Proposed Near-Term Approach: Focus on a Limited Number of HAPs

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Workshop on Estimating Benefits of Reducing Hazardous Air Pollutants
April 30, 2009

Topics

- Evaluation of toxicologic and health effects data
  - Recommended dose-response assessments
- Combining exposure data with dose-response information
  - Our current understanding of priority HAPs
  - Summaries of several recent assessments that support this understanding
- What's next – near term

Evaluating health effects data

- Program coverage
  - 187 HAPs
  - 16 HAP categories
  - Potentially thousands of compounds
- Products
  - Air Toxics Health Effects Database (ATHED)
  - Web tables of dose-response values

Evaluating health effects data – chronic

Table 1. Prioritized Chronic Dose-Response Values (6/12/2007). CAS NO. = Chemical Abstracts Services number for the compound. HAP NO. = Position of the compound on the HAP list in the Clean Air Act (112[b][2]). "999" denotes substances under consideration for listing. IARC WOE = weight-of-evidence for carcinogenicity in humans (1 - carcinogenic; 2A - probably carcinogenic; 2B - possibly carcinogenic; 3 - not classifiable; 4 - probably not carcinogenic). EPA WOE = weight-of-evidence for carcinogenicity under the 1986 EPA cancer guidelines, as superseded for specific compounds by the 1999 interim guidelines (1986 guidelines: A - human carcinogen; B1 - probable carcinogen, limited human evidence; B2 - probable carcinogen, sufficient evidence in animals; C - possible human carcinogen; D - not classifiable E - evidence of noncarcinogenicity. 1999 guidelines: CH - carcinogenic to humans; LH - likely to be carcinogenic; SE - suggestive evidence for carcinogenicity; Inl - inadequate information to determine carcinogenicity; NH - not likely to be carcinogenic). Revisions since 2/28/05 are show

