: <http://www.streetfilms.org/interview-with-enrique-penalosa-long/> OR http://www.ted.com/talks/janette_sadik_khan_new_york_s_streets_not_so_mean_any_more?language=en
 - d. Short Film: Bike vs. car vs. transit <http://www.streetfilms.org/copenhagen%E2%80%99s-climate-friendly-bike-friendly-streets/>
 - e. Short Film: Art of the Eco Mindshift http://www.ted.com/talks/natalie_jeremijenko_the_art_of_the_eco_mindshift?language=en
 4. Main Film: Project Ice (<http://projecticemovie.com/>). Synopsis: Formed by ice, filled by ice, often covered by ice, the Great Lakes encapsulate human exploration, migration, development and where we're headed. *PROJECT: ICE* views North America's fresh water inland ocean through the prism of ice, from the crossroads of history, science and climate change.

ATTACHMENTS:

- City of Highland Park Ethics Guidelines with Proposed Amendments
- Coal Tar and Other Pollutants in Stormwater:
 - October 15, 2015 Presentation Slides on Coal Tar Sealants from U.S. Geological Survey
 - 2012 Coal Tar Sealant Article from U.S. Geological Survey
- Award for Meritorious Service to the Highland Park Environment:
 - Award Criteria
 - List of Previous Recipients

**CITY OF HIGHLAND PARK
ETHICS GUIDELINES**

SECTION 1. DECLARATION OF POLICIES AND PURPOSE.

The proper operation of democratic government requires that public officials of the City be independent, impartial, and responsible to the City, the sole purpose of which is to serve and protect the public health, safety and welfare of its residents. It is therefore imperative that City offices not be used for personal, financial, or political gain, or to advance the interest of family members, and that the public have confidence in the integrity of City government. City officials should not exercise favoritism in the course of performance of their duties, and no one party should receive a benefit from any City action due to a relationship with a City official, beyond that which is available to any other party seeking similar relief. In all circumstances, City officials should conduct themselves in a manner that prevents impropriety, as well as the appearance of impropriety.

The purpose of these Ethics Guidelines is to establish ethical standards of conduct for all City officials, be they members of the City Council or members of a City agency, board, or commission. These Guidelines set forth those acts or actions that are incompatible with the proper performance of a City official's duties. These Guidelines also set forth the proper course of conduct for City officials when presented with a situation that may give rise to such incompatibility or to a conflict of interest.

SECTION 2. DEFINITIONS AND RULES OF CONSTRUCTION.

“Applicant” means any person or Business Entity that is seeking an Official Action or other form of relief from any Commission or City Staff.

“Business Entity” means any firm, proprietorship, partnership, association, corporation, venture, trust, or similar organization, including, without limitation, a charitable or religious institution.

“City Code” means “The Highland Park Code of 1968,” as amended.

“Commission” means the City Council or any City board, agency, committee, or commission established by the City Council.

“Family Member” means a spouse, domestic partner, child, grandchild, parent, grandparent, or sibling, or the spouse, domestic partner, child, grandchild, parent, grandparent, or sibling of such spouse, domestic partner, child, grandchild, parent, grandparent, or sibling.

“Land Use Related Commission” means any or all of the following ~~three~~ Commissions: the City Plan and Design Review Commission, ~~the City Plan Commission~~, or the City Zoning Board of Appeals.

“Official” means any member of any City Commission.

“**Official Action**” means any legislative, administrative, appointive, or discretionary act of the City Council or City Staff.

“**Owner**” means any person that owns 0.5% or more of the subject Business Entity.

SECTION 3. COMPLIANCE WITH OTHER LAWS GOVERNING ETHICS AND CONDUCT.

These Guidelines set forth the minimum standards of conduct for Officials, and are not intended to replace or repeal other guidelines, codes, and ordinances governing the ethics, conflicts, and conduct of Officials. These Guidelines should be read in concert with, and Officials are expected to act at all times in compliance with, all relevant federal, state, county, and City laws, ordinances, and regulations governing the conduct of such Officials, including, without limitation, the following:

- A. The Illinois State Officials and Employees Ethics Act, 5 ILCS 430/1-1 *et seq.*, and
- B. The Highland Park Gift Ban Ordinance, codified at Chapter 37 of the City Code. To

the extent that these Guidelines conflict with any ~~other~~ law (including, without limitation, the Illinois State Officials and Employees Ethics Act), ordinance, or regulation, the provision that imposes the greater restriction on the Official’s conduct shall apply and control.

SECTION 4. PROHIBITED CONFLICTS OF INTEREST.

A. No Official shall engage in any business or transaction that is incompatible with the proper discharge of the Official’s official duties in the public interest or that may tend to impair the Official’s independence, judgment, or action in the performance of such duties.

B. Except as expressly permitted by these Guidelines, no Official, or Family Member thereof, shall have any interest, directly or indirectly, in any contract, work, or business of the City.

C. No Official, or Family Member thereof, shall acquire an interest, direct or indirect, in any Business Entity or in any subject matter at a time when the Official knows, or has reason to know or believe, that such Business Entity or subject matter will directly or indirectly become the subject of an Official Action.

D. Notwithstanding the provisions of this Section, an Official shall not be prohibited from having or an acquiring an interest in, or deriving a benefit from, any City contract, work or business, when the interest or benefit is due to ownership by the Official, or Family Member thereof, of less than 0.5% of a Business Entity which has a contract, work, or business with the City.

SECTION 5. PROHIBITED REPRESENTATIONS.

- A. During Term. Throughout his or her term of office:

1. No member of the City Council shall, under any circumstances, represent any Applicant at any hearing, meeting, or other assembly of any Commission, except: (a) as provided in Section 5.C of these Guidelines; and (b) the member may appear on behalf of the City Council, if duly authorized to make such an appearance; and

2. No Official serving on a Land Use Related Commission shall, under any circumstances, represent any Applicant at any hearing, meeting, or other assembly of the City Council or of any Land Use Related Commission, except: (a) as provided in Section 5.C of these Guidelines; (b) the Official (other than a member of the City Council) may represent an Applicant for which the Official is an ex-officio member of the board of directors or other governing body of such Applicant, but only upon compliance with the rules for disclosure set forth in Section 6.C of these Guidelines and the rules for recusal set forth in Section 6.D of these Guidelines; and (c) the Official may appear on behalf of the Commission of which he or she is a member, if duly authorized to make such an appearance. Nothing in these Guidelines shall be deemed or interpreted as prohibiting an Official serving on a Land Use Related Commission from representing an Applicant at a hearing, meeting, or other assembly of a Commission other than a Land Use Related Commission.

B. Post-Term. Throughout the 12-month period immediately following the conclusion of his or her term as a member of a City Commission, no Official of a Land Use Related Commission, whose term on a Commission begins on or after January 1, 2013, shall, under any circumstances, represent any Applicant at any hearing, meeting, or other assembly of the City Council or of any Land Use Related Commission, except: (a) as provided in Section 5.C of these Guidelines; and (b) the Official may represent an Applicant for which the Official is an ex-officio member of the board of directors or other governing body of such Applicant, but only upon compliance with the rules for disclosure set forth in Section 6.C of these Guidelines and the rules for recusal set forth in Section 6.D of these Guidelines. Members of the City Council are discouraged, but not prohibited, from such representations before any City Commission throughout the 12-month period immediately following the conclusion of their terms of office as members of the City Council.

C. Self-Representation. Nothing in these Guidelines shall be deemed or interpreted as prohibiting an Official from appearing on behalf of himself or herself at a hearing, meeting, or other assembly of the Official's Commission, or before City staff, upon compliance with the following:

1. If the purpose of the Official's appearance does not relate to the primary residence of that Official, then the Official shall not make such appearance except upon the prior approval of the City Council. Nothing in these Guidelines shall be deemed or interpreted as prohibiting the petition or request by the Official to the City Council for such approval.

2. The Official shall comply with the rules for disclosure set forth in Section 6.C of these Guidelines and the rules for recusal set forth in Section 6.D of these Guidelines.

SECTION 6. DISCLOSURE AND RECUSAL.

A. Circumstances Requiring Both Disclosure and Recusal.

In the following circumstances, an Official must disclose his or her interest in compliance with the rules for disclosure set forth in Section 6.C of these Guidelines, and must recuse himself or herself from any deliberation, discussion, or Official Action of the Commission in compliance with the rules for recusal set forth in Section 6.D of these Guidelines:

1. Current Representation of Applicant on Related Matters. The Official, or the Business Entity of which the Official is a member, is currently representing the Applicant appearing before the Official's Commission on the same or related matter for which the Applicant is seeking relief before the Official's Commission.

2. Current Representation of Applicant on Unrelated Matters. The Official, or the Business Entity of which the Official is a member, is currently representing the Applicant appearing before the Official's Commission on a matter that is not related to the matter for which the Applicant is seeking relief before the Official's Commission.

3. Previous Representation of Applicant on Related Matters. The Official, or the Business Entity of which the Official is a member, has previously represented, but is not currently representing, the Applicant appearing before the Official's Commission on the same or related matter for which the Applicant is seeking relief before the Official's Commission.

4. Official's Family Member as Applicant. The Applicant appearing before the Official's Commission is a Family Member of the Official.

5. For-Profit Business Entity as Applicant. The Applicant appearing before the Official's Commission is either (a) the for-profit Business Entity of which the Official is an Owner, officer, director, or employee, or (b) another Owner, officer, director, or employee of the for-profit Business Entity of which the Official is an Owner, officer, director, or employee.

6. Not-for-Profit Business Entity as Applicant – Direct Relationship. The Applicant appearing before the Official's Commission is ~~the~~a not-for-profit Business Entity of which the Official ~~is~~is, or his or her spouse or domestic partner, is either: (a) an Owner, officer, director, or employee; or (b) an ex-officio chairperson, officer, or member, except as expressly permitted pursuant to Section 8 of these Guidelines.

7. Appearance of Impropriety. The Official has a connection to the Applicant or matter before the Official's Commission such that the Official's participation in any deliberation, discussion, or Official Action related to the Applicant or matter would appear improper.

B. Circumstances Requiring Disclosure But Not Recusal.

In the following circumstances, an Official must disclose his or her interest in compliance with the rules for disclosure set forth in Section 6.C of these Guidelines:

1. Previous Representation of Applicant on Unrelated Matters. The Official, or the Business Entity of which the Official is a member, has previously represented the Applicant on a matter that is not related to the matter for which the Applicant is seeking relief before the Official's Commission.

2. Business Entity as Applicant – Indirect Relationship. The Applicant appearing before the Official's Commission is ~~either (a) a Business Entity~~ either (a) a Business Entity ~~or (b) an Owner, officer, director, or employee of a Business Entity of which the Official is a member, but of which the Official is not an owner, officer, director, or employee.~~ or (b) an Owner, officer, director, or employee of a Business Entity of which the Official is a member, but of which the Official is not an owner, officer, director, or employee. For purposes of this Section 6.B. ~~only 2,~~ only 2, "member" means (i) a volunteer for a not-for-profit, charitable or religious institution, to whom no monetary compensation is provided. (ii) a congregant of a religious institution, or (iii) any similar relationship to a Business Entity by which the ~~Official~~ Official individual receives no ~~remuneration.~~ monetary compensation.

3. Not-for-Profit Business Entity as Applicant – Indirect Relationship. The Applicant appearing before the Official's Commission is another Owner, officer, director, or employee of the not-for-profit Business Entity of which the Official is an Owner, officer, director, or employee.

4. Official as Applicant. The Official is the Applicant appearing before the Official's Commission.

C. Rules for Disclosure. Where these Guidelines require disclosure of an Official's interest, the Official shall make such disclosure as follows:

1. The Official shall state on the record (a) that he or she has an interest for which disclosure is required, and (b) the nature of that interest.

2. The Official's statement shall be made at the hearing or meeting of the Commission from which the interest requiring disclosure has arisen.

3. The Official's statement must be made prior to any deliberation, discussion, or Official Action taken by the Commission on matters involving such interest.

4. Upon making disclosure in compliance with this Subsection, the Official may participate in any deliberation, discussion, or Official Action related to the matter for which disclosure was required, unless recusal is also required, in which case the Official shall comply with the requirements of Section 6.D of these Guidelines.

