HAPs, Micromaps and GPL - Visualization of Geographically Referenced Statistical Summaries on the World Wide Web

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Contents

- Cumulative Exposure Project
- Graphics Production Library (GPL)
- Micromaps
- Bringing all together

Cumulative Exposure Project

- Conducted by EPA's Office of Policy
- Collection of analyses, addressing multiple pollutants from multiple sites
- National analyses of
  - Air Toxics (Outdoor Concentrations)
  - Food Contaminants (Exposures)
  - Drinking Water Contaminants (Exposures)
- Pilot Community-level study: Greenpoint/Williamsburg, NYC

Air Toxics

- 188 Hazardous Air Pollutants (HAPs) in Clean Air Act
- Limited availability of air toxics monitoring data
- Atmospheric dispersion modeling provides understanding of concentrations of toxics in outdoor air

Scope of Modeling

- Modeled concentrations for each census tract in continental US (> 60,000)
- 148 HAPs modeled
- Includes stationary and mobile sources of air toxics emissions
- Uncertainty bounds derived from model-monitor comparisons

WWW-based Access of HAP Data

- Goals:
  - Concise display
  - Easy access
  - Understandable to nonstatistical audience
- Solution:
  - WWW
  - GPL
  - Micromaps

Graphics Production Library (GPL)

- Tool for creation and modification of statistical graphics on the WWW
- Follows guidelines of modern statistical graphics
- JAVA-based
- Works with Netscape and Internet Explorer

History of the GPL

- Developers: Dan Rope, Dan Carr
- Main reference: Carr, Valliant, Rope (1996): Plot Interpretation and Information Webs…, SCSG*, Vol. 7, No. 2
- New commercial product based on GPL currently developed by Dan Rope
- Upgrade and new features added to GPL through BLS and contractors

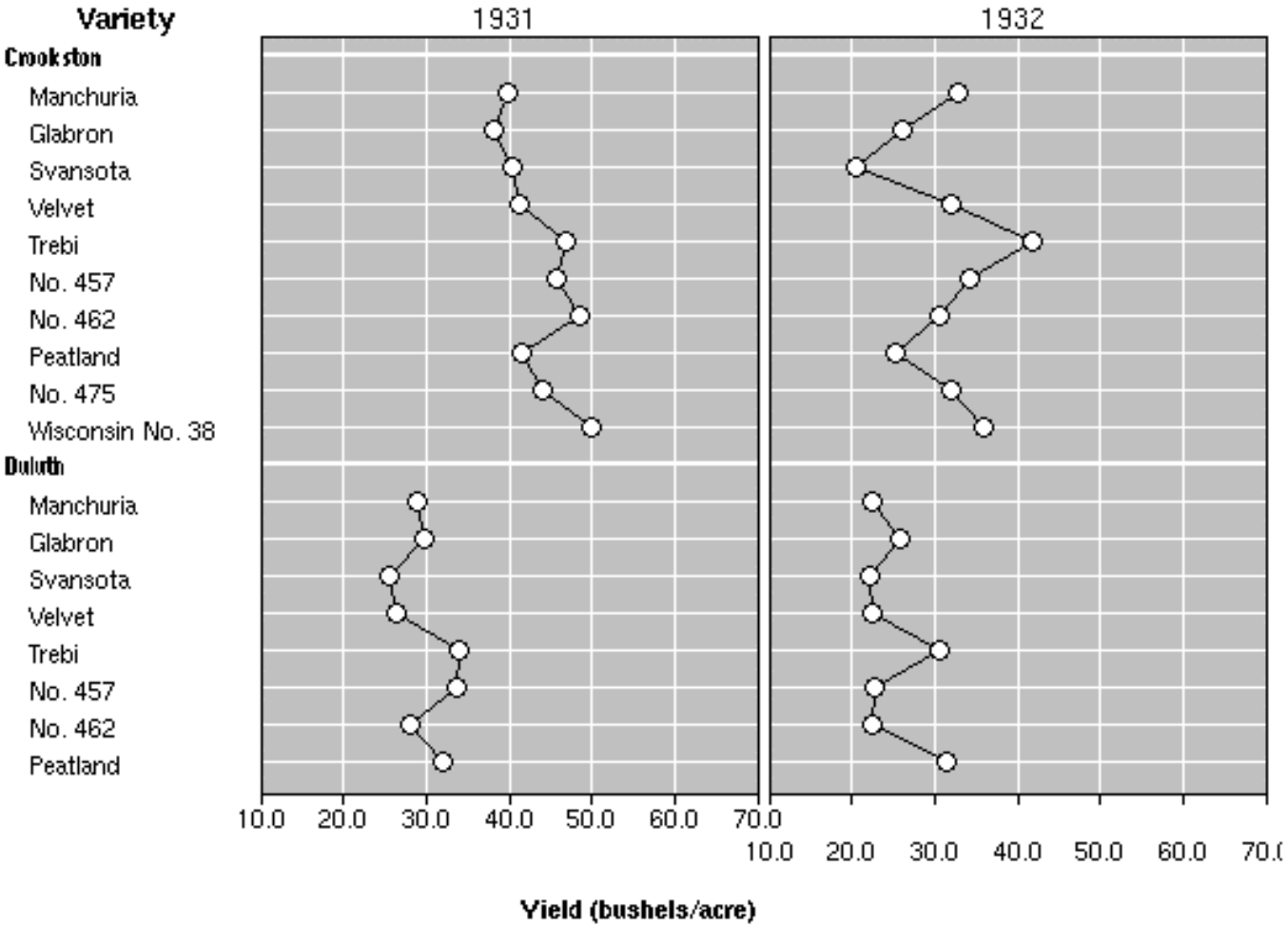
*Statistical Computing & Statistical Graphics Newsletter: http://cm.bell-labs.com/cm/ms/who/cocteau/newsletter/index.html