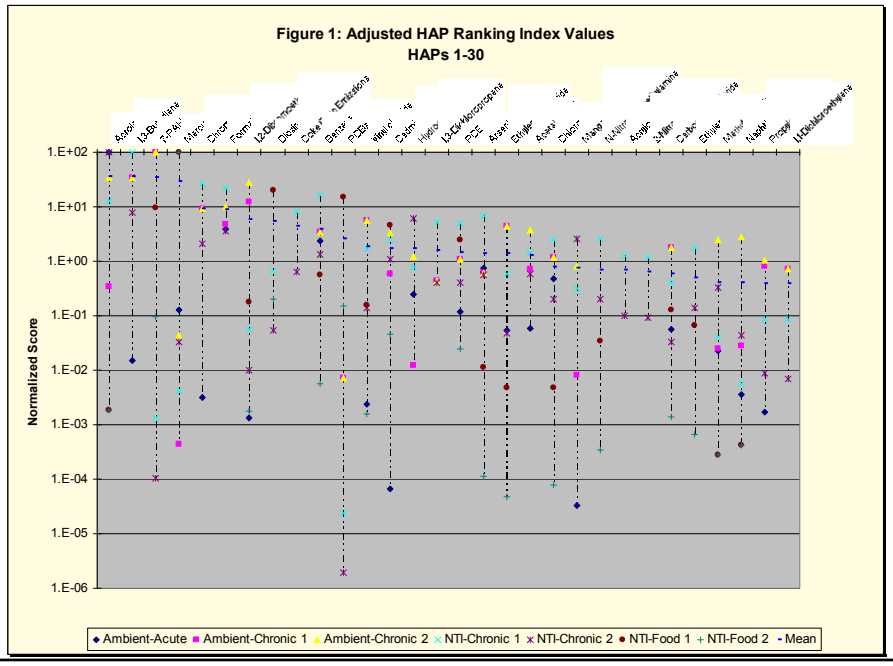
Table 1. Prioritized Chronic Dose-Response Values for Screening Risk Assessments (6/12/2007)				CHRONIC INHALATION					CHRONIC ORAL				
				NONCANCER		CANCER			NONCANCER		CANCER		
CHEMICAL NAME	CAS NO.	HAP NO.	IARC WOE	mg/m3	SOURCE	EPA WOE	1/(ug/m3)	SOURCE	mg/kg/d	SOURCE	EPA WOE	1/(mg/kg/d)	SOURCE
Acetaldehyde	75-07-0	1	2B	0.009	IRIS	B2	0.0000022	IRIS					
Acetamide	60-35-5	2	2B				0.00002	CAL					
Acetonitrile	75-05-8	3		0.06	IRIS	Inl							
Acetophenone	98-86-2	4				D							
Acrolein	107-02-8	6	3	0.00002	IRIS	Inl							
Acrylamide	79-06-1	7	2A	0.0007	P-CAL	B2	0.0013	IRIS					
Acrylic acid	79-10-7	8		0.001	IRIS								
Acrylonitrile	107-13-1	9	2A	0.002	IRIS	B1	0.000068	IRIS					
Allyl chloride	107-05-1	10	3	0.001	IRIS	C	0.000006	CAL					
Aniline	62-53-3	12	3	0.001	IRIS	B2	0.0000016	CAL					
Antimony compounds	7440-36-0	173											
Antimony pentoxide	1314-60-9	173											
Antimony potassium tartrate	304-61-0	173											
Antimony tetroxide	1332-81-6	173											
Antimony trioxide	1309-64-4	173	2B	0.0002	IRIS								
Arsenic compounds	7440-38-2	174	1	0.00003	CAL	A	0.0043	IRIS					
Arsenic pentoxide	***1303-28-2***	***174***		***0.00003***	***CAL***								
Arsine	7784-42-1	174		0.00005	IRIS								
Benzene	71-43-2	15	1	0.03	IRIS	CH	0.0000078	IRIS					
Benzidine	92-87-5	16		0.01	P-CAL	A	0.067	IRIS					
Benzotrichloride	98-07-7	17	2B			B2	0.0037	Conv. Oral					
Benzyl chloride	100-44-7	18	2B			B2	0.000049	CAL					
Beryllium compounds	7440-41-7	175	1	0.00002	IRIS	LH	0.0024	IRIS					
Beryllium oxide	***1304-56-9***	***175***		***0.000007***	***CAL***								
Biphenyl	92-52-4	19				D							
Bis(2-ethylhexyl)phthalate	117-81-7	20	2B	0.01	P-CAL	B2	0.0000024	CAL					
Bis(chloromethyl)ether	542-88-1	21	1			A	0.062	IRIS					
Bromoform	75-25-2	22	3			B2	0.0000011	IRIS					
1,3-Butadiene	106-99-0	23	2A	0.002	IRIS	CH	0.00003	IRIS					
Cadmium compounds	7440-43-9	176	1	0.00002	CAL	B1	0.0018	IRIS	0.0005	IRIS	B1		

Evaluating health effects data – acute

Table 2. Acute Dose-Response Values for Screening Risk Assessments (6/12/2007). Revisions since 6/2/05 are shown in red. AEGL = Acute exposure guideline levels for mild effects (AEGL-1) and moderate effects (AEGL-2) for 1- and 8-hour exposures. Superscripts indicate the AEGL's status: f = final, i=interim, and p=proposed. ERPG = US DOE Emergency Removal Program guidelines for mild or transient effects (ERPG-1) and irreversible or serious effects (ERPG-2) for 1-hour exposures. MRL = ATSDR minumum risk levels for no adverse effects for 1 to 14-day exposures. REL = California EPA reference exposure level for no adverse effects. Most, but not all, RELs are for 1-hour exposures. IDLH/10 = One-tenth of levels determined by NIOSH to be imminently dangerous to life and health, approximately comparable to mild effects levels for 1-hour exposures. TEEL = US DOE Temporary emergency exposure limits for no effects (TEEL-0) and mild, transient effects (TEEL-1) for 1-hour exposures. TEELs are derived according to a tiered, formula-like methodology, and do not undergo peer review. They are not recommended as the basis for regulatory desision-making, and are shown here only to inform situations where acute values from other sources are not available.