5. Notwithstanding the provisions of Section 6.C.4 of these Guidelines, in the event that the Official is the Applicant appearing before the Official's Commission, the Official may not cast a vote in connection with any proposed Official Action regarding the matter for which disclosure is required.

D. Rules for Recusal. Where these Guidelines require the recusal of an Official, the Official shall recuse himself or herself as follows:

1. The Official shall first disclose the interest for which recusal is required, in accordance with and pursuant to Sections 6.C.1 through 6.C.3 of these Guidelines.

2. Following such disclosure, the Official shall depart the room in which the Commission will conduct any proceedings related to the matter for which recusal is required. The Official shall not re-enter such room until such time as the Commission concludes its deliberation, discussion or Official Action on such matter.

3. Following the disclosure required pursuant to Section 6.D.1 of these Guidelines, and until the Commission takes Official Action regarding the matter for which the Official has recused himself or herself, the Official shall not communicate in any manner regarding the matter for which the Official has recused himself or herself with (a) any other member of the Commission from which the Official has recused himself or herself, (b) any member of the City Council, or (c) any City employee who the Official knows or should know is familiar with the matter for which recusal was required.

SECTION 7. REPRESENTATIONS BEFORE OTHER COMMISSIONS AND CITY STAFF.

A. Permitted Representations Before Other Commissions. Except as provided in Section 5 of these Guidelines with respect to members of the City Council and Officials serving on a Land Use Related Commission, an Official may represent an Applicant before an Commission other than that Official's Commission, upon disclosure by the Official at a public meeting of the Commission before which the Official is representing the Applicant (1) of his or her status as an Official, and (2) that, prior to the disclosure, he or she has not communicated with any member of the Commission before which the Official is representing the Applicant.

B. Representations Before City Staff.

1. Prohibited Representations During Term. Except as provided in Section 5.C of these Guidelines, throughout his or her term of office:

a. No member of the City Council shall, under any circumstances, represent any Applicant before City Staff regarding the issuance of a permit or approval for a matter for which: (i) the City has discretionary authority (for example, the granting of a variation or the approval of a planned development minor amendment); and (ii) the City Council has, or in the future may have, jurisdiction.

b. No Official serving on a Land Use Related Commission shall, under any circumstances, represent any Applicant before any member or division of the City's Department of Community Development regarding the issuance of a permit or approval for a matter for which: (i) the City has discretionary authority (for example, the granting of a variation or the approval of a planned development minor amendment); and (ii) a Land Use Related Commission has, or in the future may have, jurisdiction; except: (A) the Official may represent

an Applicant for which the Official is an ex-officio member of the board of directors or other governing body of such Applicant, but only upon compliance with the rules for disclosure set forth in Section 6.C of these Guidelines; and (B) the Official may represent the Commission of which he or she is a member, if duly authorized to make such an appearance.

c. No other Official shall, under any circumstances, represent any Applicant before any member or division of the City's Department of Community Development regarding the issuance of a permit or approval for a matter for which: (i) the City has discretionary authority (for example, the granting of a variation or the approval of a planned development minor amendment); and (ii) the Official's Commission has, or in the future may have, jurisdiction; except the Official may represent an Applicant for which the Official is an ex-officio member of the board of directors or other governing body of such Applicant, but only upon compliance with the rules for disclosure set forth in Section 6.C of these Guidelines.

2. Prohibited Representations Post-Term. Throughout the 12-month period immediately following the conclusion of his or her term as a member of a Land Use Related Commission, no Official serving on a Land Use Related Commission, whose term on such Commission begins on or after January 1, 2013, shall represent any person or Business Entity before City staff regarding the issuance of a permit or approval for a matter for which: (a) the City has discretionary authority (for example, the granting of a variation or the approval of a planned development minor amendment); and (b) any Land Use Related Commission has, or in the future may have, jurisdiction; except: (i) as provided in Section 5.C of these Guidelines; and (ii) the Official may represent an Applicant for which the Official is an ex-officio member of the board of directors or other governing body of such Applicant, but only upon compliance with the rules for disclosure set forth in Section 6.C of these Guidelines. Members of the City Council are discouraged, but not prohibited, from such representations before City staff throughout the 12-month period immediately following the conclusion of their terms of office as members of the City Council

3. Permitted Representations Before City Staff.

a. A member of the City Council may represent any person or Business Entity before City staff regarding the issuance of a permit or approval for a matter for which either: (i) the City does not have discretionary authority (for example, the issuance of a building permit); or (ii) the City Council does not, and in the future will not, have jurisdiction.

b. An Official serving on a Land Use Related Commission may represent any person or Business Entity before City staff regarding the issuance of a permit or approval for a matter for which either: (i) the City does not have discretionary authority (for example, the issuance of a building permit); or (ii) a Land Use Related Commission does not, and in the future will not, have jurisdiction.

c. All other Officials may represent any person or Business Entity before City staff regarding the issuance of a permit or approval for a matter for which either: (i) the City does not have discretionary authority (for example, the issuance of a building permit); or (ii) the Official's Commission does not, and in the future will not, have jurisdiction.

SECTION 8. PERMITTED CONDUCT ~~CITY~~ ~~COUNCIL~~
OF MEMBERS OFFICIALS.

Nothing in these Guidelines shall be deemed or interpreted as prohibiting: (a) a member of the City Council from participating in any deliberation, discussion, or Official Action of the City Council related to an entity for which the City Council member serves in an advisory, representative, ex-officio, or similar capacity through appointment or confirmation by the City Council, and solely as a result of his or her status as a member of the City Council; or (b) an Official from participating in any deliberation, discussion, or Official Action of the Official's Commission that is not specific to, and does not involve any payment to, a Business Entity of which the Official or his or her Family Member is an Owner, officer, director, employee, or member, but rather is merely related to a general subject matter that directly or indirectly affects, or is affected by, such Business Entity.

SECTION 9. MISCELLANEOUS PROHIBITIONS.

A. Abuse of Power. No Official shall use the power or prestige of a City office or Commission for private financial gain.

B. Confidentiality. No Official shall disclose confidential information concerning the property, government or affairs of the City, or use such information to advance the personal or financial interests of any party, except upon receipt of proper legal authorization.

C. Use of Public Property. No Official shall use, or permit to be used, any property owned by the City, including without limitation, City vehicles, for the profit or convenience of the user, except as expressly authorized by an administrative order of the City.

SECTION 10. ORGANIZATIONAL INTEREST DISCLOSURE STATEMENT.

On or before January 31 of each calendar year, each Official serving on the City Council or a Land Use Related Commission, must file with the City Clerk, on a form to be provided by the City Clerk, a statement identifying all Business Entities: (a) that have conducted business with the City during the preceding calendar year; and (b) of which the Official, or a Family Member thereof who resides with the Official, is an Owner, officer, director, or employee. All statements filed pursuant to this Section 10 will be subject to disclosure pursuant to the Illinois Freedom of Information Act, 5 ILCS 140/1 et seq.

Document comparison by Workshare Compare on Thursday, June 18, 2015
1:34:11 PM

Input:	
Document 1 ID	interwovenSite://HKDMS/Active/11240373/4
Description	#11240373v4<Active> - HP: June 2012 Ethics Guidelines
Document 2 ID	interwovenSite://HKDMS/Active/35292687/8
Description	#35292687v8<Active> - HP: April 2015 Ethics Guidelines
Rendering set	Standard

Legend:	
Insertion	
Deletion	
Moved from	
Moved to	
Style change	
Format change	
Moved deletion	
Inserted cell	
Deleted cell	
Moved cell	
Split/Merged cell	
Padding cell	

Statistics:	
	Count
Insertions	24
Deletions	12
Moved from	2
Moved to	2
Style change	0
Format changed	0
Total changes	40

Coal-Tar-Based Pavement Sealcoat and PAHs: Implications for the Environment, Human Health, and Stormwater Management

Barbara J. Mahler,^{†,*} Peter C. Van Metre,[†] Judy L. Crane,[‡] Alison W. Watts,[§] Mateo Scoggins,^{||} and E. Spencer Williams[⊥]

[†]U.S. Geological Survey, Austin, Texas 78754, United States

[‡]Minnesota Pollution Control Agency, St. Paul, Minnesota 55155-4194, United States

[§]University of New Hampshire, Durham, New Hampshire 03856, United States

^{||}City of Austin, Austin, Texas 78767, United States

[⊥]Baylor University, Waco, Texas 76798, United States



■ INTRODUCTION

Driveways and parking lots are common features of cities, suburbs, and small towns. Most single-family residences in the U.S. have paved driveways, and we encounter parking lots at multifamily residences, schools, offices, and commercial businesses. Most people in developed countries, when outdoors, probably spend as much time walking on pavement as on any other type of surface.

There are differences among paved surfaces, however. Most pavement is concrete or asphalt. The asphalt pavement of many parking lots, driveways, and even some playgrounds in North America is sprayed or painted with a black, shiny coating referred to as “sealcoat,” “pavement sealant,” or “driveway sealer” (Figure 1A). Sealcoat is marketed as improving pavement appearance and increasing pavement longevity.¹ In addition to making pavement black, however, one type of commonly used pavement sealcoat contains refined coal tar and is a potent source of polycyclic aromatic hydrocarbons (PAHs).^{2–8} The contribution of pavement sealcoat to PAH contamination of soils, lakes, and homes has only recently been recognized.^{4–6}

Coal-Tar-Based Sealcoat: A Newly Identified Source of PAHs. The two primary sealcoat product types on the market are refined coal-tar-pitch emulsion and asphalt emulsion. Coal-tar pitch, a known (Group 1) human carcinogen,⁹ is the residue remaining after the distillation of crude coal tar (a byproduct of the coking of coal), and contains about 200 PAH compounds.¹⁰ Most coal-tar-based sealcoat products consist of 20–35% coal-tar pitch as the binder. Asphalt is the residue remaining after the distillation of crude oil and is the binder in asphalt-based sealcoat products. Although the two sealcoat product types are

similar in appearance, PAH concentrations in coal-tar-based sealcoat are about 1000 times higher than those in asphalt-based sealcoat¹¹ (Table 1).

In the U.S., coal-tar-based sealcoat is used primarily east of the Continental Divide, and asphalt-based sealcoat is used primarily west of the Continental Divide.³ Coal-tar-based sealcoat also is used in Canada.¹² Geographic differences in use in North America likely are a historical and economic artifact of the location of most coal-tar-distillation plants near steel mills, which historically were (and are) in the central and eastern United States. An estimated 85 million gallons (320 million liters) of coal-tar-based sealcoat are used annually in the United States.¹¹

The pavement sealcoat issue has been evolving since 2000, when PAH concentrations were discovered to be increasing in many urban lakes across the United States,¹⁵ even as concentrations of other contaminants like lead, polychlorinated biphenyls (PCBs), and DDT were decreasing.^{16,17} This was an apparent reversal from earlier reports that PAH concentrations in the U.S. were decreasing in response to reduced emissions from power plants and industries.^{18,19} The earlier studies, however, had focused on lakes in undeveloped watersheds, whereas the upward trends in PAHs were in lakes in urban and suburban watersheds. This meant, first, that reductions in PAH emissions caused by changes in home-heating and power-generation technology had been eclipsed in urban areas by some other urban source of PAHs,¹⁵ and second, that this other source was specific to urban and suburban areas.

A breakthrough in understanding urban sources of PAHs came in 2003, when staff with the City of Austin, TX, noted elevated PAH concentrations ($\Sigma\text{PAH}_{16} > 1000 \text{ mg/kg}$) in some sediment samples collected from small tributaries and drainages in largely residential areas.²⁰ Concentrations of PAHs this high are typical of contaminated soils at some manufactured gas plant Superfund sites,²¹ but cannot be accounted for by common urban sources (e.g., tire wear, vehicle emissions, asphalt).² City of Austin staff connected the dots and hypothesized that the source of the elevated PAHs was particles eroded from parking lots that were coated with coal-tar-based sealcoat.²² Since that time, an understanding has emerged of relations between coal-tar-based pavement sealcoat and PAHs in the environment.