GPL Examples

- WWW: http://www.monumental.com/dan_rope/gpl/
- WWW mirror site: http://www.galaxy.gmu.edu/~symanzik/gpl/data/

The Barley Data

From Visualizing Data by W.S. Cleveland



Show Data

Pan And Zoom

Micromaps

- Link of row-labeled univariate (or multivariate) statistical summaries to corresponding geographical region
- Focus on statistical display and not on maps
- S-Plus functions (available at ftp://galaxy.gmu.edu/pub/dcarr/newsletter/micromap/)

History of Micromaps

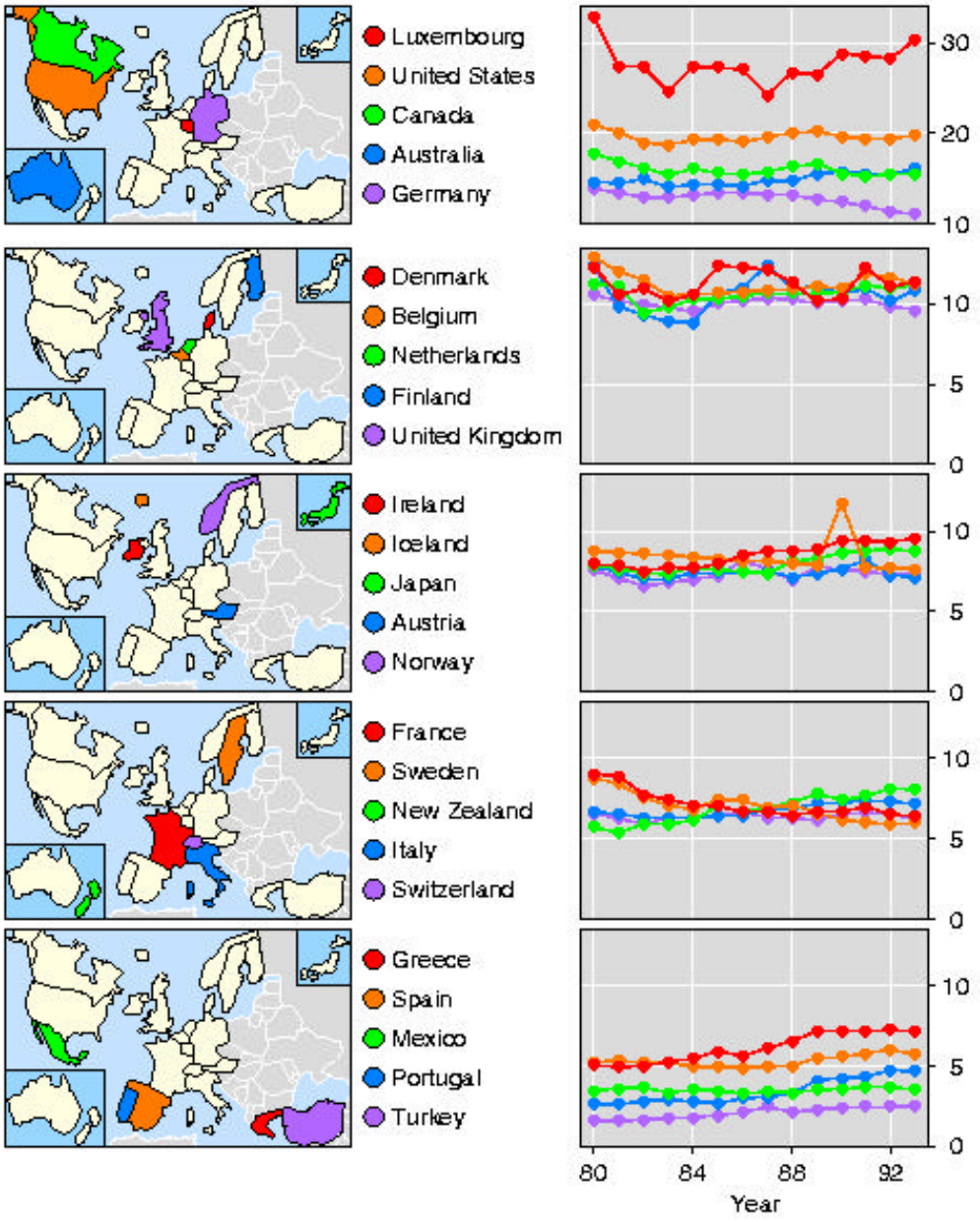
- First presented at 1995 American Statistical Association's annual meeting (Olsen, Carr, Courbois, Pierson)
- Main references:
  - Carr, Pierson (1996) Emphasizing Statistical Summaries … with Micromaps, SCSG, Vol. 7, No.3
  - Carr, Olsen, Courbois, Pierson, Carr (1998) Linked Micromap Plots …, SCSG, Vol. 9, No.1