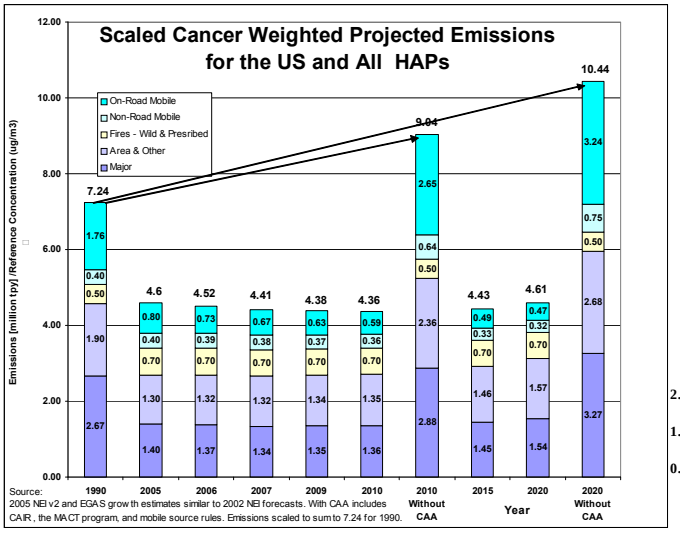
Table 2. Acute Dose-Response Values for Screening Risk Assessments (6/12/2007)			AEGL-1 (1-h)	AEGL-1 (8-h)	AEGL-2 (1-h)	AEGL-2 (8-h)	ERPG-1	ERPG-2	MRL	REL	IDLH/10	TEEL-0	TEEL-1
CHEMICAL NAME	CAS NO.	HAP NO.	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3
Acetaldehyde	75-07-0	1	81 f	81 f	490 f	200 f	81	490			360		
Acetamide	60-35-5	2										25	75
Acetonitrile	75-05-8	3	22 f	22 f	540 f	140 f					84		
Acetophenone	98-86-2	4										10	30
2-Acetylaminofluorene	53-96-3	5										0.25	0.75
Acrolein	107-02-8	6	0.069 f	0.069 f	0.23 f	0.23 f	0.069	0.23	0.0069	0.00019	0.46		
Acrylamide	79-06-1	7									6		
Acrylic acid	79-10-7	8	4.4 f	4.4 f	140 f	41 f	4.4	140		6			
Acrylonitrile	107-13-1	9	10 p	10 p	130 p	19 p	22	77	0.22		19		
Allyl chloride	107-05-1	10					9.4	130			78		
4-Aminobiphenyl	92-67-1	11										0.5	1.5
Aniline	62-53-3	12	30 f	3.8 f	46 f	5.7 f					38		
Anisidine	90-04-0	13									5		
Antimony compounds	7440-36-0	173									5		
Antimony pentafluoride	7783-70-2	173										0.75	0.75
Antimony potassium tartrate	304-61-0	173										1.2	4
Antimony trihydride	7803-52-3	173										0.51	0.51
Antimony trioxide	1309-64-4	173										0.6	1.5
Arsenic chloride	7784-34-1	174										0.19	0.56
Arsenic compounds	7440-38-2	174								0.00019	0.5		
Arsenic oxide	1327-53-3	174		p	3 p	1.2 p							
Arsenic pentoxide	1303-28-2	174								0.00019			
Arsine	7784-42-1	174		f	0.54 f	0.064 f		0.54		0.16	0.96		
Asbestos	1332-21-4	999										0.005	0.5
Benzene	71-43-2	15	170 f	29 f	2600 f	640 f	170	2600	0.029	1.3	160		
Benzidine	92-87-5	16										0.15	0.5
Benzotrichloride	98-07-7	17										0.1	0.1
Benzyl chloride	100-44-7	18					5.2	52		0.24	5.2		
Beryllium chloride	7787-47-5	175										0.015	0.04
Beryllium compounds	7440-41-7	175						0.025			0.4		
Beryllium fluoride	7787-49-7	175										0.01	0.025
Beryllium nitrate	13597-99-4	175										0.03	0.075
Beryllium oxide	1304-56-9	175										0.005	

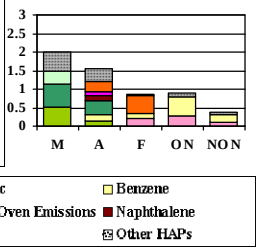
Considering exposure – selecting urban HAPs



