

# MAJOR CHANGES IN USEPA'S RISK ASSESSMENT OF PAHS

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# Agenda

- Background on PAHs
- Status of EPA PAH Policies
- Cleanup Implications of New EPA Policy on BaP
- Results of State Survey
- Focus on Selected States
- Vapor Intrusion Update
  - Naphthalene Update
  - Ethylbenzene Update

# Background on PAHs

## History:

7 cPAHs assessed with EPA Cancer Slope Factor for benzo(a)pyrene (BaP) + EPA Relative Potency Factors (RPFs)



## EPA 2012:

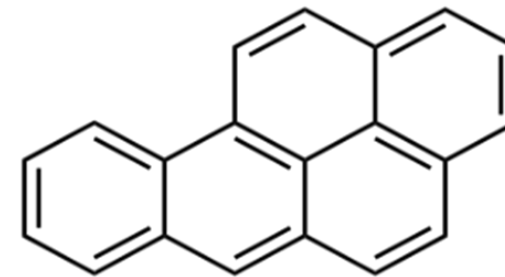
Proposal to issue new BaP toxicity factors

- Modify oral cancer value; issue new values for inhalation cancer, oral non-cancer and inhalation non-cancer
- Issue new “Dermal Slope Factor” (DSF)



## EPA 2010:

Proposal to increase cPAHs to 25



# Status of EPA Policies on PAHs

Expanded list of cPAH

- no action, no plans

New toxicity factors

- issued January 2017

Regional Screening Levels

- updated June 2017

Dermal Slope Factor

- withdrawn, no plans

# Implications of New EPA Policy on BaP

- Cancer slope factor lowered by 7.3X
- Areas requiring cleanup lowered, cleanup levels elevated
- Cleanup levels apply to benzo(a)pyrene toxic equivalents for EPA's 7 cPAH

Receptor	Old 10 <sup>-5</sup> RSL	New 10 <sup>-5</sup> RSL
Residential	0.16 ppm	1.1 ppm
Commercial/Industrial	2.9 ppm	21 ppm

- Site-specific and state-specific cleanup levels may vary due to different exposure assumptions

# Implications Including Bioavailability Adjustments

- Recent coal tar pitch site: favorable site-specific oral and dermal bioavailability test results
- Ingestion: 20% versus 100% default
- Dermal: 1% versus 13% default

Receptor	10 <sup>-5</sup> Cleanup Level
Residential	~20 ppm
Commercial/Industrial	~120 ppm

# Action at PAH Sites

- Window of opportunity:
  - New – Favorable BaP toxicity value
  - On hold - Longer list, high RPFs, dermal slope factor
- Review and reassess remedial action plans
- Consider taking remedial action now
- Consider role of bioavailability testing
- Many states have not adopted new toxicity factors
- PAH policies more complicated in some states
- Outlier states likely define the future