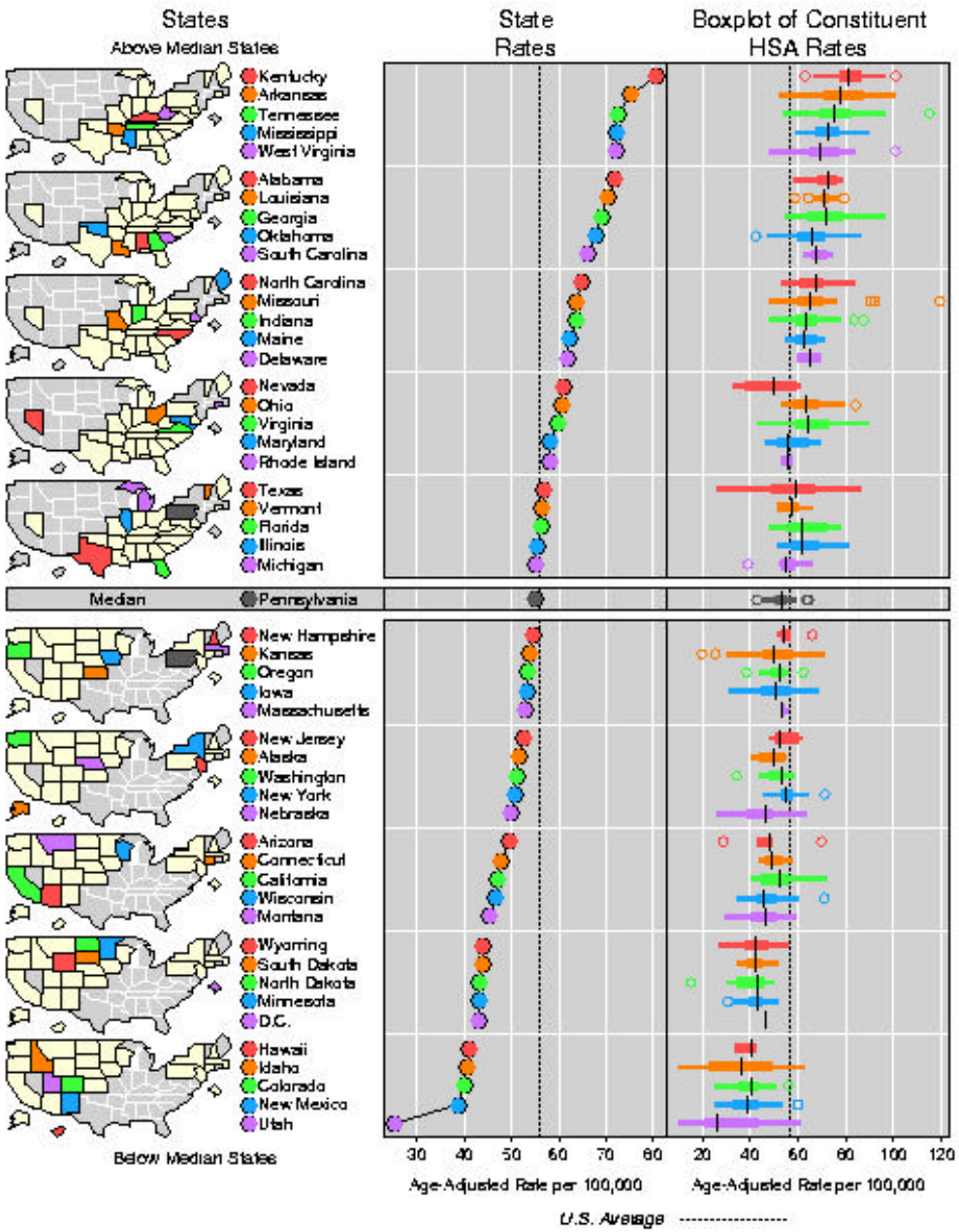
Micromap Examples

- ftp://galaxy.gmu.edu/pub/dcarr/newsletter/lmplots/

Annual CO2 Emissions From Energy Use

Units = Tons Per Person




Lung Cancer Mortality Rates By State
White Males, 1988-1992
States
Above Median States
Kentucky
Arkansas
Tennessee
Mississippi
West Virginia
Alabama
Louisiana
Georgia
Oklahoma
South Carolina
North Carolina
Missouri
Indiana
Maine
Delaware
Nevada
Ohio
Virginia
Maryland
Rhode Island
Texas
Vermont
Florida
Illinois
Michigan
Median
Pennsylvania
New Hampshire
Kansas
Oregon
Iowa
Massachusetts
New Jersey
Alaska
Washington
New York
Nebraska
Arizona
Connecticut
California
Wisconsin
Montana
Wyoming
South Dakota
North Dakota
Minnesota
D.C.
Hawaii
Idaho
Colorado
New Mexico
Utah
Below Median States
State Rates
Boxplot of Constituent HSA Rates
30 40 50 60 70 80
20 40 60 80 100 120
Age-Adjusted Rate per 100,000
Age-Adjusted Rate per 100,000
U.S. Average