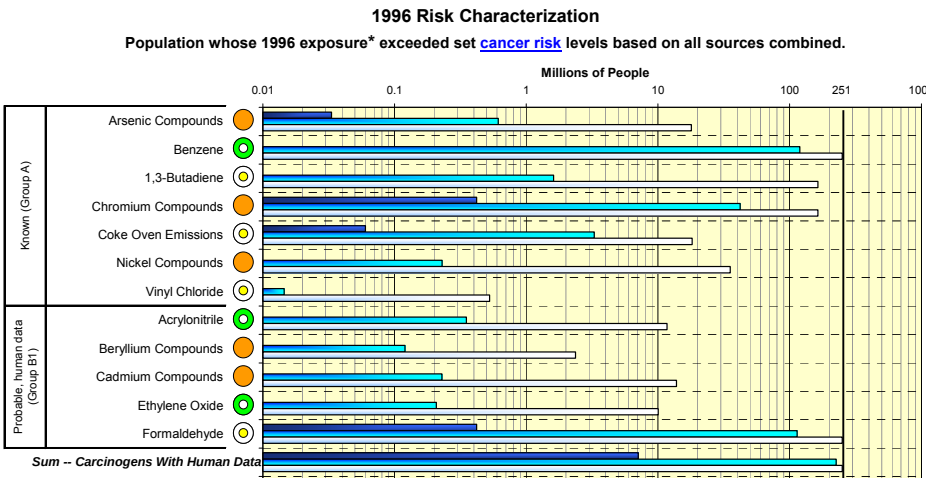
Proposed Near-Term Approach: Focus on Limited Number of HAPs