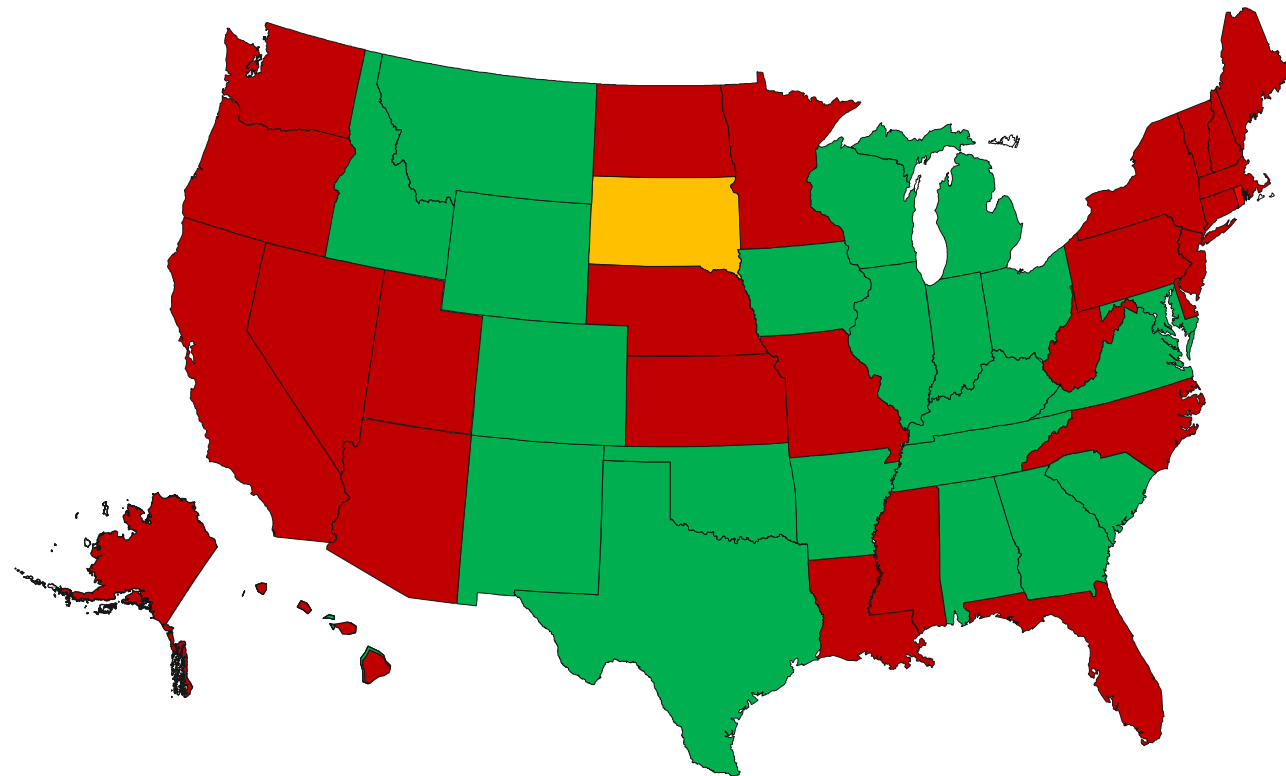


# State Survey

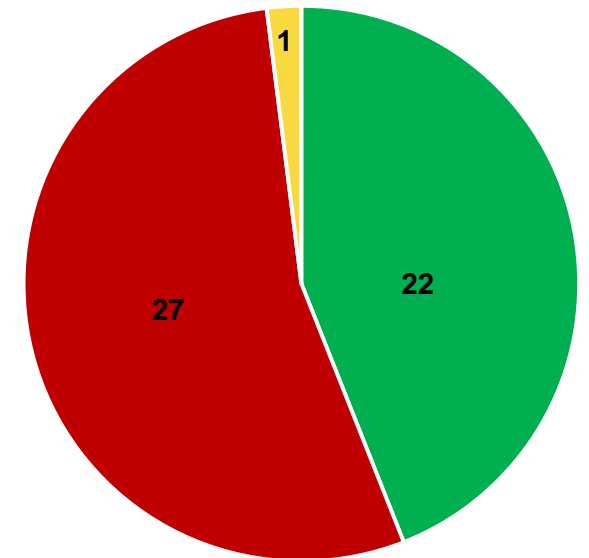
- Most PAH sites are not Federal-lead sites
- What are State policies?
- Survey of States performed:
  - Use of EPA RSLs
  - Use of new EPA toxicity factors
  - Use non-EPA toxicity factors
  - Number of PAHs evaluated
  - Treatment of naphthalene