Bringing All Together

- **Hierarchical Clickable Micromaps in the GPL Environment for the Display of Hazardous Air Pollutants Data**
- GPL extended with micromaps
- Selection of HAPs
- Clickable maps
- Hierarchy of maps

Realization

- Automatic one-time creation of micromaps
- C CGI scripts used to create follow-up data sets and Web pages
- Political vs. scientific design and layout
- Availability: ???
- http://www.epa.gov/CumulativeExposure

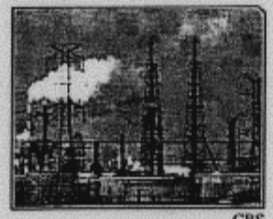
Current Standing

NATIONAL ‹ back to NEWS

Is House Paint Killing Us?

- *Industry May Not Be The Only Polluter*
- *Toxins Lurk In House Paint And Lawn Mowers*
- *But Some Question Validity Of Data*

UNION COUNTY, New Jersey
Saturday, February 20,1999 - 08:44 PM ET



CBS

(CBS) Breathing can be hazardous to your health. A groundbreaking study by the Environmental Protection Agency has found that virtually every American is inhaling unsafe levels of chemicals, reports **CBS News Correspondent Jeffrey Kofman.**

"It's almost: We found the problem, and it's us." Robert Shinn, New Jersey environmental commissioner

VIDEO
CBS News Correspondent Jeffrey Kofman Reports

The study looked beyond high-profile pollution problems like lead and carbon monoxide, testing for 148 toxins that haven't been examined closely before. It found unsafe levels of at least eight cancer-causing chemicals virtually everywhere in America.

CBS, 2/20/1999

Living On Earth TOP STORY

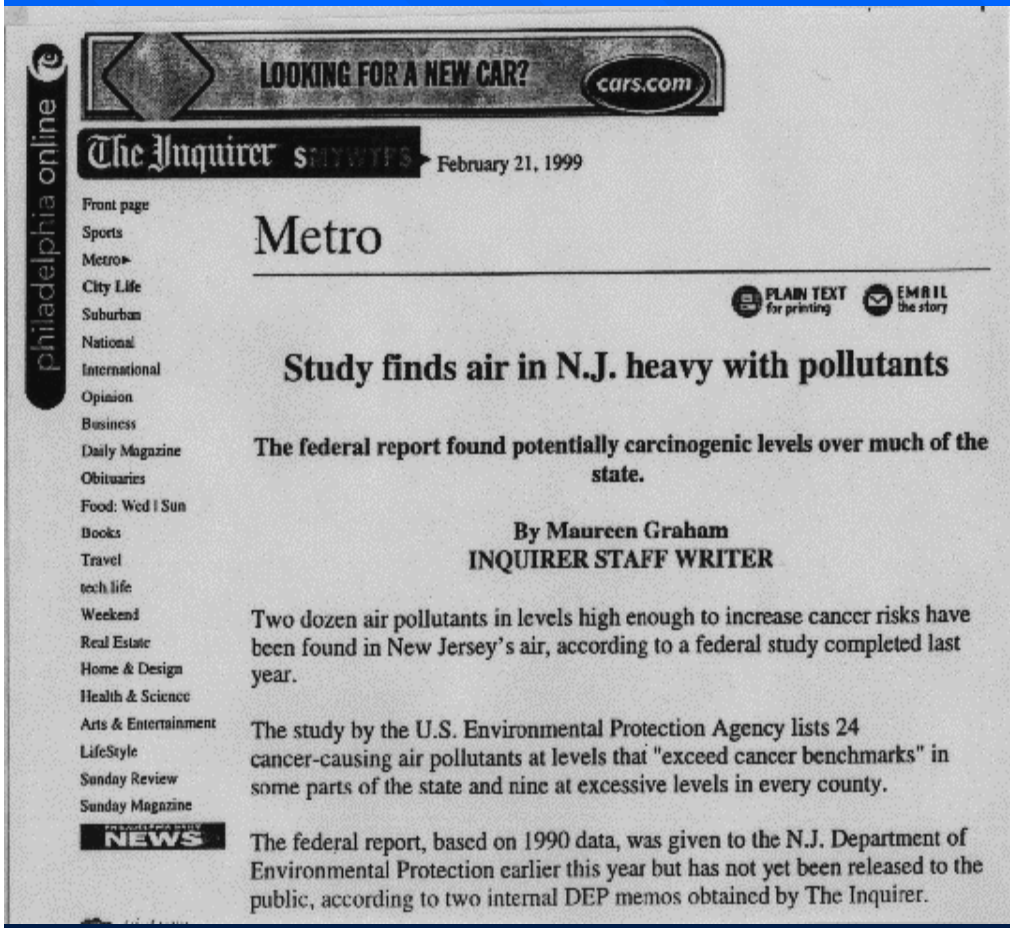
EPA Air Pollution Study Put On Hold

Air Date: Week of January 22, 1999

CURWOOD: This is Living on Earth. I'm Steve Curwood. The results of a groundbreaking new Federal study of air pollution might have been available at the click of a button. But they're not, because of objections from the nation's mayors. The Environmental Protection Agency's Cumulative Exposure Project is looking at airborne toxic chemicals. So far it has found that at least 8 of these chemicals are present at dangerous levels in every neighborhood in the continental US. The EPA was ready to post the city-by-city results on their Web site last month, but it decided not to, after the Conference of Mayors questioned the findings, saying they were based on untested models and old data. Scott Allen covers the environment for the Boston Globe. He says the report's conclusions are disturbing.