Considering exposures – toxicity weighting emissions

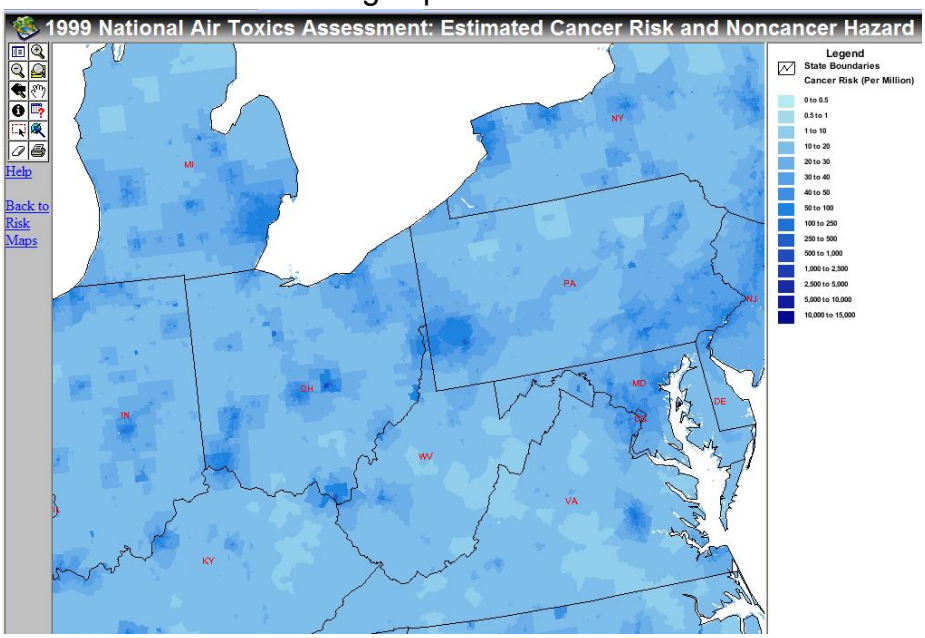




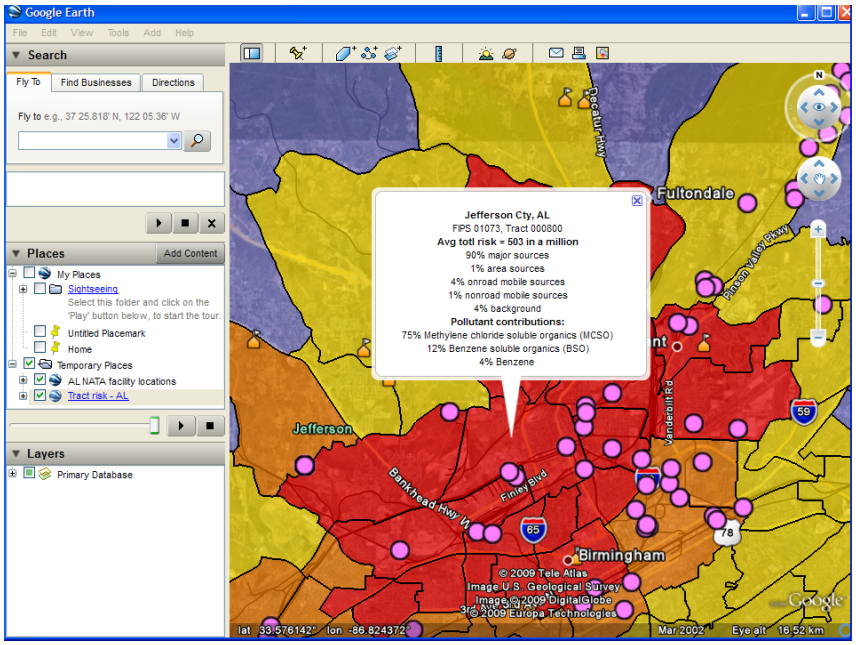
Considering exposure – NATA 1996



Considering exposure – NATA 1999



Considering exposure – NATA 2002



Considering exposure – NATA cancer drivers

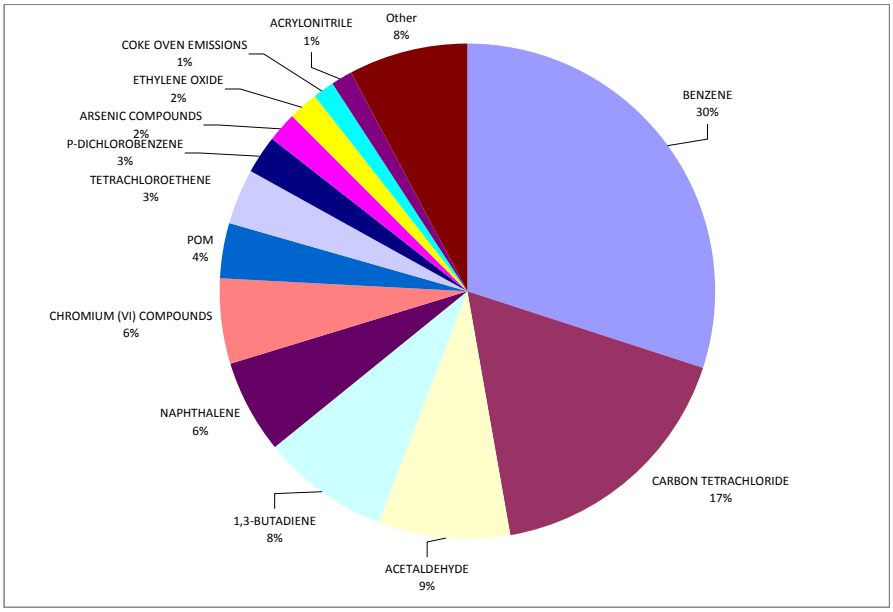
National drivers

- 1996
  - Benzene
  - Chromium VI
  - Formaldehyde
- 1999
  - Benzene

Regional drivers

- 1996
  - Arsenic
  - Coke oven emissions
  - 1,3-Butadiene
  - POM
- 1999
  - Arsenic
  - Benzidine
  - 1,3-Butadiene
  - Chromium VI
  - Coke oven emissions
  - Carbon tetrachloride
  - Cadmium
  - Ethylene oxide
  - Hydrazine
  - Naphthalene
  - Perchloroethylene
  - POM