# Status of State Adoption of New EPA Toxicity Values for BaP



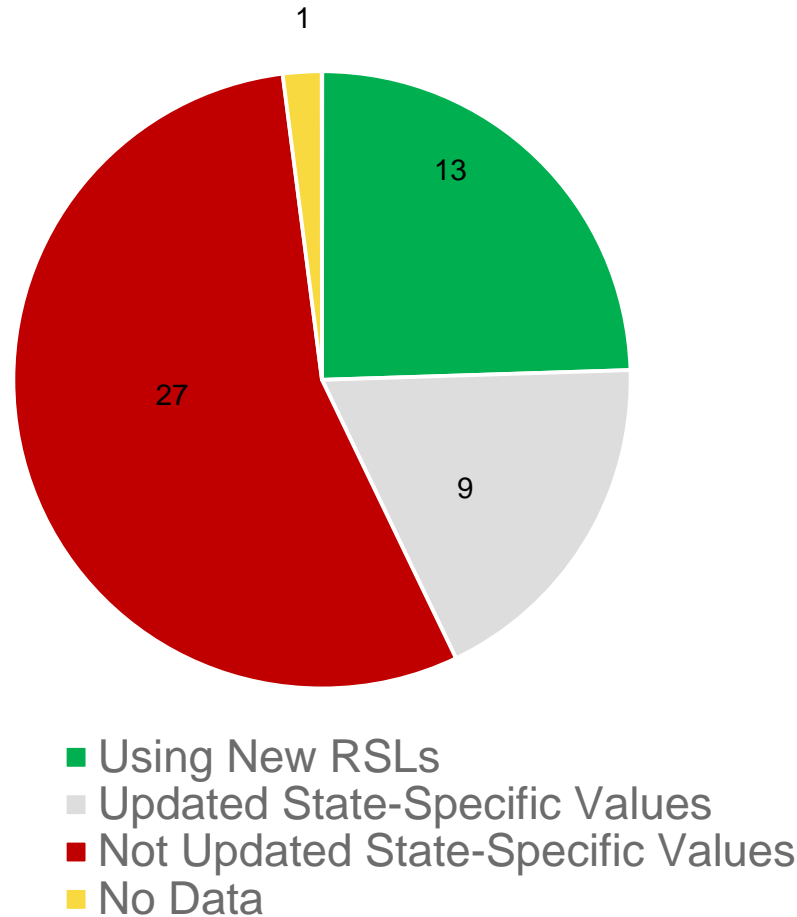
Number of States



- Using New BaP Values
- Not Using New BaP Values
- No Data

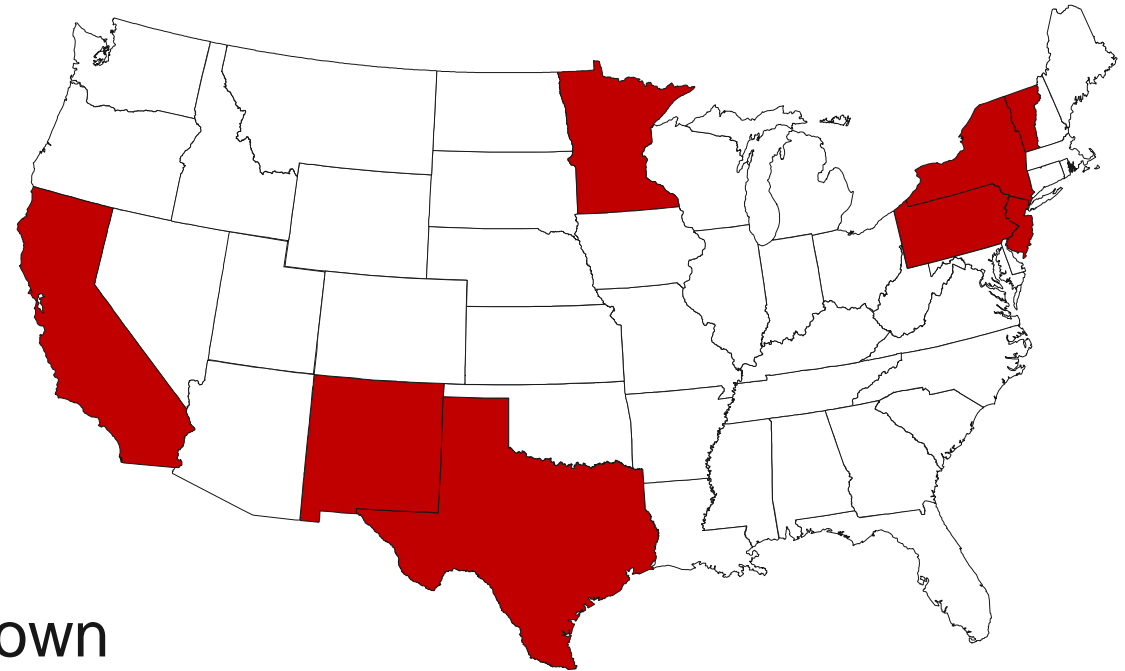
# Detail on States Using New BaP Value

Number of States



# Toxicity Values for State Criteria & Risk Assessment

- 38 States Use EPA CERCLA Hierarchy or RSL- Listed Values
- 8 States Use Other Toxicity Values
  - California
  - Minnesota
  - New Jersey
  - New Mexico
  - New York
  - Pennsylvania
  - Texas
  - Vermont
- Mississippi and South Dakota Unknown