ALLEN: If you are living anywhere in the United States and taking a breath as we speak, you're getting at least an 8 in a million lifetime cancer risk of exposure from what you're breathing. That may not sound like a whole lot, but when you multiply it over a city's population, a couple million people living in a city or 5 million people in a state, it adds up to hundreds and thousands of cancers spread across a lot of people. And you have to also consider that there are some places, in fact about 10% of the United States, has got a significantly higher risk of cancer from the toxic chemicals in the air. Their risk is at least one in 10,000. And that means in any small town in America, practically, 1 or 2 people are getting cancer from breathing the air. Not any special pollution, but just the regular everyday air.

NPR, 1/22/99



philadelphia online

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The Inquirer STATE EDITION February 21, 1999

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Health & Science
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LifeStyle
Sunday Review
Sunday Magazine
NEWS

Metro

PLAIN TEXT for printing EMAIL the story

Study finds air in N.J. heavy with pollutants

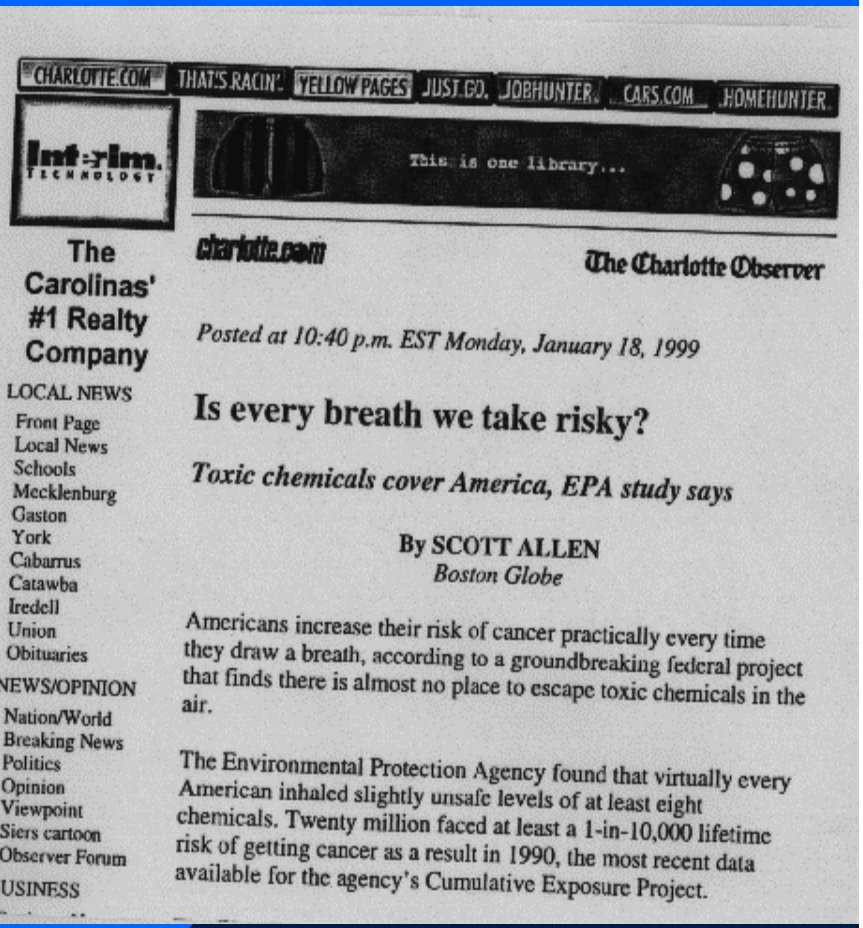
The federal report found potentially carcinogenic levels over much of the state.

By Maureen Graham
INQUIRER STAFF WRITER

Two dozen air pollutants in levels high enough to increase cancer risks have been found in New Jersey's air, according to a federal study completed last year.

The study by the U.S. Environmental Protection Agency lists 24 cancer-causing air pollutants at levels that "exceed cancer benchmarks" in some parts of the state and nine at excessive levels in every county.

The federal report, based on 1990 data, was given to the N.J. Department of Environmental Protection earlier this year but has not yet been released to the public, according to two internal DEP memos obtained by The Inquirer.



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charlotte.com The Charlotte Observer

Posted at 10:40 p.m. EST Monday, January 18, 1999

Is every breath we take risky?