Considering exposure – NATA cancer drivers



Considering exposure – assessing risks at schools

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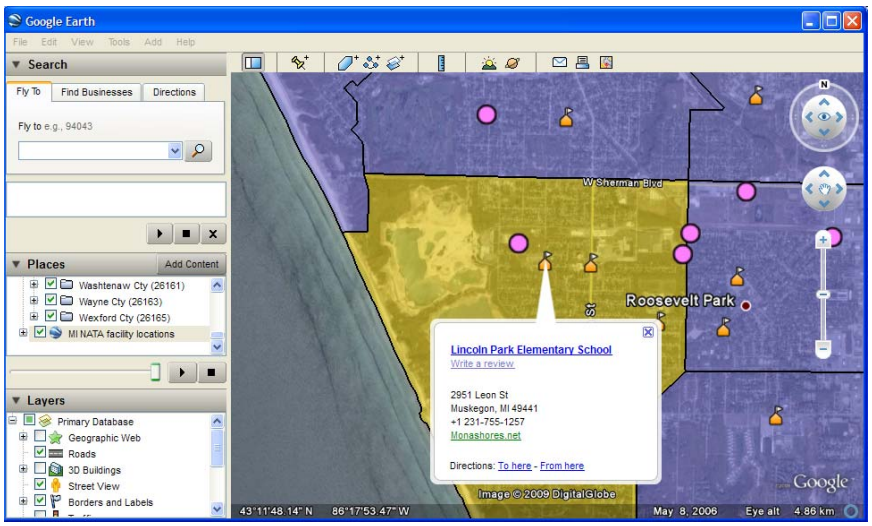

School Monitoring Program Primary Drivers

- 1,3-BUTADIENE
- 4,4'-METHYLENEDIANILINE
- ACETALDEHYDE
- ACROLEIN
- ACRYLAMIDE
- ANTIMONY COMPOUNDS
- ARSENIC COMPOUNDS
- BENZENE
- CADMIUM COMPOUNDS
- CHROMIUM COMPOUNDS(EXCEPT CHROMITE ORE MINED IN THE TRANSVAAL REGION)
- COBALT COMPOUNDS
- LEAD COMPOUNDS
- MANGANESE COMPOUNDS
- NAPHTHALENE
- NICKEL COMPOUNDS
- PAHs
- TOLUENE
- TOLUENE DIISOCYANATE (MIXED ISOMERS)
- XYLENE (MIXED ISOMERS)

Considering exposure – List of 14 PB-HAPs

- Combined existing EPA PBT lists with HAP list
  - Created emission-toxicity-BCF index
- Cross-checked results against other EPA lists:
  - Pollution Prevention Program http://www.epa.gov/pbt/cheminfo.htm
  - Great Waters Pollutants of Concern http://www.epa.gov/oar/oaqps/gr8water/3rdrpt/execsum.html
  - TRI PBTs http://www.epa.gov/tri/chemical/pbt_chem_list.htm

Considering exposure – List of 14 PB-HAPs

HAP/PB	OAQPS rank	2P Priority PBTs	Great Waters POCs	TRI PBTs
Cadmium compounds	NA		X	
Chlordane	7	X	X	X
Chlorinated dibenzodioxins & furans	1	X	X	X
DDE	8	X	X	
Heptachlor	4			X
Hexachlorobenzene	6	X	X	X
Hexachlorocyclohexane (all isomers)	NA		X	
Lead compounds	NA	X	X	X
Mercury compounds	NA	X	X	X
Methoxychlor	NA			X
Polychlorinated biphenyls	3	X	X	X
Polycyclic organic matter	2	X	X	X
Toxaphene	5	X	X	X
Trifluralin	NA			X

Considering exposure – HAPs that lack dose-response assessments

- 47 HAPs lack <u>both</u> RfC and URE
- To estimate their possible importance, we tox-weighted their emissions with surrogate dose-response values:
  - Median URE: 6.8 e-5 per µg/m3 (50th percentile)
  - Upper-bound URE: 4.8 e-2 per µg/m3 (95th percentile)
  - Median RfC: 9.9 µg/m3 (50th percentile)
  - Upper-bound RfC: 0.024 µg/m3 (5th percentile)

Considering exposure – HAPs that lack dose-response assessments

- HAPs contributing > 1 % of total
  - 50%ile toxicity
    - Cancer – none
    - Noncancer –2,2,4-trimethylpentane (1.5%)
  - 95%ile toxicity
    - Cancer – ethyl acrylate (15%)
    - Noncancer – 2,2,4-trimethylpentane (80%), carbonyl sulfide (5%), propionaldehyde (4%)

What's next? In the near term, OAQPS could…

- Seek out more opportunities to use ATHED and NATA to support research, e.g.,
  - Epi studies
  - EJ studies (using Census data)
- Collaborate with ORD to expand and disseminate ATHED
- Use urban scoring methods and NATA to search for priority substances beyond the HAP list