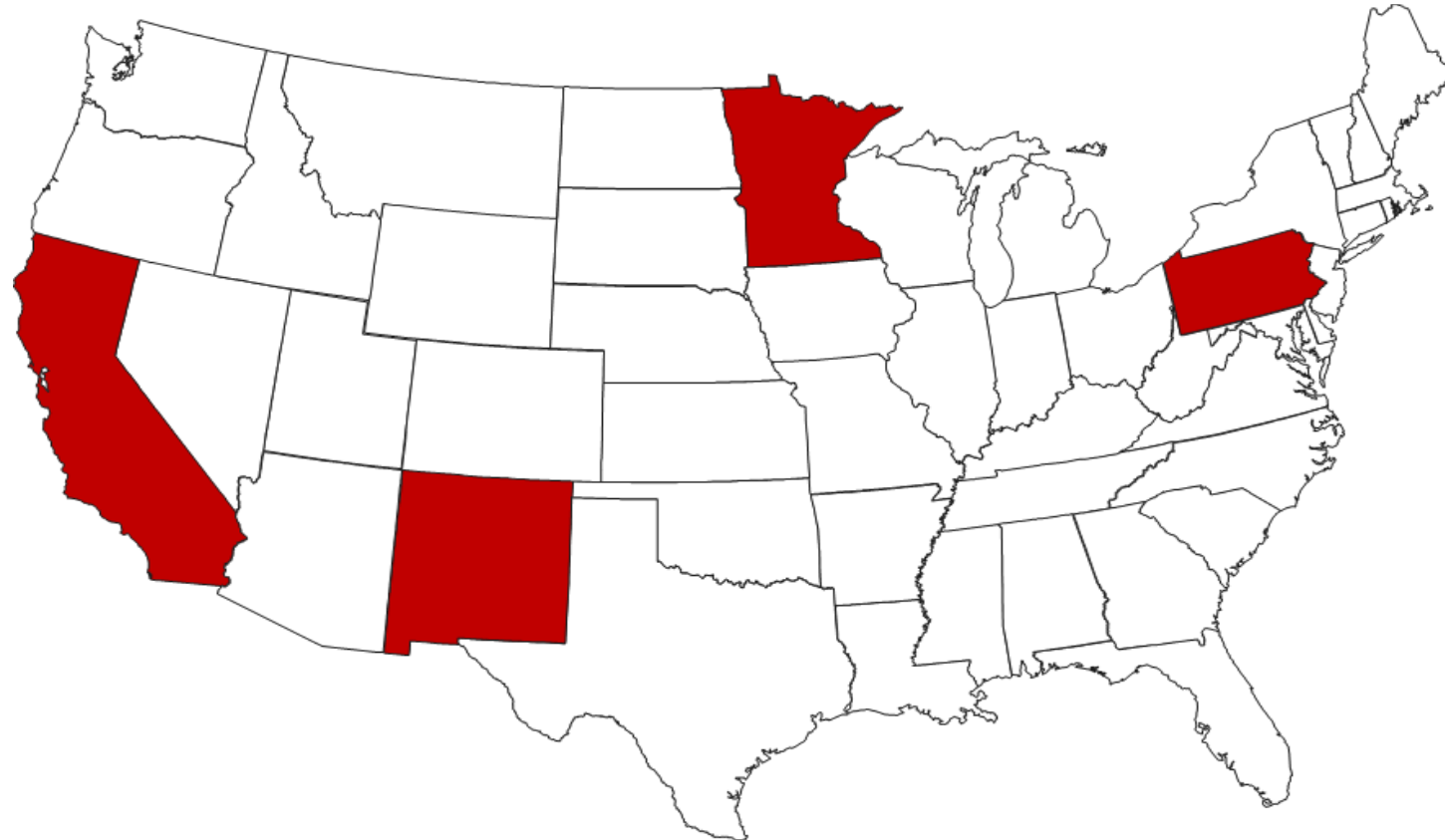


# Number of cPAHs Assessed

- Most states evaluate IRIS 7 cPAHs or the RSL 10 cPAHs
  - RSL Tables:
    - Benzo(j)fluoranthene,
    - 1,2-dimethylbenz(a)anthracene,
    - 4-nitropyrene
- California: 26 cPAH; potentially more for Proposition 65
- Minnesota: 19 – 25 (policy in flux)
- New Jersey: 26
- Texas: 13

# Focus on Selected State Programs

- California
- Minnesota
- New Mexico
- Pennsylvania



# California



PAH	Potency Equiv. Factor	Oral Cancer Slope Factor (mg/kg/d) <sup>-1</sup>	Inh Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	Inh Slope Factor (mg/kg/d) <sup>-1</sup>	Date
Benzo(a)pyrene	1	2.9	1.10E-03	3.9	2009, 2010, 2011
Benzo(a)anthracene	0.1	1.2	1.10E-04	3.90E-01	2009, 2011
Benzo(b)fluoranthene	0.1	1.20E+00	1.10E-04	3.90E-01	2009, 2011
Benzo(k)fluoranthene	0.1	1.20E+00	1.10E-04	3.90E-01	2009, 2011
Chrysene	0.01	1.20E-01	1.10E-05	3.90E-02	2009, 2011