Toxic chemicals cover America, EPA study says

By SCOTT ALLEN
Boston Globe

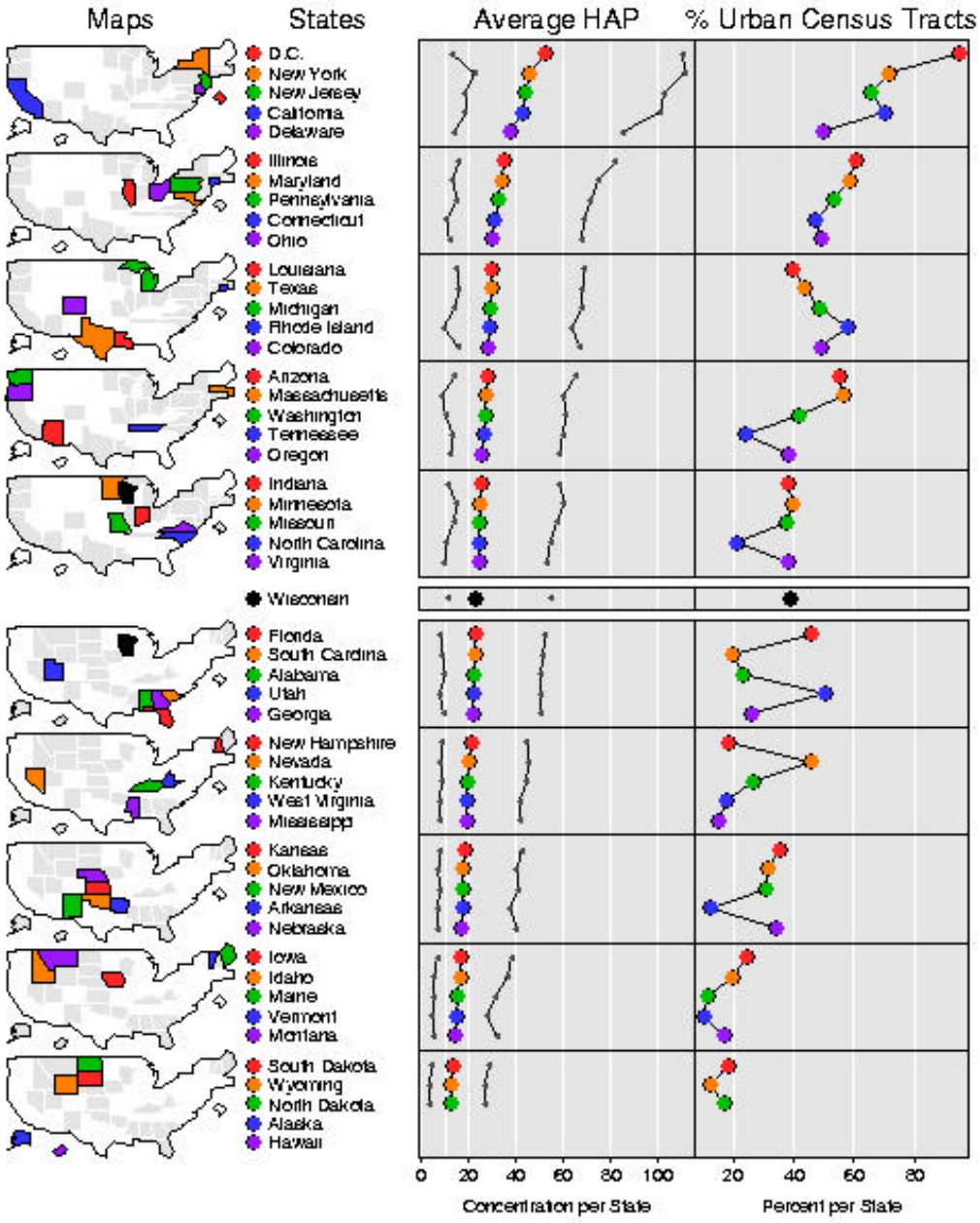
Americans increase their risk of cancer practically every time they draw a breath, according to a groundbreaking federal project that finds there is almost no place to escape toxic chemicals in the air.