Published: January 24, 2012

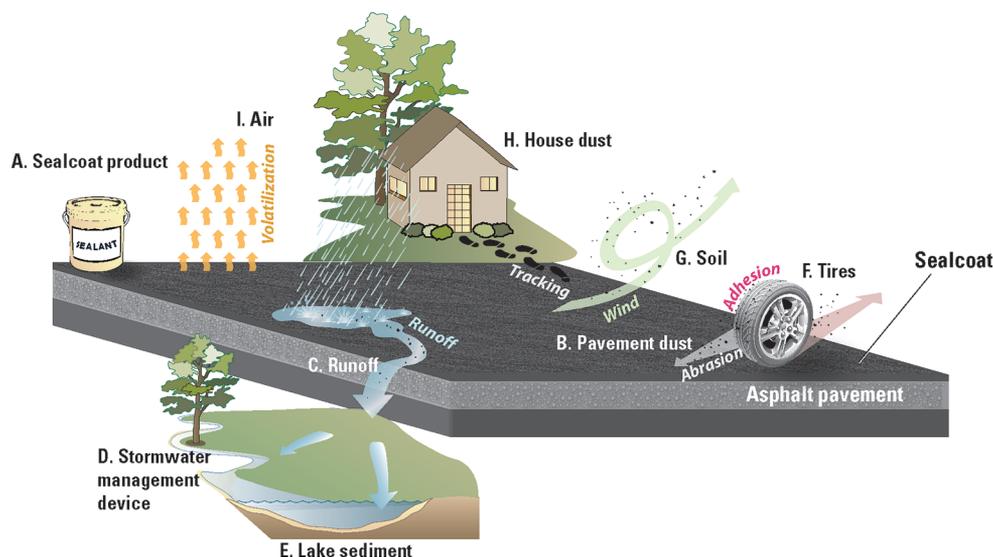


Figure 1. PAHs from coal-tar-based pavement sealcoat are transported by different pathways to various environmental compartments. Once dry, the sealcoat product (A), which contains high concentrations of PAHs, is abraded into a powder and becomes part of the dust on the pavement (B). That dust is transported by storm runoff (C) to stormwater management devices (D) or to receiving streams and lakes (E). Parking lot dust also adheres to tires (F) that track it onto unsealed pavement, and wind and runoff transport the dust to nearby soils (G). Dust particles also are tracked on shoes into residences, where they become incorporated into house dust (H). Volatile PAHs in coal-tar-based sealcoat are released into the air (I). PAH concentrations associated with each compartment and literature sources are provided in Table 1.

WHAT ARE POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)? PAHs are a large group of organic compounds composed of two or more fused benzene rings arranged in various configurations. Those with a low molecular weight (two or three benzene rings) tend to be more volatile, soluble, and biodegradable than those with a higher molecular weight (four or more benzene rings). PAHs occur naturally in coal and petroleum products and are formed by the incomplete combustion of organic matter, from fossil fuels to wood to cigarettes. PAHs have many urban sources, including used motor oil, automobile exhaust, industrial atmospheric emissions, tire particles, and asphalt.^{13,14} PAHs always occur as a mixture of different PAH compounds, and are ubiquitous in the urban environment. Of all known PAH sources, the highest concentrations are in coal tar and the related compound creosote. Most laboratories analyze only a subset of PAHs, and concentrations of total PAHs are reported as the sum of the subset analyzed as described in Table 1.

Migration of PAHs from Sealcoated Surfaces into the Environment. Sealcoat doesn't remain on the pavement surface indefinitely, and different applicators recommend reapplication from every 1 to 2 years (e.g., ref 23) to every 3 to 5 years (e.g., ref 24). Tires and snowplows, in particular, abrade the friable sealcoat surface into fine particles.^{5,11} The overall annual loss of sealcoat from parking lots in a warm climate is about 2.4% of total sealcoat applied, with wear being most rapid (about 5% per year) in driving areas.¹¹ Higher wear rates have been noted in a cold-weather climate.⁷ The mobilized sealcoat particles and associated PAHs are transported to various environmental compartments (Figure 1, Table 1).

The first compartment is the dust on the pavement surface itself, generated as the sealcoat is abraded from the surface

(Figure 1B). Concentrations of PAHs in fine particles (dust) on pavement with coal-tar-based sealcoat are hundreds of times higher than those in dust on concrete pavement or on asphalt pavement that is unsealed or that has asphalt-based sealcoat^{3–5} (Table 1). PAHs in dust on sealcoated pavement in the central and eastern U.S. are about 1000 times higher than in dust on sealcoated pavement in the western U.S., supporting anecdotal reports of geographic differences in product use³ (Figure 2).

Stormwater runoff transports abraded sealcoat particles off sealed pavement (Figure 1C, Table 1). The PAH concentration measured in particles in runoff from parking lots with coal-tar-based sealcoat (3500 mg/kg) was 65 times higher on average than the concentration in particles in runoff from unsealed asphalt and cement lots.² Concentrations in unfiltered stormwater runoff from coal-tar-sealcoated pavement are particularly elevated during the months following sealcoat application. The mean ΣPAH_{16} in stormwater runoff from a coal-tar-sealcoated parking lot during the 3 months following sealcoat application was 1357 $\mu\text{g/L}$ and the 3-month mean during the following two years ranged from 17 to 116 $\mu\text{g/L}$.⁷ This relatively elevated concentration persists for years—the median ΣPAH_{18} in stormwater runoff from a parking lot in Madison, WI, 5 years after the last application of coal-tar-based sealcoat, was 52 $\mu\text{g/L}$.²⁵ That concentration is about 10 times higher than that in runoff from a mixed-use strip mall, arterial street, and unsealed parking lot (4.8–5.7 $\mu\text{g/L}$), more than 20 times higher than in runoff from a minor arterial street and a commercial rooftop (1.8–2.4 $\mu\text{g/L}$), and about 1000 times higher than in runoff from a residential feeder street (0.05 $\mu\text{g/L}$).²⁵

In many communities, the first stop for stormwater runoff is a stormwater-retention pond or other stormwater-management device (Figure 1D), where suspended sediment and associated contaminants settle out. Stormwater ponds are designed to efficiently collect sediment-associated contaminants, which creates an unintended problem for many municipalities because PAHs accumulate in pond sediment. In 5 of 10 ponds sampled in the Minneapolis-St. Paul, MN, metropolitan area, concentrations

Table 1. Concentrations of PAHs as Reported in the Literature for Environmental Compartments Shown in Figure 1, and Definitions of PAH Summations Used

environmental compartment (Figure 1)	medium	PAH concentration (median or mean) in coal-tar-based sealcoat or affected medium	PAH concentration (median or mean) in asphalt sealcoat, affected medium, or associated with unsealed pavement	summation ^a	units	reference
A	sealcoat products	66 000	50	ΣPAH_{16}	mg/kg	11,22
B	pavement dust	2200	11	ΣPAH_{12}	mg/kg	3
		4760	9	ΣPAH_{16}	mg/kg	4
		685	<1	ΣPAH_{16}	mg/kg	5
		3500	54	ΣPAH_{12}	mg/kg	2
C	runoff, particles	3500	54	ΣPAH_{12}	mg/kg	2
	runoff, unfiltered water ^b	71	2	ΣPAH_{16}	$\mu\text{g/L}$	7
		52	5	ΣPAH_{18}	$\mu\text{g/L}$	25
D	stormwater-management-device sediment	646	2	ΣPAH_{16}	mg/kg	5
E	lake sediment ^c	33	0.4	$\Sigma\text{PAH}_{\text{CMB}}$	mg/kg	6
F	tires	1380	3	ΣPAH_{16}	mg/kg	5
G	soil ^d	105	2	ΣPAH_{16}	mg/kg	5
H	settled house dust	129	5	ΣPAH_{16}	mg/kg	4
I	air (0.03 m from pavement), 3–8 years after sealing	1320	66	ΣPAH_8	ng/m^3	28
	air (1.28 m from pavement), 3–8 years after sealing	138	26	ΣPAH_8	ng/m^3	28
	air (0.03 m from pavement), 1.6 h after sealing	297 000	66	ΣPAH_8	ng/m^3	29
	air (1.28 m from pavement), 1.6 h after sealing	5680	26	ΣPAH_8	ng/m^3	29

^a ΣPAH_{12} is the sum of concentrations of the 12 parent PAH (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, and dibenz[a,h]anthracene), which are those PAHs used in computation of the probable effects concentration (PEC) sediment-quality guideline,⁴¹ less 2-methylnaphthalene. ΣPAH_{16} is the sum of the concentrations of the 16 priority pollutants identified by the U.S. Environmental Protection Agency,⁴² equal to the sum of ΣPAH_{12} and concentrations of benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, and indeno[1,2,3-cd]pyrene. ΣPAH_{18} is equal to ΣPAH_{16} plus concentrations of 1-methylnaphthalene and 2-methylnaphthalene. $\Sigma\text{PAH}_{\text{CMB}}$ is the sum of concentrations of phenanthrene, anthracene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, indeno[1,2,3-cd]pyrene, and benzo[e]pyrene. ΣPAH_8 is the sum of concentrations of phenanthrene, anthracene, 4,5-methylphenanthrene, 1-methylphenanthrene, fluoranthene, pyrene, chrysene, and benzo[b]fluoranthene. On the basis of PAH data from primarily combustion sources presented in Mahler et al.,⁴ ΣPAH_{12} is about 70–75% of ΣPAH_{16} . ΣPAH_{18} is similar to ΣPAH_{16} , as the additional compounds in the summation either are not detected or are detected at very low concentrations.^{2,25} ^bCollected >3 months after sealcoat application. ^cMeans for urban lakes with >70% PAH from sealcoat and 0–20% from sealcoat. ^dConcentration in soil adjacent to a sealed parking lot.

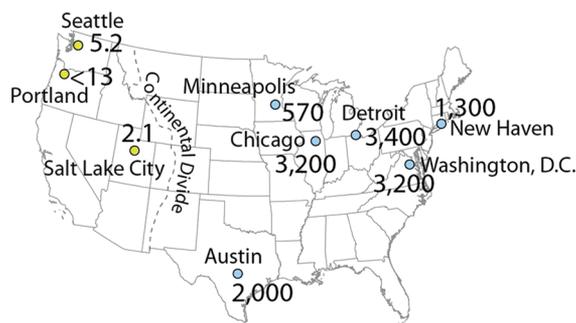


Figure 2. PAHs in dust swept from sealcoated parking lots show a striking geographic difference. PAH concentrations in dust from parking lots in central and eastern U.S. cities, where coal-tar-based sealcoat is commonly used, are about 1000 times higher than in the western U.S., where asphalt-based sealcoat is more commonly used. Concentrations are the sum of 12 PAHs (ΣPAH_{12}), in mg/kg. (Figure adapted from ref 3, Figures 1 and 2).

of PAHs in sediment exceeded Minnesota's Level 2 Soil Reference Value of 3 mg/kg benzo[a]pyrene equivalents (BaPeq), greatly increasing the cost for disposal.²⁶ Even a small amount of sealcoated pavement can be the dominant source of PAHs to sediment that collects in stormwater-management

devices, as demonstrated at the University of New Hampshire Stormwater Center.⁵ Sediment collected from a stormwater-management device receiving runoff from a parking lot with coal-tar-based sealcoat contained ΣPAH_{16} of 393–1180 mg/kg; sediment in devices receiving mixed runoff (4% sealed pavement and 96% unsealed pavement) contained 61–638 mg/kg ΣPAH_{16} ; and sediment in a device in the center of an adjacent unsealed lot contained less than 4 mg/kg ΣPAH_{16} .⁵

Some sealcoat particles that are not trapped by stormwater ponds or other collection devices are transported down streams and rivers to lakes, where they are deposited in lake sediment (Figure 1E). Do the PAHs associated with the particles constitute a majority of PAHs in urban lake sediments, and might coal-tar-based sealcoat account for many of the upward trends in PAHs reported by Van Metre et al.¹⁵ An initial indication comes from a comparison of PAH ratios, or “fingerprints”, of the dust collected from parking lots in nine U.S. cities to that of PAHs in sediment from lakes in the same watersheds.³ In the central and eastern U.S., PAH fingerprints of lake sediment and dust from sealcoated parking lots were similar, and were different from fingerprints of lake sediment and dust in the western U.S., reflecting regional differences in sealcoat product type used. A more sophisticated source-apportionment method—a statistical approach that quantifies

the contribution of sources with known PAH profiles to an environmental receptor—was used to quantify the contribution of identified urban PAH sources to PAHs in bed sediment in 40 U.S. urban lakes.⁶ Coal-tar-based sealcoat was estimated to contribute about one-half of the PAHs in the lake sediment, when averaged across the 40 lakes; vehicle-related sources and coal combustion also were important contributors. PAH concentrations in lake sediment and the proportion contributed from coal-tar-based sealcoat were greater in the central and eastern U.S. than in the western U.S. Using sediment cores, trends in PAHs were investigated for eight urban lakes; of the six with significant upward trends, source apportionment indicated that coal-tar-based sealcoat was the cause of the trend in all six of them.