Dibenz(a,h)anthracene	0.1	1.20E+00	1.10E-04	3.90E-01	2009, 2011
Indeno(1,2,3-c,d)pyrene	No - de novo	4.10E+00	1.20E-03	4.10E+00	1992, 2009, 2011
Naphthalene	No - de novo	1.20E-01	3.40E-05	1.20E-01	2004, 2009, 2011

# Potency Equivalency Factors and Relative Potency Factors for Other PAHs Regulated by the State of California

PAH	Potency Equivalency Factor	EPA Relative Potency Factor (1993)
Benzo[a]pyrene	1	1
Benz[a]anthracene	0.1	0.1
Benzo[b]fluoranthene	0.1	0.1
Benzo[j]fluoranthene	0.1	-
Benzo[k]fluoranthene	0.1	0.01
Dibenz[a,j]acridine	0.1	-
Dibenz[a,h]acridine	0.1	-
Dibenz[a,h]anthracene	-	1
7H-Dibenzo[c,g]carbazole	1	-
Dibenzo[a,e]pyrene	1	-
Dibenzo[a,h]pyrene	10	-
Dibenzo[a,i]pyrene	10	-
Dibenzo[a,l]pyrene	10	-
Indeno[1,2,3-cd]pyrene	Not used	0.1
5-methylchrysene	1	-
1-nitropyrene	0.1	-
4-nitropyrene	0.1	-
1,6-dinitropyrene	10	-
1,8-dinitropyrene	1	-
6-nitrochrysene	10	-
2-nitrofluorene	0.01	-
Chrysene	0.01	0.001