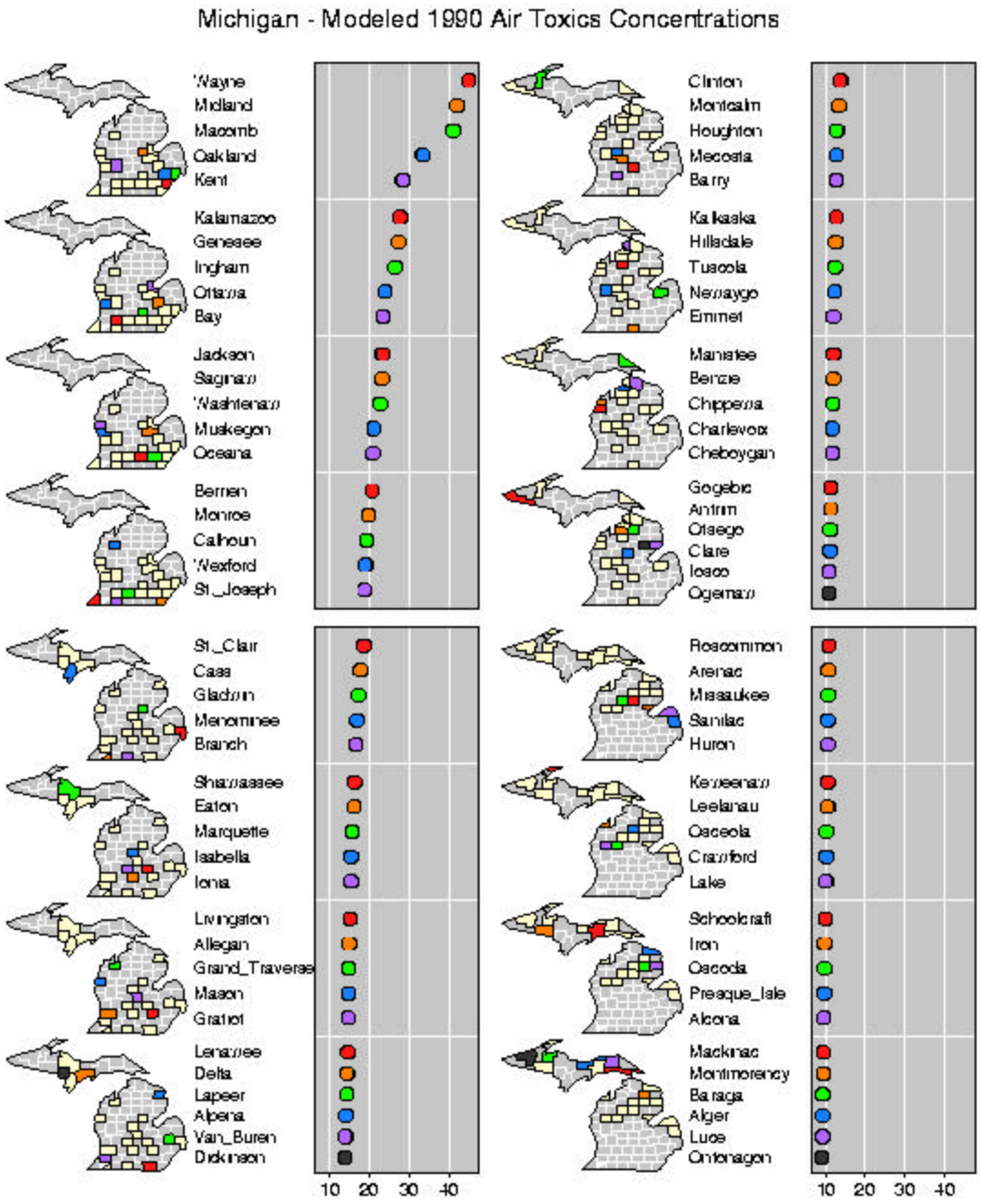
The Environmental Protection Agency found that virtually every American inhaled slightly unsafe levels of at least eight chemicals. Twenty million faced at least a 1-in-10,000 lifetime risk of getting cancer as a result in 1990, the most recent data available for the agency's Cumulative Exposure Project.

Philadelphia Inquirer, 2/21/99

Charlotte Observer, 1/18/99

Hazardous Air Pollutants (HAPs)
1990 Annual Average Per State




Michigan - Modeled 1990 Air Toxics Concentrations
Wayne
Midland
Macomb
Oakland
Kent
Kalamazoo
Genesee
Ingham
Ottawa
Bay
Jackson
Saginaw
Washtenaw
Muskegon
Oceana
Berrien
Monroe
Calhoun
Wexford
St_Joseph
St_Clair
Cass
Gladwin
Menominee
Branch
Shiawassee
Eaton
Marquette
Isabella
Ionia
Livingston
Allegan
Grand_Traverse
Mason
Gratiot
Lenawee
Delta
Lapeer
Alpena
Van_Buren
Dickinson
Clinton
Montcalm
Houghton
Mecosta
Barry
Kalkaska
Hillsdale
Tuscola
Newaygo
Emmet
Manistee
Benzie
Chippewa
Charlevoix
Cheboygan
Gogebic
Antrim
Otsego
Clare
Iosco
Ogemaw
Roscommon
Arenac
Missaukee
Sanilac
Huron
Keweenaw
Leelanau
Osceola
Crawford
Lake
Schoolcraft
Iron
Oscoda
Presque_Isle
Alcona
Mackinac
Montmorency
Baraga
Alger
Luce
Ontonagon
10
20
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40
10
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30
40

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Bookmarks Go To: http://www.epa.gov/CumulativeExposure

HOME
AIR
FOOD
DRINKING WATER
ABOUT THE PROJECT
WHAT'S NEW
RESOURCES
COMMUNITY-SPECIFIC STUDY
GREENPOINT/WILLIAMSBURG

EPA United States Environmental Protection Agency

CUMULATIVE EXPOSURE

P R O J E C T

EPA's Cumulative Exposure Project (CEP) is examining how much toxic contamination Americans are exposed to cumulatively through air, food,and drinking water. The study will estimate exposure levels for different communities and demographic groups nationwide, and identify which types of communities and demographic groups appear to have the highest exposures. The Cumulative Exposure Project is being conducted by EPA's Office of Policy.