Turning our attention back to sealed pavement, dust from pavement with coal-tar-based sealcoat contaminates nearby unsealed pavement, with concentrations decreasing with distance from the sealed pavement.⁵ A petrographic analysis of dust from unsealed pavement in Fort Worth, TX, found that coal-tar pitch was the dominant (92%) source of PAHs in the dust.⁸ Particles are transported by adhesion to vehicle tires and by wind from sealed to unsealed surfaces— ΣPAH_{16} in particles swept from tires driven over sealed lots were 400 times higher than in particles swept from tires driven over unsealed lots⁵ (Table 1, Figure 1F). Transport of abraded coal-tar-based sealcoat particles by wind and tires might be one reason why PAH concentrations in dust from unsealed parking lots in the central and eastern U.S. (median ΣPAH_{12} 27 mg/kg), where coal-tar-based sealcoat is predominantly used, are significantly higher than those in dust from unsealed parking lots in the western U.S. (median ΣPAH_{12} 0.8 mg/kg), where the asphalt-based product is predominantly used.³

PAHs in particles abraded from coal-tar-based sealcoat also are transported by wind, runoff, and snow removal to nearby soils (Table 1, Figure 1G). ΣPAH_{16} in surface soil adjacent to coal-tar-sealed lots at the University of New Hampshire was as high as 411 mg/kg, and concentrations decreased with distance from the sealed lot to less than 10 mg/kg.⁵ The highest concentrations were measured in areas where snow was piled adjacent to the lots during the winter months—snowplows were scraping the sealcoat off with the snow. PAHs in surface soils from commercial areas in Fort Worth, TX, were dominantly (88%) from coal-tar pitch.⁸

PAHs from pavement sealed with coal-tar-based sealcoat can contaminate the indoor environment (Figure 1H) as well as the outdoor environment. In a study in Austin, TX, apartments with parking lots with coal-tar-based sealcoat had ΣPAH_{16} in house dust that was 25 times higher, on average, than ΣPAH_{16} in house dust from apartments with parking lots with other surface types (concrete, unsealed asphalt, or asphalt-based sealcoat)⁴ (Table 1). The presence or absence of coal-tar-based sealcoat on the apartment complex parking lot was strongly correlated with PAH concentrations in house dust. Although tobacco smoking, candle and incense burning, and barbecue and fireplace use have been suggested to affect PAH concentrations in house dust, Mahler et al.⁴ found no relation between any of these and PAH concentrations in the house dust. Concentrations of individual PAHs in house dust collected from apartments in Austin adjacent to pavement with coal-tar-sealcoated parking lots were about 140 times higher than those measured in a study of house dust in California.²⁷ Lower concentrations of PAHs in house dust in California are consistent with the very low concentrations of

PAHs measured in pavement dust in the western U.S. (Figure 2), where coal-tar-based sealcoat is not commonly used.

In addition to contaminating stormwater, sediment, soil, and house dust, PAHs from coal-tar-based sealcoat contaminate air (Figure 1I). Several of the lower molecular weight PAHs in coal-tar-based sealcoat are volatile, which is why sealed parking lots and driveways frequently give off a strong smell. A recent study²⁸ reported that the flux of ΣPAH_8 from in-use parking lots with coal-tar-based sealcoat of various ages (mostly more than 3 years old) was 60 times higher than that from unsealed pavement on average. A second study²⁹ reported that ΣPAH_8 in air just after sealcoat application was hundreds to thousands of times higher than that above unsealed parking lots (Table 1), and that one-quarter to one-half of the PAHs in the applied sealcoat were lost to the atmosphere during the first 16 days following application. A mass balance indicated that ΣPAH_8 emissions from new applications of coal-tar-based sealant each year are larger than annual vehicle emissions of PAHs for the U.S.²⁹

Biological Concerns. The detrimental effects of PAHs on terrestrial and aquatic ecosystems are well documented.³⁰ For example, when fish are exposed to PAHs, they exhibit chronic effects, including fin erosion, liver abnormalities, cataracts, skin tumors, and immune system impairments leading to increased susceptibility to disease.³¹ When benthic macroinvertebrates— insects and other organisms that live at the bottom of rivers and lakes and that make up the base of the aquatic food chain—are exposed to PAHs, they are susceptible to a number of detrimental effects, including inhibited reproduction, delayed emergence, sediment avoidance, and mortality.³¹ The most important mechanism by which acute effects occur in benthic invertebrates is a nonspecific narcosis-like mode of action that results in the degradation of cell membranes.³² Ultraviolet (UV) radiation greatly increases the toxicity of PAHs in a wide variety of aquatic organisms.^{33–36}

As the importance of coal-tar-based sealcoat as a source of PAHs has emerged, several studies have looked at potential biological effects of this particular source of PAHs. When sediment was spiked with coal-tar-based sealcoat to provide a range of environmentally relevant PAH concentrations, frogs (*Xenopus laevis*) had stunted growth or delayed development at 30 mg/kg ΣPAH_{16} , and complete mortality occurred at the highest treatment of 300 mg/kg ΣPAH_{16} .³⁷ Salamanders (*Ambystoma maculatum*) and newts (*Notophthalmus viridescens*) exposed to sediment contaminated with coal-tar-based sealcoat at PAH concentrations similar to the highest treatment in the frog study had stunted growth, difficulty swimming or righting themselves, and liver problems.^{38,39} These effects were magnified by the addition of UV light.³⁸ At the community level, macroinvertebrate communities exposed to sediment spiked with coal-tar-based sealcoat had significant decreases in species abundance and richness at ΣPAH_{16} concentrations exceeding 300 mg/kg.⁴⁰ Similarly, in a study of urban streams, aquatic invertebrate communities downstream from parking lots with coal-tar-based sealcoat suffered losses of abundance and diversity along a gradient of increasing total PAH concentration, starting near the ΣPAH_{12} probable effects concentration (PEC) value of 22.8 mg/kg.^{20,41} These studies demonstrate that PAHs in sediment contaminated by coal-tar-based sealcoat are bioavailable and that environmentally relevant concentrations adversely affect amphibians and benthic communities, two robust indicators of aquatic ecosystem health. The finding of adverse biological effects to biota when exposed to

sediment with PAH concentrations near the PEC has widespread relevance: Of the 40 U.S. urban lakes investigated by Van Metre and Mahler,⁶ sediment in the nine lakes with the greatest mass loading of PAHs from coal-tar-based sealcoat had concentrations of PAHs that exceeded the PEC.

Human-Health Concerns. Coal tar and coal-tar pitch are listed as Group 1 (carcinogenic to humans) carcinogens,⁹ and the U.S. EPA currently classifies seven PAH compounds as probable human carcinogens (Group B2): benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, chrysene, dibenz[*a,h*]anthracene, and indeno[1,2,3-*cd*]pyrene.⁴² Coal tar itself is a powerful mutagen: The mutagenicity index for coal tar is about 1000 times that of asphalt cements.⁴³ However, although coal-tar-based sealcoat has been on the market since at least 1960,⁶ little has been published to date about the contribution of the sealcoat to PAH exposures and the associated potential for adverse human-health outcomes.

The elevated concentrations of PAHs in house dust, soil, air, water, and sediment associated with coal-tar-based sealcoat raise the possibility of several complete exposure pathways for humans. Incidental ingestion of house dust and soil is particularly relevant for small children, who put their hands and objects into their mouths. A recent study⁴⁴ reported that children living in homes adjacent to pavement with coal-tar-based sealcoat likely are exposed to about 14-fold higher doses of PAHs through ingestion of house dust than are children living in residences adjacent to unsealed pavement, and that exposure from ingestion of PAH-contaminated house dust is estimated to be more than double that from diet, even under conservative assumptions. Ingestion of contaminated soil is another way that children might be exposed to PAHs from coal-tar-based sealcoat, particularly given that ingestion rates of soil typically exceed those of house dust.⁴⁵ Incidental ingestion of dust directly from sealed pavement also might be important, because the extremely high concentrations of PAHs measured in these materials (Table 1) could translate to substantial doses from miniscule exposures. On a long-term basis, nondietary ingestion of PAH-contaminated house dust and soil likely are the most important routes of exposure, but a complete human-health risk analysis is required before the cancer risk associated with ingestion of these media can be quantified.

Other routes of exposure to coal-tar-based sealcoat, in addition to ingestion, might have implications for human health. Relatively high acute exposures might occur from inhalation of wind-blown particles or fumes that volatilize from sealed parking lots, especially during sealcoat application. Sealcoat applicators, in particular, might be subject to substantial inhalation exposures, but such exposures have not yet been characterized. Other potential routes include skin contact with sealcoat and abraded sealcoat particles and contaminated soil, sediment, dust, and water. Such exposures likely would be relatively infrequent and short-term. However, PAHs are readily absorbed through the skin,⁴⁶ and circumstances that increase the frequency or magnitude of exposure events, such as daily activity on pavement treated with coal-tar-based sealcoat, might be associated with increased cancer risk.

Regulatory and Retail Actions. Research to date, as documented here, provides a compelling weight-of-evidence that coal-tar-based sealcoat products are an important source of PAHs to our environment. A patchwork of actions has been taken to either ban or restrict the use of coal-tar-based sealcoat in the United States. The first ban was implemented by the City

of Austin, TX, in 2006.⁴⁷ As of January 2012, 15 municipalities and two counties in four states (Minnesota, New York, Texas, and Wisconsin), the District of Columbia, and the State of Washington had enacted some type of ban, affecting nearly 10.4 million people.⁴⁸ Other local and state jurisdictions have used voluntary or limited-use restrictions for certain groups (e.g., city government) to discourage the use of coal-tar-based sealcoat.⁴⁸

Minnesota, in particular, has been actively engaged in this issue after municipalities contacted state agencies and the Minnesota Legislature for assistance addressing PAH-contaminated stormwater pond sediment.⁴⁹ Costs for disposing of this sediment could reach \$1 billion if PAHs in sediment in just 10% of the estimated 20 000 municipal stormwater ponds in the Minneapolis-St. Paul, MN, metropolitan area exceed Minnesota's Level 2 human-health risk-based Soil Reference Value of 3 mg/kg BaPeq⁵⁰ (Donald Berger, Minnesota Pollution Control Agency, written communication, 2011). The Minnesota Legislature passed a bill in 2009 that provides small grants to local governments for use in treating or disposing of contaminated sediment in stormwater ponds, provided that the governments restrict the use of undiluted coal-tar-based sealcoat.⁴⁹ As of January 2012, 13 municipalities had passed ordinances and three municipalities have received grants for remediation of stormwater ponds.

Several national and regional hardware and home-improvement retailers have voluntarily ceased selling coal-tar-based driveway-sealer products.⁴⁸ Some private applicators have chosen to use only asphalt-based sealcoat (e.g., refs 51,52). Many professional sealcoating companies in areas unaffected by bans or restrictions use coal-tar-based sealcoat, however, and coal-tar-based sealcoat products are readily available online for purchase by homeowners.

No action has been taken at a federal level to restrict the use of coal-tar-based sealcoat. Coke product residues, such as coal tar, are not classified as hazardous waste under the Resource Conservation and Recovery Act if the product is recycled.⁵³ This exemption allows coal-tar pitch to be used in the production of aluminum (~95% of use), commercial carbon, built-up roofing, and pavement sealcoat.⁵⁴

Because PAHs are a ubiquitous and persistent class of urban contaminants, a decade or more might be required to assess the effectiveness of bans, restrictions, and/or changes in the retail availability of coal-tar-based sealcoat on reducing PAH concentrations in urban water bodies. Research on trends in the occurrence of PCBs and DDTs supports this concern. Following national bans on use of PCBs and DDT in the 1970s, it was 10–15 years before concentrations in lakes and reservoirs decreased by one-half.^{17,55} Unlike these chemicals, all sources of PAHs in urban watersheds will not be eliminated by banning coal-tar-based sealcoat. However, reductions in PAH loads over time might be sufficient to provide more options for disposal of dredged material from stormwater ponds and navigation channels and reduce risk to terrestrial and aquatic ecosystems and human health.