# Minnesota

- Minnesota Department of Health (MDH) guidance
  - 2001 (25 cPAH)
  - 2013
  - 2014
  - 2016 (19 cPAH, 18 “Secondary cPAHs”)
- Minnesota Pollution Control Agency (MPCA)
  - 2009 Soil Reference Value (SRV) spreadsheet
  - 2016 Draft SRV Technical Support Document



# MDH Priority Carcinogenic Polycyclic Aromatic Hydrocarbons and Relative Potency Factors (February 2016)

MDH Priority cPAHs (n = 19)	Relative Potency Factors	Source
Anthanthrene	0.4	USEPA (2010)
Benz[a]anthracene	0.2	USEPA (2010)
Benzo[a]pyrene	1	USEPA (2010)
Benzo[b]fluoranthene	0.8	USEPA (2010)
Benzo[c]fluorene	20	USEPA (2010)
Benzo[g,h,i]perylene	0.009	USEPA (2010)
Benzo[j]fluoranthene	0.3	USEPA (2010)
Benzo[k]fluoranthene	0.03	USEPA (2010)
Chrysene	0.1	USEPA (2010)
Cyclopenta[c,d]pyrene	0.4	USEPA (2010)
Dibenz[a,h]anthracene	10	USEPA (2010)
Dibenzo[a,e]pyrene	0.4	USEPA (2010)
Dibenzo[a,h]pyrene	0.9	USEPA (2010)
Dibenzo[a,i]pyrene	0.6	USEPA (2010)
Dibenzo[a,l]pyrene	30	USEPA (2010)
Fluoranthene	0.08	USEPA (2010)
Indeno[1,2,3-cd]pyrene	0.07	USEPA (2010)
5-Methylchrysene	1	OEHHA (2009)
6-Nitrochrysene	10	OEHHA (2009)

# Secondary cPAHs, February 2016

MDH Secondary cPAHs (n = 18)	Relative Potency Factors		Source
1H-Benz[b,c]aceanthrylene	0.05		USEPA (2010)
Benz[e]aceanthrylene	0.8		USEPA (2010)
Benz[j]aceanthrylene	60		USEPA (2010)
Benz[l]aceanthrylene	5		USEPA (2010)
4H-Cyclopenta[d,e,f]chrysene	0.3		USEPA (2010)
Dibenz[a,h]acridine	0.1		OEHHA (1994)
Dibenz[a,j]acridine	0.1		OEHHA (1994)
Dibenzo[a,e]fluoranthene	0.9		USEPA (2010)
7H-Dibenzo[c,g]carbazole	1		OEHHA (1994)
7,12-Dimethylbenz[a]anthracene	64 (air only)	150 (oral/dermal)	MDH (2016)
1,6-Dinitropyrene	10		OEHHA (1994)
1,8-Dinitropyrene	1		OEHHA (1994)
3-Methylcholanthrene	5.6 (air only)	13 (oral/dermal)	MDH (2016)
Naphtho[2,3-e]pyrene	0.3		USEPA (2010)
5-Nitroacenaphthene	0.02		MDH (2016)
2-Nitrofluorene	0.01		OEHHA (1994)
1-Nitropyrene	0.1		OEHHA (1994)
4-Nitropyrene	0.1		OEHHA (1994)

# MPCA MDH Priority Carcinogenic Polycyclic Aromatic Hydrocarbons (September 2016)

MPCA Priority cPAHs	MPCA Priority cPAHs
Benz[a]anthracene	Dibenz[a,h]acridine
Benzo[a]pyrene	Dibenz[a,j]acridine
Benzo[b]fluoranthene	7H-Dibenzo[c,g]carbazole
Benzo[j]fluoranthene	7,12-Dimethylbenz[a]anthracene
Benzo[k]fluoranthene	1,6-Dinitropyrene
Chrysene	1,8-Dinitropyrene
Dibenz[a,h]anthracene	3-Methylcholanthrene
Dibenzo[a,e]pyrene	5-Nitroacenaphthene
Dibenzo[a,h]pyrene	2-Nitrofluorene
Dibenzo[a,i]pyrene	1-Nitropyrene
Dibenzo[a,l]pyrene	4-Nitropyrene
Indeno[1,2,3-cd]pyrene	
5-Methylchrysene	
6-Nitrochrysene	

**MPCA 2009 Relative Potency Factors differ from  
the MDH 2016 Relative Potency Factors**

# Minnesota Guidance (MPCA, 2016)

- Only evaluate EPA 7 cPAHs at the majority of sites
- Evaluate the extended list of 25 (MDH, 2001) in MPAC spreadsheet if:
  - Source of contamination was from a combustion process such as an incinerator or open burning
  - Environmental fingerprinting or forensics will be used to identify sources or waste streams
  - Extended list of 25 cPAHs are a concern or have been previously identified
- MDH (2016) guidance appears not to be followed by MPCA

# New Mexico



PAH	Oral Cancer Slope Factor (mg/kg/d) <sup>-1</sup>	Inh Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	Reference Dose (mg/kg/d)	Reference Concentration mg/m <sup>3</sup>
Benzo(a)pyrene	1	6.00E-04	3.00E-04	2.00E-06
Benzo(a)anthracene	7.30E-01	1.10E-04	NA	NA
Benzo(b)fluoranthene	7.30E-01	1.10E-04	NA	NA
Benzo(k)fluoranthene	7.30E-02	1.10E-04	NA	NA
Chrysene	7.30E-03	1.10E-05	NA	NA
Dibenz(a,h)anthracene	7.3	1.20E-03	NA	NA
Indeno(1,2,3-c,d)pyrene	7.30E-01	1.10E-04	NA	NA

Only BaP is updated, not other cPAHs

# Pennsylvania



Regulated Substance	Reference Dose (mg/kg-d)	Oral Cancer Slope Factor (mg/kg-d) <sup>-1</sup>	Reference Concentration (mg/m <sup>3</sup> )	Inh. Unit Risk (µg/m <sup>3</sup> ) <sup>-1</sup>
Benzo[a]anthracene	-	0.7	-	0.00011
Benzo[a]pyrene	-	7.3	-	0.0011
Benzo[b]fluoranthene	-	1.2	-	0.00011
Benzo[k]fluoranthene	-	1.2	-	0.00011
Chrysene	-	0.12	-	0.000011
Dibenzo[a,h]anthracene	-	4.1	-	0.0012
Indeno[1,2,3-cd]pyrene	-	1.2	-	0.00011
Naphthalene	0.02	0.12	0.003	0.000034

**PADEP values have not been updated and use non-EPA toxicity values.**

# Summary of State Survey

- More than half have not updated their approach for PAHs and are using old EPA values, which are more stringent
- Most States assess standard EPA list of 7 cPAHs or 10 listed on RSL table
  - Four assess more PAHs: CA, MN, NJ, TX
- Most States use standard EPA toxicity factors
  - Eight states do not: CA, MN, NJ, NM, NY, PA, TX, VT
- Action: Lobby your states to update their state-specific criteria or allow use of new factors for site cleanups
- Action: Take care in states such as CA and MN, lobby MN



# Vapor Intrusion Update

- EPA's vapor intrusion program evaluates benzene, ethylbenzene and naphthalene based on cancer risk
- Evidence that ethylbenzene and naphthalene pose cancer risks to humans is very limited

Chemical	10 <sup>-6</sup> Residential Indoor Air VISL (ug/m <sup>3</sup> )	10 <sup>-6</sup> Commercial Indoor Air VISL (ug/m <sup>3</sup> )
Benzene	0.36	1.57
Ethylbenzene	1.1	4.9
Naphthalene	0.08	0.36