■ AUTHOR INFORMATION

Corresponding Author

*E-mail: bjmahler@usgs.gov.

Notes

The authors declare no competing financial interest.

■ REFERENCES

- (1) Dubey, G. *Understanding how sealcoating works ... and how it can save you money*; <http://pavementpro.org/understanding.htm>.
- (2) Mahler, B. J.; Van Metre, P. C.; Bashara, T. J.; Wilson, J. T.; Johns, D. A. Parking lot sealcoat: An unrecognized source of urban polycyclic aromatic hydrocarbons. *Environ. Sci. Technol.* **2005**, *39*, 5560–5566.
- (3) Van Metre, P. C.; Mahler, B. J.; Wilson, J. T. PAHs underfoot: Contaminated dust from coal-tar sealcoated pavement is widespread in the United States. *Environ. Sci. Technol.* **2009**, *43* (1), 20–25.
- (4) Mahler, B. J.; Van Metre, P. C.; Wilson, J. T.; Musgrove, M.; Burbank, T. L.; Ennis, T. E.; Bashara, T. J. Coal-tar-based parking lot sealcoat: An unrecognized source of PAH to settled house dust. *Environ. Sci. Technol.* **2010**, *44*, 894–900.
- (5) *Polycyclic aromatic hydrocarbons released from sealcoated parking lots – A controlled field experiment to determine if sealcoat is a significant source of PAHs in the environment*; University of New Hampshire Stormwater Center: Durham, NH, 2010.
- (6) Van Metre, P. C.; Mahler, B. J. Contribution of PAHs from coal-tar pavement sealcoat and other sources to 40 U.S. lakes. *Sci. Total Environ.* **2010**, *409*, 334–344.
- (7) Watts, A. W.; Ballester, T. P.; Roseen, R. M.; Houle, J. P. Polycyclic aromatic hydrocarbons in stormwater runoff from sealcoated pavements. *Environ. Sci. Technol.* **2010**, *44*, 8849–8854.
- (8) Yang, Y.; Van Metre, P. C.; Mahler, B. J.; Wilson, J. T.; Ligouis, B.; Razaque, M.; Schaeffer, C.; Werth, C. The influence of coal-tar sealcoat and other carbonaceous materials on polycyclic aromatic hydrocarbon loading in an urban watershed. *Environ. Sci. Technol.* **2010**, *44* (23), 1217–1233.
- (9) *Monographs on the Evaluation of Carcinogenic Risks to Humans Supplement 7: Coal-Tar Pitches (Group 1)*; International Agency for Research on Cancer: Lyon, France, 1987; <http://monographs.iarc.fr/ENG/Monographs/suppl7/Suppl7-57.pdf>.
- (10) *Toxicological profile for wood creosote, coal tar creosote, coal tar, coal tar pitch, and coal tar pitch volatiles*; U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry: Atlanta, GA, September 2002; <http://www.atsdr.cdc.gov/ToxProfiles/tp85.pdf>.
- (11) Scoggins, M.; Ennis, T.; Parker, N.; Herrington, C. A photographic method for estimating wear of coal tar sealcoat from parking lots. *Environ. Sci. Technol.* **2009**, *43* (13), 4909–4914.
- (12) *Reconnaissance study of coal tar sealcoat application in Toronto and an estimate of related PAH emissions*; Diamond Environmental Group, Department of Geography and Department of Chemical Engineering, University of Toronto: Toronto, ON, 2011. Prepared for Environment Canada.
- (13) Rogge, W. F.; Hildemann, L. M.; Mazurek, M. A.; Cass, G. R.; Simoneit, B. R. T. Sources of fine organic aerosol. 3. Road dust, tire debris, and organometallic brake lining dust: roads as sources and sinks. *Environ. Sci. Technol.* **1993**, *27* (9), 1892–1904.
- (14) Yunker, M. B.; Macdonald, R. W.; Vingarzan, R.; Mitchell, R. H.; Goyette, D.; Sylvestre, S. PAHs in the Fraser River basin: A critical appraisal of PAH ratios as indicators of PAH source and composition. *Org. Geochem.* **2002**, *33*, 489–515.
- (15) Van Metre, P. C.; Mahler, B. J.; Furlong, E. T. Urban sprawl leaves its PAH signature. *Environ. Sci. Technol.* **2000**, *34*, 4064–4070.
- (16) Mahler, B. J.; Van Metre, P. C.; Callender, E. Trends in metals in urban and reference lake sediments across the United States, 1970–2001. *Environ. Toxicol. Chem.* **2006**, *25* (7), 1698–1709.
- (17) Van Metre, P. C.; Mahler, B. J. Trends in hydrophobic organic contaminants in urban and reference lake sediments across the United States, 1970–2001. *Environ. Sci. Technol.* **2005**, *39*, 5567–5574.
- (18) Furlong, E. T.; Cessar, L. R.; Hites, R. A. Accumulation of polycyclic aromatic hydrocarbons in acid sensitive lakes. *Geochem. Cosmochim. Acta* **1987**, *51* (11), 2965–2975.
- (19) Gschwend, P. M.; Hites, R. A. Fluxes of polycyclic aromatic hydrocarbons to marine and lacustrine sediments in the northeastern United States. *Geochem. Cosmochim. Acta* **1981**, *45* (12), 2359–2367.
- (20) Scoggins, M.; McClintock, N.; Gosselink, L.; Bryer, P. Occurrence of polycyclic aromatic hydrocarbons below coal-tar-sealed parking lots and effects on stream benthic macroinvertebrate communities. *J. N. Am. Benthol. Soc.* **2007**, *26* (4), 694–707.
- (21) Haeseler, F.; Blancher, D.; Druelle, V.; Werner, P.; Vandecasteele, J.-P. Ecotoxicological assessment of soils of former manufactured gas plant sites: Bioremediation potential and pollutant mobility. *Environ. Sci. Technol.* **1999**, *33* (24), 4379–4384.
- (22) *PAHs in Austin, Texas, Sediments and Coal-Tar Based Pavement Sealants, Polycyclic Aromatic Hydrocarbons*; City of Austin Watershed Protection and Development Review Department: Austin, TX, 2005; http://www.ci.austin.tx.us/watershed/downloads/coaltar_draft_pah_study.pdf.
- (23) The Blacktop Guy - FAQ. http://www.blacktopguy.com/faq.php#_13.
- (24) A-Line Asphalt Products Frequently Asked Questions. <http://www.alineasphaltproducts.com/faq.html>.
- (25) Selbig, W. R. *Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) in Urban Stormwater, Madison, Wisconsin, 2005–08*; Open File Report 2009–1077; U.S. Geological Survey: Denver, CO, 2009; <http://pubs.usgs.gov/of/2009/1077/pdf/of20091077.pdf>.
- (26) Polta, R.; Balogh, S.; Craft-Reardon, A. *Characterization of stormwater pond sediments. Final project report*, EQA Report 06–572; Environmental Quality Assurance Department, Metropolitan Council Environmental Services: St. Paul, MN, 2006; <http://www.metrocouncil.org/Environment/sediment/FinalReport.pdf>.
- (27) Whitehead, T.; Metayer, C.; Gunier, R. B.; Ward, M. H.; Nishioka, M. G.; Buffler, P.; Rappaport, S. M. Determinants of polycyclic aromatic hydrocarbon levels in house dust. *J. Expo. Sci. Env. Epid.* **2011**, *21* (March/April), 123–132.
- (28) Van Metre, P. C.; Majewski, M. S.; Mahler, B. J.; Foreman, W. T.; Braun, C. L.; Wilson, J. T.; Burbank, T. Volatilization of polycyclic aromatic hydrocarbons from coal-tar-sealed pavement. *Chemosphere* **2012**, <http://dx.doi.org/10.1016/j.chemosphere.2011.12.072>.
- (29) Van Metre, P. C.; Majewski, M. S.; Mahler, B. J.; Foreman, W. T.; Braun, C. L.; Wilson, J. T.; Burbank, T. PAH volatilization following application of coal-tar-based pavement sealant. *Atmos. Environ.* **2012**, <http://dx.doi.org/10.1016/j.atmosenv.2012.01.036>.
- (30) Douben, P. E. T. *PAHs: An Ecotoxicological Perspective*; John Wiley & Sons Ltd.: West Sussex, England, 2003.
- (31) Toxicological profile for polycyclic aromatic hydrocarbons; <http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=122&tid=25>.
- (32) Van Brummelen, T. A.; et al. Bioavailability and ecotoxicity of PAHs. In *PAHs and Related Compounds. The Handbook of Environmental Chemistry*; Neilson, A.; Hutzinger, O., Eds.; Springer Verlag: Berlin, Germany, 1998; Vol. 3, part J.
- (33) Ireland, D. S.; Burton, G. A. Jr.; Hess, G. G. In situ toxicity evaluations of turbidity and photoinduction of polycyclic aromatic hydrocarbons. *Environ. Toxicol. Chem.* **1996**, *15*, 574–581.
- (34) Diamond, S. A.; Milroy, N. J.; Mattson, V. R.; Heinis, L. J.; Mount, D. R. Photoactivated toxicity in amphipods collected from polycyclic aromatic hydrocarbon-contaminated sites. *Environ. Toxicol. Chem.* **2003**, *22*, 2752–2760.
- (35) Diamond, S. A.; Mount, D. R.; Burkhard, L. P.; Ankley, G. T.; Makynen, E. A.; Leonard, E. N. Effect of irradiance spectra on the photoinduced toxicity of three polycyclic aromatic hydrocarbons. *Environ. Toxicol. Chem.* **2000**, *19*, 1389–1396.
- (36) Ankley, G. T.; et al. Assessing risks from photoactivated toxicity of PAHs to aquatic organisms. In *PAHs: An Ecotoxicological Perspective*; Douben, P. E. T., Ed.; John Wiley & Sons Ltd.: West Sussex, England, 2003; pp 275–296.
- (37) Bryer, P. J.; Elliott, J. N.; Willingham, E. J. The effects of coal tar based pavement sealer on amphibian development and metamorphosis. *Ecotoxicology* **2006**, *15*, 241–247.
- (38) Bommarito, T.; Sparling, D. W.; Halbrook, R. S. Toxicity of coal-tar pavement sealants and ultraviolet radiation to *Ambystoma maculatum*. *Ecotoxicology* **2010**, *19*, 1147–1156.

(39) Bommarito, T.; Sparling, D. W.; Halbrook, R. S. Toxicity of coal-tar and asphalt sealants to eastern newts, *Notophthalmus viridescens*. *Chemosphere* **2010**, *81* (2), 187–193.

(40) Bryer, P. J.; Scoggins, M.; McClintock, N. L. Coal-tar based pavement sealant toxicity to freshwater macroinvertebrates. *Environ. Pollut.* **2009**, *158* (5), 1932–1937.

(41) MacDonald, D. D.; Ingersoll, C. G.; Berger, T. A. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contamin. Toxicol.* **2000**, *39*, 20–31.

(42) Integrated Risk Information System (IRIS); <http://cfpub.epa.gov/ncea/iris/index.cfm>.

(43) Detection of coal tar materials in asphalt pavements using chemical and biological methods; http://www.asphaltinstitute.org/public/engineering/PDFs/Environmental/Detection_Coal_Tar_Materials_Aspphalt_Pavements_Using_Chem_Bio_Methods.pdf.

(44) Williams, E. S.; Mahler, B. J.; Van Metre, P. C. Coal-tar pavement sealants might substantially increase children's PAH exposures. *Environ. Pollut.* **2012**, <http://dx.doi.org/10.1016/j.envpol.2012.01>.

(45) *Exposure Factors Handbook: 2011 ed.*; EPA/600/R-090/052F; U.S. Environmental Protection Agency: Washington, D.C., 2011; <http://www.epa.gov/ncea/efh/pdfs/efh-complete.pdf>.

(46) Roy, T. A.; Krueger, A. J.; Taylor, B. B.; Mauro, D. M.; Goldstein, L. S. Studies estimating the dermal bioavailability of polynuclear aromatic hydrocarbons from manufactured gas plant tar-contaminated soils. *Environ. Sci. Technol.* **1998**, *32* (20), 3113–3117.

(47) *An ordinance amending the city code to add a new Chapter 6-6 relating to coal tar pavement products, creating offenses, and providing penalties*, Ordinance No. 2005117-070, 2005; <http://www.ci.austin.tx.us/edims/document.cfm?id=94225>.

(48) Status of actions regarding use of coal tar-based sealants; <http://www.pca.state.mn.us/index.php/view-document.html?gid=16180>.

(49) Crane, J. L.; Grosenheider, K.; Wilson, C. B. *Contamination of Stormwater Pond Sediments by Polycyclic Aromatic Hydrocarbons (PAHs) in Minnesota—The Role of Coal Tar-based Sealcoat Products as a Source of PAHs*; Minnesota Pollution Control Agency: St. Paul, MN, 2010, document tdr-g1-07; <http://www.pca.state.mn.us/index.php/view-document.html?gid=12960>.

(50) Stollenwerk, J.; Smith, J.; Ballavance, B.; Rantala, J.; Thompson, D.; McDonald, S.; Schnick, E. *Managing dredged materials in the State of Minnesota*; Minnesota Pollution Control Agency: St. Paul, MN, 2011, document wq-gen2-01; <http://www.pca.state.mn.us/index.php/view-document.html?gid=12959>.

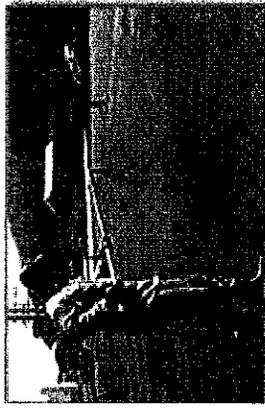
(51) South GA Sealcoating and Striping Sealer performance F.A.Q.; http://www.sgasealcoating.com/sealcoating_fa.htm#5.

(52) A Better Driveway. Driveway sealcoating – now environmentally friendly; http://www.abetterdriveway.com/residential_services.

(53) Hazardous Waste Recycling Exemptions; <http://www.epa.gov/osw/hazard/recycling/regulations.htm>.

(54) Valle, S.; Panero, M. A.; Shor, L. *Pollution prevention and management strategies for polycyclic aromatic hydrocarbons in the New York/New Jersey Harbor*; Harbor Consortium of the New York Academy of Sciences: New York, NY, 2007.

(55) Van Metre, P. C.; Wilson, J. T.; Callender, E.; Fuller, C. C. Similar rates of decrease of persistent, hydrophobic contaminants in riverine systems. *Environ. Sci. Technol.* **1998**, *32* (21), 3312–3317.



Coal-tar-based sealcoat being applied to a test plot.

What's Sealcoats

What is pavement sealcoat?

What are PAHs?

What are coal tar and coal tar pitch?

PAHs and Sealcoat Contaminants

Barbara Mahler
USGS Research Hydrologist
(512) 927-3566

Peter Van Metre
USGS Research Hydrologist
(512) 927-3506

Mailing Address:
U.S. Geological Survey
1505 Ferguson Lane
Austin, TX 78754

ABOUT THE TEXAS WSC

USGS Research: PAHs and Coal-Tar-Based Pavement Sealcoat

Coal-tar-based pavement sealant is a potent source of polycyclic aromatic hydrocarbons (PAHs), as documented by the [USGS](#) and other researchers.

Coal-tar-based sealcoat products typically are 20 to 35% coal tar or coal-tar pitch—these materials are [known human carcinogens](#) that contain high concentrations of PAHs and related chemicals. Coal-tar-based pavement sealcoat typically contains 35,000 to 200,000 mg/kg (parts per million, or ppm) PAHs, about 100 times more PAHs than in used motor oil and about 1,000 times more PAHs than in sealcoat products with an asphalt base.

Coal-tar sealcoat is abraded to a fine dust by car tires and snow plows, requiring reapplication every 2–5 years. The mobile high-PAH dust is blown, washed, or tracked into nearby soil, stormwater ponds, streams, lakes, and house dust. Many of the lighter-weight chemicals in coal-tar sealcoat volatilize (evaporate) into the air, primarily during the 2 weeks following application, but continuing for years after application.

Learn more about PAHs and coal-tar-based sealcoat

- [Coal-Tar-Based Pavement Sealcoat, Polycyclic Aromatic Hydrocarbons \(PAHs\), and Environmental Health \(USGS factsheet, 2011\)](#) and
- [Coal-Tar-Based Pavement Sealcoat and PAHs: Implications for the Environment, Human Health, and Stormwater Management \(Environmental Science & Technology feature article, 2012\)](#).
- [Additional peer-reviewed journals, USGS publications, and presentations](#)

Related USGS Research

- [NAWOA: Contaminant Trends in Lake Sediments - A national assessment of trends in metals and hydrophobic organic contaminants in streams and rivers of the United States using lake and reservoir sediment cores.](#)

Access publications and other information at:
tx.usgs.gov/sealcoat.html

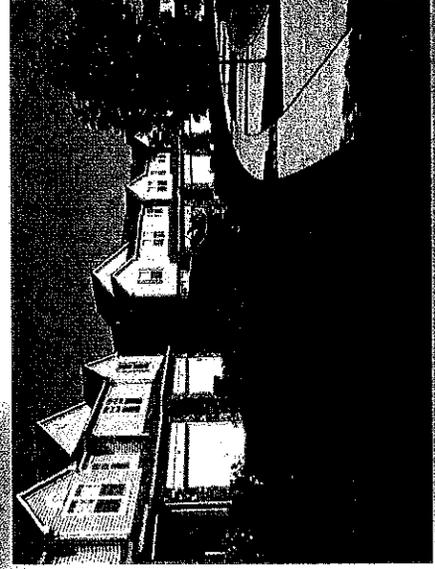


PAHs in urban sources

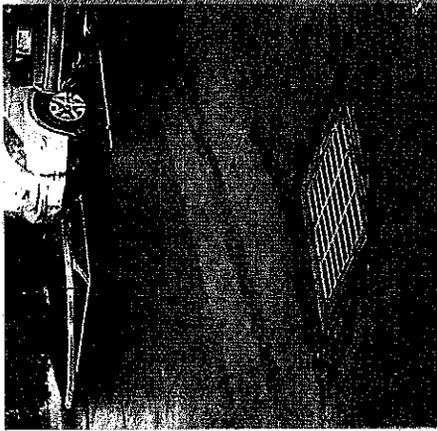
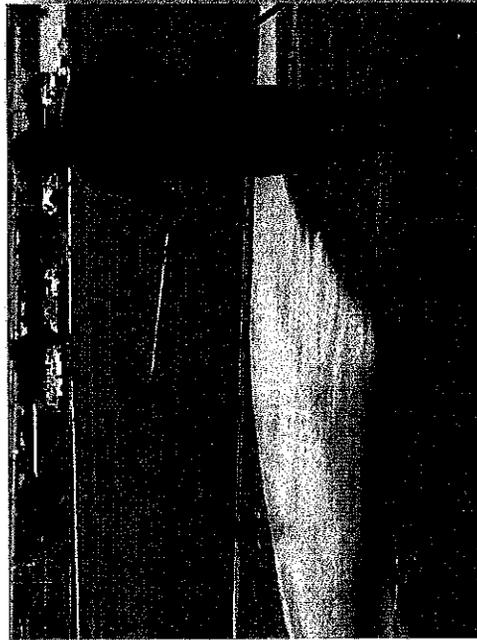
All concentrations in mg/kg (averages of up to 6 studies)

Fresh asphalt	1.5	Pavement Sealcoat
Weathered asphalt	3	Asphalt Based
Fresh motor oil	4	~ 50
Brake particles	16	
Road dust	24	
Tire particles	86	Coal-tar-based
Diesel engine	102	~70,000
Gasoline engine	370	
Used motor oil	440	

References are available on request



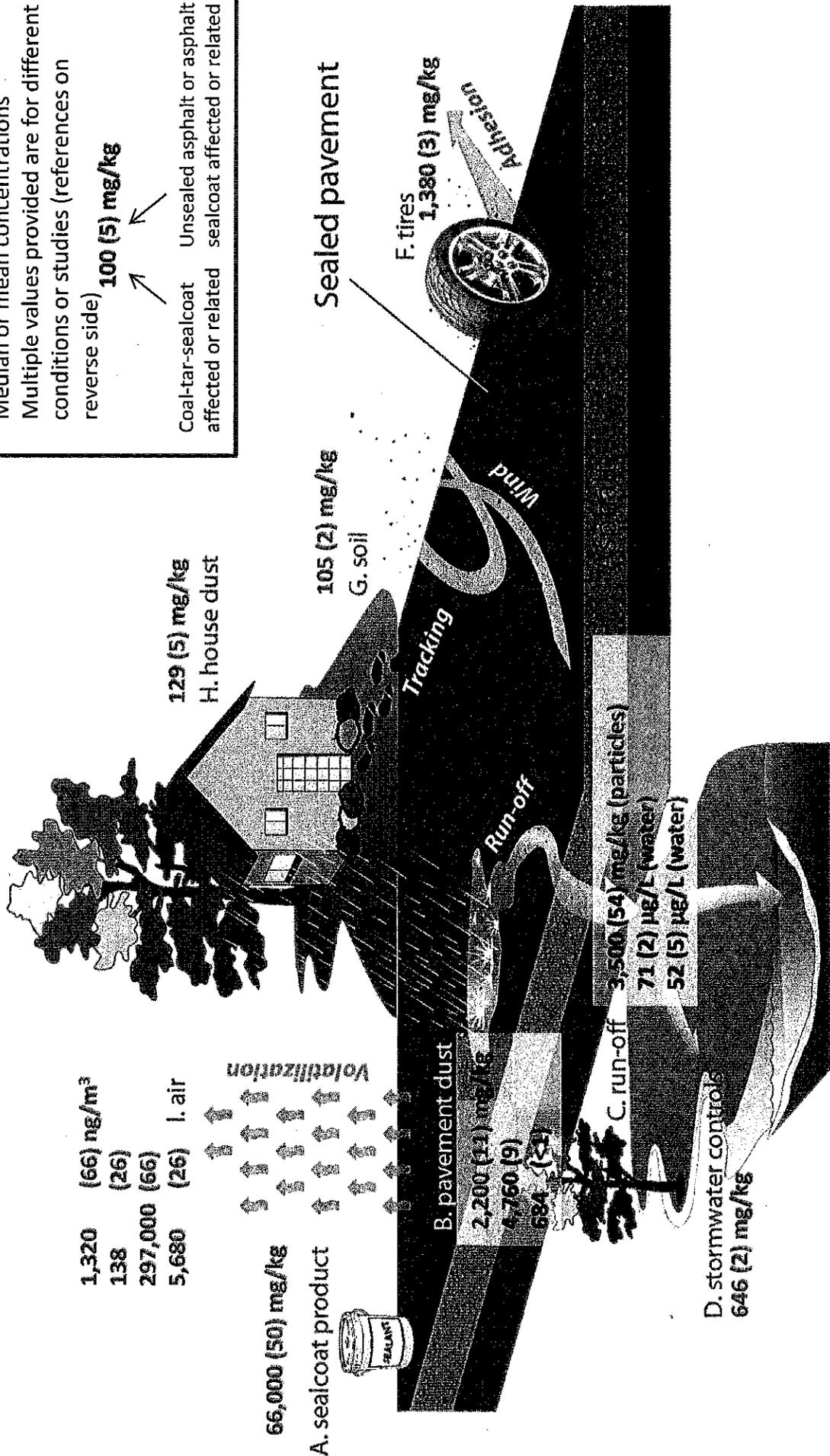
USGS sealcoat web page:
<http://tx.usgs.gov/sealcoat.html>



Polycyclic Aromatic Hydrocarbons (PAHs) From Coal-Tar-Based Sealcoat Affect Numerous Environmental Compartments

EXPLANATION
 Median or mean concentrations
 Multiple values provided are for different conditions or studies (references on reverse side)
100 (5) mg/kg

Coal-tar-sealcoat Unsealed asphalt or asphalt affected or related sealcoat affected or related