# Naphthalene Status

- EPA and most States evaluate naphthalene as an inhalation carcinogen despite that fact that USEPA IRIS withdrew its Unit Risk Factor years ago pending a robust research program
- Several states do not:
  - CT, FL, GA, IA, LA, ME, MS, NH, NY, NC, ND, PA, TX, UT
- PA evaluates naphthalene also as an ingestion carcinogen
- USEPA lists naphthalene in IRIS Step 1, Draft Development despite the fact that \$3M+ of toxicology research requested by EPA was completed several years ago

# Ethylbenzene Background

- EPA IRIS classifies ethylbenzene as “Group D” and has no toxicity factors for carcinogenic effects
- CalEPA classifies it as carcinogenic and has a Inhalation Unit Risk (IUR)
- EPA RSL Program ignores IRIS classification and classifies it as carcinogenic and uses CalEPA IUR to calculate RSLs
- EPA VISLs classify it as carcinogenic and calculate VISL using CalEPA IUR

# Ethylbenzene Update

- EPA IRIS Assessment Plan for Ethylbenzene (9/17)
- “Evaluation of cancer endpoints could be complex and, therefore, might require more time to assess than noncancer endpoints. For this reason, a cancer assessment might be developed separately from RfC or RfD toxicity values.”
- EPA IRIS is planning to dodge the main issue, carcinogenicity, meanwhile EPA programs will continue to assess ethylbenzene as a carcinogen based on CalEPA assessment.
- Science Advisory Board Briefing September 27-28

# Questions/Discussion



# State Survey Grand Summary (1 of 2)

State	New BaP Value?	Non-EPA Toxicity Values?	EPA cPAH List?
Alabama	Yes	No	Yes
Alaska	No	No	Yes
Arizona	No	No	Yes
Arkansas	Yes	No	Yes
California	No	Yes	No
Colorado	Yes	No	Yes
Connecticut	No	No	Yes
Delaware	No	No	Yes
Florida	No	No	Yes
Georgia	Yes	No	Yes
Hawaii	No	No	Yes
Idaho	Yes	No	Yes

State	New BaP Value?	Non-EPA Toxicity Values?	EPA cPAH List?
Illinois	Yes	No	Yes
Indiana	Yes	No	Yes
Iowa	Yes	No	Yes
Kansas	No	No	Yes
Kentucky	Yes	No	Yes
Louisiana	No	No	Yes
Maine	No	No	Yes
Maryland	Yes	No	Yes
Massachusetts	Yes	No	Yes
Michigan	Yes	No	Yes
Minnesota	No	Yes	No
Mississippi	No	No	Yes

# State Survey Grand Summary (2 of 2)

State	New BaP Value?	Non-EPA Toxicity Values?	EPA cPAH List?
Missouri	No	No	Yes
Montana	Yes	No	Yes
Nebraska	No	No	Yes
Nevada	No	No	Yes
New Hampshire	No	No	Yes
New Jersey	No	Yes	No
New Mexico	Yes, BaP only	Yes	Yes
New York	No	Yes	Yes
North Carolina	No	No	Yes
North Dakota	No	No	Yes
Ohio	Yes	No	Yes
Oklahoma	Yes	No	Yes
Oregon	No	No	Yes

State	New BaP Value?	Non-EPA Toxicity Values?	EPA cPAH List?
Pennsylvania	No	Yes	Yes
Rhode Island	No	No	Yes
South Carolina	Yes	No	Yes
South Dakota	?	?	?
Tennessee	Yes	No	Yes
Texas	Yes	Yes	No
Utah	No	No	Yes
Vermont	No	Yes	Yes
Virginia	Yes	No	Yes
Washington	No	No	Yes
West Virginia	No	No	Yes
Wisconsin	Yes	No	Yes
Wyoming	Yes	No	Yes

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