From "Coal-tar-based pavement sealcoat and PAHs: Implications for the environment, human health, and stormwater management," Mahler et al., 2012. *Environmental Science and Technology*, 46: 3039-3045.
<http://pubs.acs.org/doi/abs/10.1021/es303371t>



Table 1. Concentrations of PAHs as Reported in the Literature for Environmental Compartments Shown in Figure 1, and Definitions of PAH Summations Used

environmental compartment (Figure 1)	medium	PAH concentration (median or mean) in coal-tar-based sealcoat or affected medium	PAH concentration (median or mean) in asphalt sealcoat, affected medium, or associated with unsealed pavement	summation ^a	units	reference
A	sealcoat products	66 000	50	ΣPAH_{16}	mg/kg	11,22
B	pavement dust	2200	11	ΣPAH_{12}	mg/kg	3
		4760	9	ΣPAH_{16}	mg/kg	4
		685	41	ΣPAH_{16}	mg/kg	5
C	runoff, particles	3500	54	ΣPAH_{12}	mg/kg	2
	runoff, unfiltered water ^b	71	2	ΣPAH_{16}	$\mu\text{g/L}$	7
		52	5	ΣPAH_{16}	$\mu\text{g/L}$	25
		646	2	ΣPAH_{16}	mg/kg	5
D	stormwater-management-device sediment			$\Sigma\text{PAH}_{\text{CMB}}$	mg/kg	6
E	lake sediment ^c	33	0.4	ΣPAH_{16}	mg/kg	5
F	tires	1380	3	ΣPAH_{16}	mg/kg	5
G	soil ^d	105	2	ΣPAH_{16}	mg/kg	4
H	settled house dust	129	5	ΣPAH_{16}	mg/m ³	28
I	air (0.03 m from pavement), 3-8 years after sealing	1320	66	ΣPAH_{16}	ng/m ³	28
	air (1.28 m from pavement), 3-8 years after sealing	138	26	ΣPAH_{16}	ng/m ³	29
	air (0.03 m from pavement), 1.6 h after sealing	297 000	66	ΣPAH_{16}	ng/m ³	29
	air (1.28 m from pavement), 1.6 h after sealing	5680	26	ΣPAH_{16}	ng/m ³	29

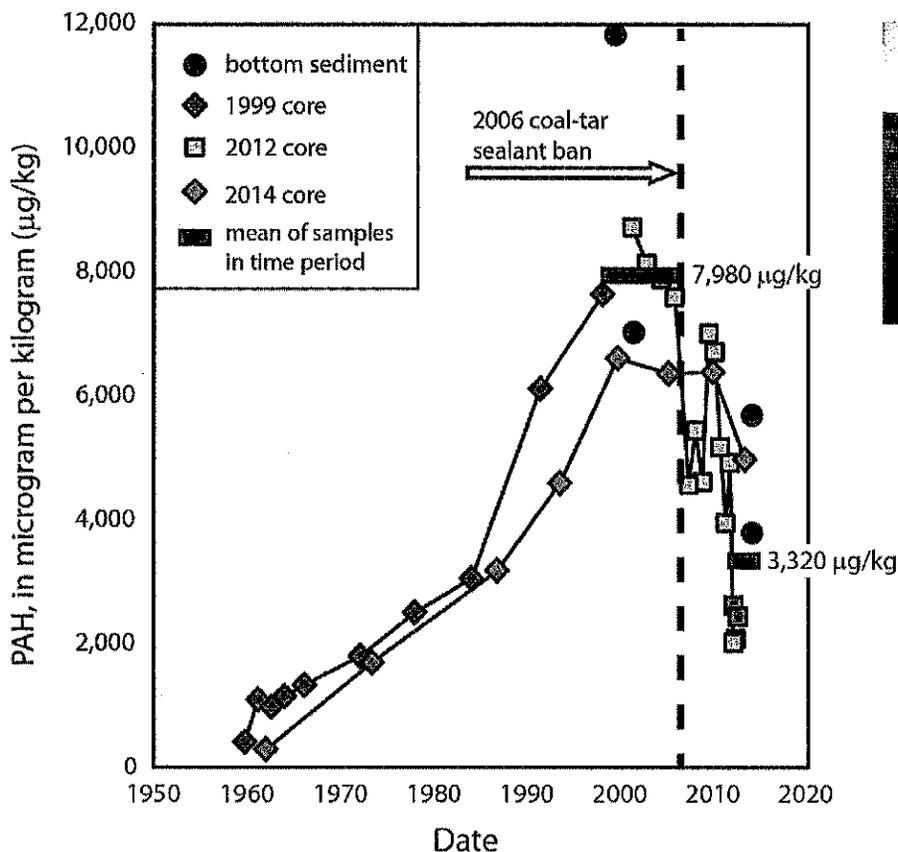
^a ΣPAH_{12} is the sum of concentrations of the 12 parent PAH (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[a]pyrene, and dibenz[a,h]anthracene), which are those PAHs used in computation of the probable effects concentration (PEC) sediment-quality guideline, ⁴¹ less 2-methylnaphthalene. ΣPAH_{16} is the sum of the concentrations of the 16 priority pollutants identified by the U.S. Environmental Protection Agency, ⁴² equal to the sum of ΣPAH_{12} and concentrations of benzo[b]fluoranthene, benzo[k]fluoranthene, and indeno[1,2,3-cd]pyrene. ΣPAH_{16} is equal to ΣPAH_{16} plus concentrations of 1-methylnaphthalene and 2-methylnaphthalene. $\Sigma\text{PAH}_{\text{CMB}}$ is the sum of concentrations of phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-cd]pyrene, and benzo[e]pyrene. ΣPAH_3 is the sum of concentrations of phenanthrene, anthracene, 4,5-methylphenanthrene, fluoranthene, pyrene, chrysene, and benzo[b]fluoranthene. On the basis of PAH data from primarily combustion sources presented in Mahler et al., ⁴ ΣPAH_{12} is about 70-75% of ΣPAH_{16} . ΣPAH_{16} is similar to ΣPAH_{16} as the additional compounds in the summation either are not detected or are detected at very low concentrations. ^{2,5} ^bCollected >3 months after sealcoat application. ³Means for urban lakes with >70% PAH from sealcoat and 0-20% from sealcoat. ⁴Concentration in soil adjacent to a sealed parking lot.

From "Coal-tar-based pavement sealcoat and PAHs: Implications for the environment, human health, and stormwater management," Mahler et al., 2012. *Environmental Science and Technology*, 46: 3039-3045. <http://pubs.acs.org/doi/abs/10.1021/es303371t>

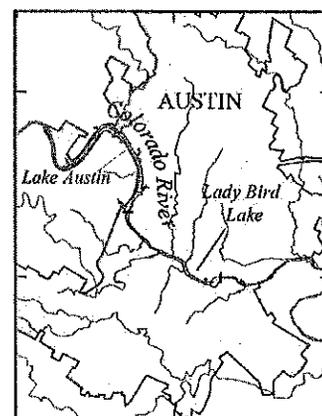


Austin Coal-Tar Sealant Ban Leads to Decline in PAHs

By 2012-2014, average PAH levels had declined 58%



Lady Bird Lake, Austin



- The City of Austin banned use of coal-tar-based sealants in January 2006.
- Lady Bird Lake (LBL) is a reservoir lake on the Colorado River that receives runoff from much of the city.
- Until the early 2000s, PAHs had been increasing for 4 decades in LBL sediments¹ and PAH source analysis attributed most of the increase to coal-tar sealants².
- In 2012 and 2014, 6 to 8 years after the ban, USGS collected sediment cores and surface sediments to test whether the ban was affecting PAH concentrations in the lake.
- Average total PAH concentrations had decreased by 58% 6–8 y after the ban³.

(1) Van Metre, P.C., Mahler, B.J., and Furlong, E.T., 2000, Urban sprawl leaves its PAH signature: Environmental Science and Technology, Vol. 34, No. 19, 4064-4070.

(2) Van Metre, P.C., and Mahler, B.J., 2010, Contribution of PAHs from Coal-Tar Pavement Sealcoat and Other Sources to 40 U.S. Lakes: The Science of the Total Environment, 409, 334-344.

(3) Van Metre, P.C., and Mahler, B.J., 2014, PAH Concentrations in Lake Sediments Decline Following 2006 Ban on Coal-Tar-Based Pavement Sealants in Austin, Texas, Environmental Science and Technology, 48(13), p. 7222-7228.

Bibliography of USGS research on coal-tar-based pavement sealant and polycyclic aromatic hydrocarbon (PAH) contamination

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

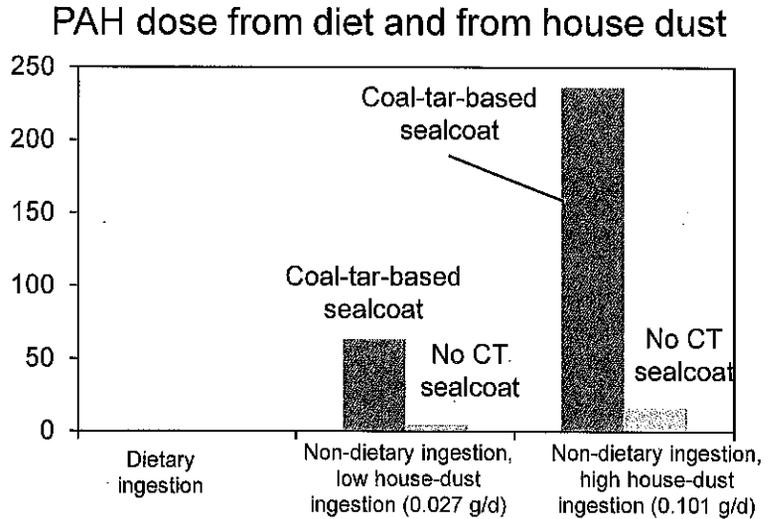
- **General Information**
 - Mahler, B.J., Van Metre, P.C., Crane, J.L., Watts, A.W., Scoggins, M., and Williams, E.S. 2012. Coal-tar-based pavement sealant and PAHs: Implications for the environment, human health, and stormwater management. Environ. Sci. Technol., 46(6):3039-3045.
 - Mahler, B.J., Van Metre, P.C. Coal-tar-based pavement sealant, polycyclic aromatic hydrocarbons (PAHs), and environmental health: U.S. Geological Survey Factsheet 2011-3010, 6 p. 2011.
 - Van Metre, P.C., Mahler, B.J., Scoggins, M., and Hamilton, P.A. Parking-lot sealcoat: A major source of PAHs (polycyclic aromatic hydrocarbons) in urban and suburban environments. U.S. Geological Survey Fact Sheet 2005-3147. 2005.
- **Environmental Effects**
 - Kienzler, A., Mahler, B.J., Van Metre, P.C., Schweigert, N., Devaux, A., and Bony, S. 2015. Exposure to runoff from coal-tar-sealed pavement induces genotoxicity and impairment of DNA repair capacity in the RTL-W1 fish liver cell line. Sci. Total Environ., 520:73-80.
 - Mahler, B.J., Ingersoll, C.G., Van Metre, P.C., Kunz, J.L., and Little, E.E. Acute toxicity of runoff from sealcoated pavement to *Ceriodaphnia dubia* and *Pimephales promelas*. Environ. Sci. Technol., in review.
- **Sealcoated Pavement and Runoff**
 - Mahler, B.J., Van Metre, P.C., and Foreman, W.T. Concentrations of polycyclic aromatic hydrocarbons (PAHs) and azarenes in runoff from coal-tar- and asphalt-sealcoated pavement. 2014. Environ. Poll., 188:81-87.
 - Van Metre, P.D., Mahler, B.J., and Wilson, J.T. PAHs underfoot: Contaminated dust from sealcoated pavement. 2009. Environ. Sci. Technol., 43(1):20-25.
 - Van Metre, P.C., Mahler, B.J., Wilson, J.T., and Burbank, T.L. Collection and analysis of samples for polycyclic aromatic hydrocarbons in dust and other solids related to sealed and unsealed pavement from 10 cities across the United States, 2005-07: U.S. Geological Survey Data Series 361, 5 p. 2008.
 - Mahler, B.J., Van Metre, P.C., Bashara, T.J., Wilson, J.T., and Johns, D.A. 2005. Parking lot sealcoat: An unrecognized source of urban PAH. Environ. Sci. Technol., 39: 5560-5566.
 - Mahler, B.J., Van Metre, P.C., and Wilson, J.T. Concentrations of polycyclic aromatic hydrocarbons (PAHs) and major and trace elements in simulated rainfall runoff from parking lots, Austin, Texas, 2003, 2004. U.S. Geological Survey Open-File Report 2004-1208.
- **Water Bodies**
 - Van Metre, P.C. and Mahler, B.J. PAH concentrations in lake sediments decline following 2006 ban on coal-tar-based pavement sealants in Austin, Texas. 2014. Environ. Sci. Technol., 48:7222-7228.
 - Van Metre, P.C., Mahler, B.J., Wilson, J.T., Ligouis, B., Razzague, M., Schaeffer, C., and Werth, C. 2010. The influence of coal-tar sealcoat and other carbonaceous materials on polycyclic aromatic hydrocarbon loading in an urban watershed. Environ. Sci. Technol., 44(4): 1217-1223.
 - Van Metre, P.C., and Mahler, B.J. Contribution of PAHs from coal-tar pavement sealcoat and other sources to 40 U.S. Lakes. Sci. Total Environ., 409: 334-344.
- **Air**
 - Van Metre, P.C., Majewski, M.S., Mahler, B.J., Foreman, W.T., Braun, C.L., Wilson, J.T., and Burbank, T.L. 2012. PAH volatilization of polycyclic aromatic hydrocarbons from coal-tar-sealed pavement. Chemosphere, 88(1):1-7.
 - Van Metre, P.C., Majewski, M.S., Mahler, B.J., Foreman, W.T., Braun, C.L., Wilson, J.T., and Burbank, T.L. 2012. Volatilization of polycyclic aromatic hydrocarbons from coal-tar-sealed pavement. Atmos. Environ., 51:108-115.
- **Human Health**
 - Williams, E.S., Mahler, B.J., and Van Metre, P.C. Cancer risk from incidental ingestion exposures to PAHs associated with coal-tar-sealed pavement. 2013. Environ. Sci. Technol., 47:1101-1109.
 - Williams, E.S., Mahler, B.J., and Van Metre, P.C. 2012. Coal-tar pavement sealants might substantially increase children's PAH exposures. Environ. Poll., 164:40-41.
 - Mahler, B.J., Van Metre, P.C., Wilson, J.T., Musgrove, M., Burbank, T., Ennis, T.E., and Bashara, T.J. 2010. Coal-tar-based pavement sealcoat: An unrecognized source of PAH to settled house dust. Environ. Sci. Technol., 44: 894-900.

Children Living by Coal-Tar-Sealed Pavement Ingest More PAHs from House Dust than Diet and Have a Higher Estimated Risk of Cancer

Photo courtesy of CLEARCorps
Dumont, NC



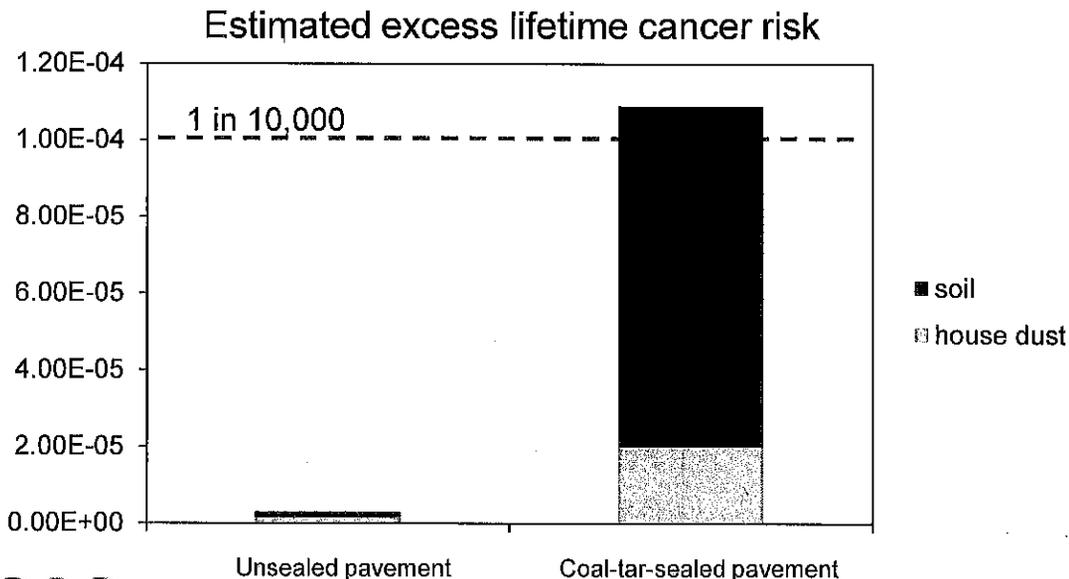
Carcinogenic PAH dose (ng B2-PAH/kg body weight/day)



Data from "Coal-tar pavement sealants may significantly increase children's PAH exposures," Williams et al., 2012. *Environmental Pollution*, 164: 40-41. <http://www.sciencedirect.com/science/article/pii/S0269749112000279>

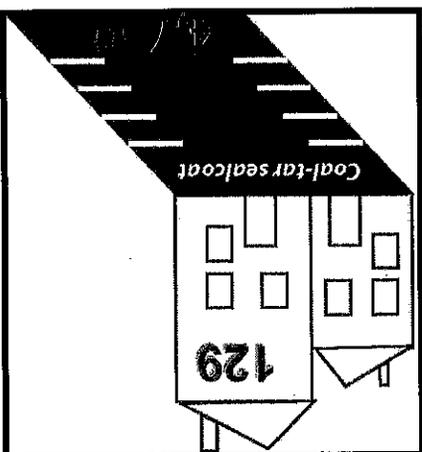
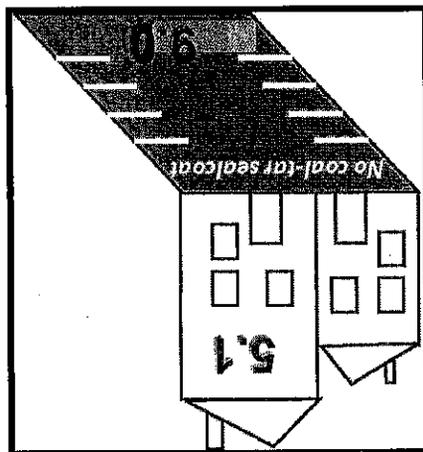
Children living adjacent to coal-tar-sealcoated parking lots who ingest low amounts of house dust are estimated to consume about **2.5 times** as much carcinogenic PAH from non-dietary ingestion as from their diet. Children with higher daily house dust ingestion rates (0.101 grams, or slightly more than the weight of a baby aspirin) consume **9.5 times** more carcinogenic PAHs through non-dietary ingestion as through diet.

The associated estimated excess lifetime cancer risk for residents living next to coal-tar-sealed pavement is **38 times** higher than for unsealed pavement. The excess lifetime cancer risk was estimated on the basis of non-dietary ingestion of soil and house dust. Most of the risk is incurred during childhood.



Data from "Cancer risk from incidental ingestion exposures to PAHs associated with coal-tar-sealed pavement," Williams et al., 2013. *Environmental Science and Technology*, 47: 1101-1109. <http://pubs.acs.org/doi/abs/10.1021/es303371t>

USGS Research: Elevated PAHs in House Dust Affected by Coal-Tar-Based Pavement Sealants

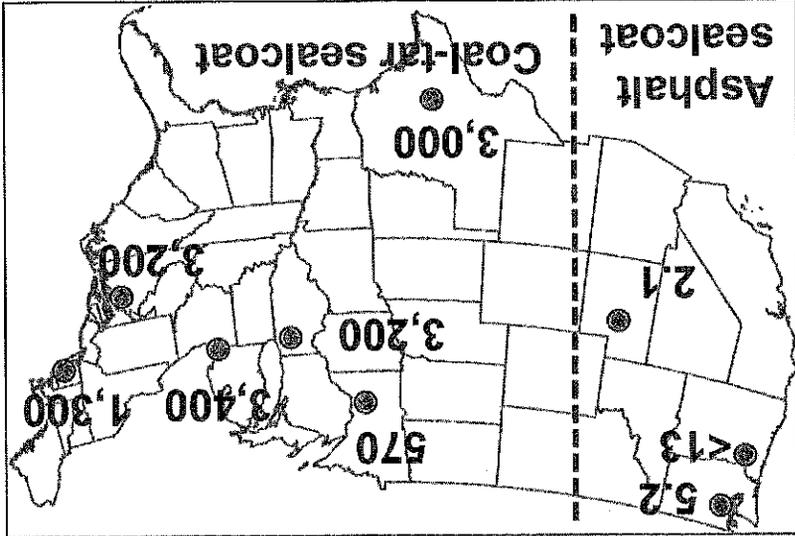


Data from "Coal-tar-based parking lot sealcoat: An unrecognized source of PAH to settled house dust." B.J. Mahler et al., 2010. *Environmental Science and Technology*, 44: 894-900. <http://pubs.acs.org/doi/abs/10.1021/es902533r>

Median PAH concentration (sum of the 16 U.S. EPA Priority Pollutant PAHs), in milligrams per kilogram, in house dust and parking lot dust for apartments without coal-tar sealcoat (unsealed or asphalt-sealed parking lots) (left) and in house dust in apartments with coal-tar-sealed parking lots (right).

The median concentration in house dust in apartments adjacent to coal-tar-sealed parking lots was **25 times** higher than in apartments adjacent to parking lots with other surface types.

Similarly elevated PAH concentrations (mg/kg shown) have been measured in dust from coal-tar-sealed parking lots and driveways in those parts of the U.S. where coal-tar-based pavement sealcoat is commonly used (west of the Continental Divide). Locations shown here include Lake in the Hills, Ill (3,200 milligrams per kilogram).



Data from "PAHs underfoot: Contaminated dust from coal-tar sealcoated pavement is widespread in the United States." P.C. Van Meira et al., 2009. *Environmental Science and Technology*, 43: 20-26. <http://pubs.acs.org/doi/abs/10.1021/es802119h>



Nominations Now Being Accepted for the Natural Resources Commission's Annual Awards for Meritorious Service to the Highland Park Environment

The Natural Resources Commission is currently accepting nominations for a **Highland Park resident and/or a Highland Park business** that has demonstrated a noteworthy commitment to the City's environment. This year, the Commission will recognize one resident and one business during a ceremony held at City Hall at 6:30 p.m. on December 12th. Nominations for this award must clearly describe achievements that a Highland Park resident and/or Highland Park business has demonstrated in one or more of the following areas:

1. The nominee has demonstrated outstanding leadership, skills, abilities, or resourcefulness in:
 - A. Implementing innovative approaches that result in significant improvements to the Highland Park environment; or,
 - B. Organizing, planning, or facilitating activities that promote environmental protection, pollution prevention or reduction, environmental enhancement, or the public awareness of environmental problems in the City.
2. The nominee has demonstrated personal diligence or initiative by accepting responsibility for special projects which have resulted in significant studies of or improvements to the quality of Highland Park's environment.
3. The nominee has shown technical expertise and competence in dealing with and resolving an environmental problem in the City.
4. The nominee has demonstrated unusual courage or competence in responding to an environmental emergency in the City.
5. The nominee has demonstrated excellence in environmental education within the City.

Each candidate must be nominated by a person or group living or working in the City of Highland Park. Elected and appointed City officials are ineligible to receive the award. **To request the Commission's consideration of a nomination, a fully completed nomination form must be submitted by Monday, November 10th at 4:00 p.m. to the attention of Assistant to the City Manager Karen Berardi by email at kberardi@cityhpil.com or by mail to:**

Karen Berardi
1707 St. Johns Avenue
Highland Park, Illinois, 60035

Nomination forms are available on the Commission's website at: <http://www.cityhpil.com/index.aspx?nid=379>. Questions regarding the nominations may be directed to Karen Berardi at 847-926-1043.

Prior Environmental Award Recipients

2004	Larry King, Peg Laemle
2005	Joe Guill
2006	Karen May
2007	<i>Not awarded</i>
2008	Margie Ettlenger
2009	Bertram Frey
2010	None
2011	Joyce O'Keefe
2012	None
2013	Debbie Bohmbach & Job Youshaei
2014	Michelle Kramer and Dean Mouscher