About the Project

W H A T ' S N E W ?

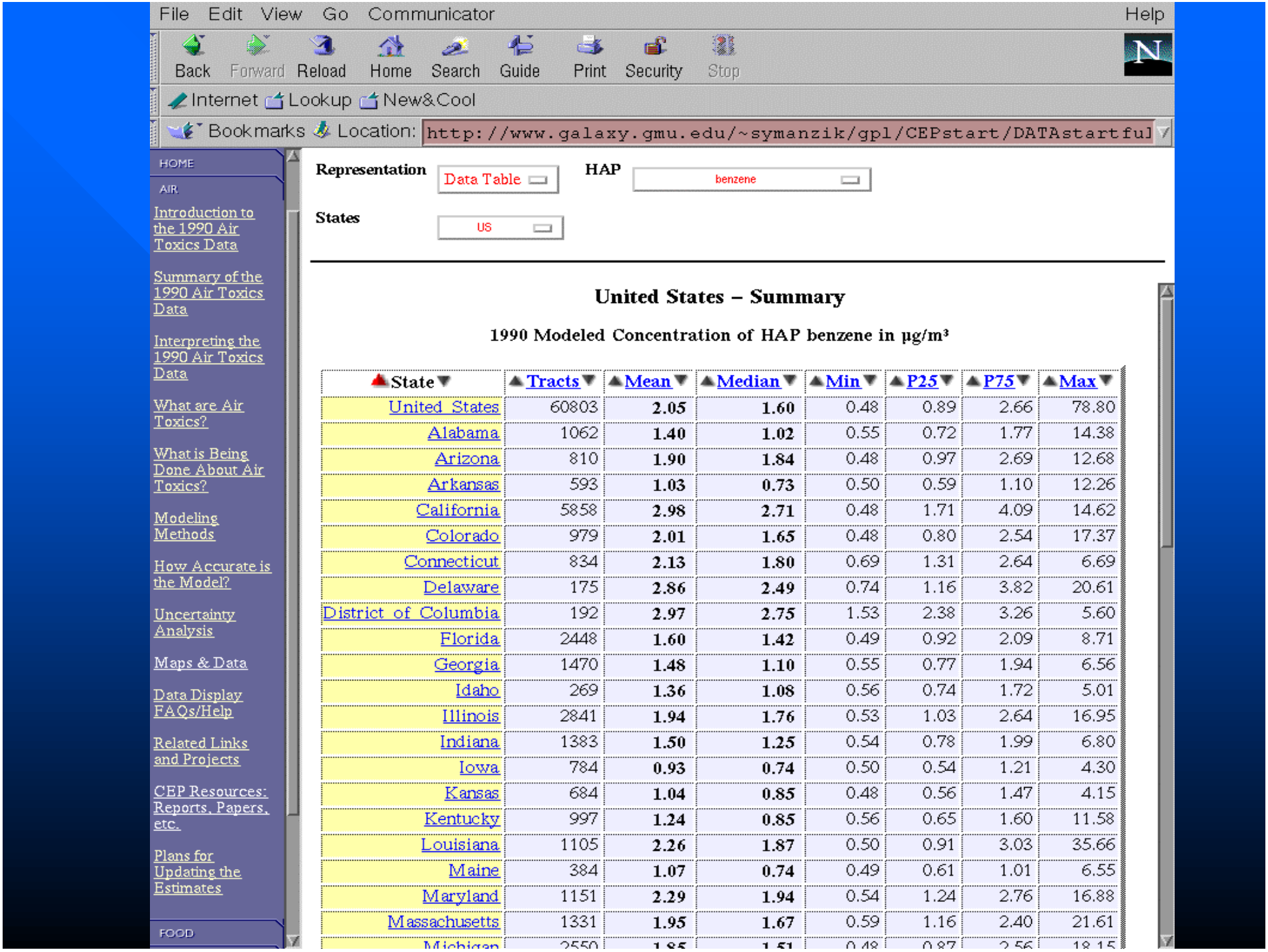
Modeled 1990 air toxics concentrations are now available.

[Cumulative Exposure Project Home | EPA Home | Search | What's new]

http://www.epa.gov/CumulativeExposure/index.htm

last updated 12/3/98

Please send comments about this page to axelrad.daniel@epa.gov



United States – Summary

1990 Modeled Concentration of HAP benzene in µg/m³

State	Tracts	Mean	Median	Min	P25	P75	Max
United States	60803	**2.05**	**1.60**	0.48	0.89	2.66	78.80
Alabama	1062	**1.40**	**1.02**	0.55	0.72	1.77	14.38
Arizona	810	**1.90**	**1.84**	0.48	0.97	2.69	12.68
Arkansas	593	**1.03**	**0.73**	0.50	0.59	1.10	12.26
California	5858	**2.98**	**2.71**	0.48	1.71	4.09	14.62
Colorado	979	**2.01**	**1.65**	0.48	0.80	2.54	17.37
Connecticut	834	**2.13**	**1.80**	0.69	1.31	2.64	6.69
Delaware	175	**2.86**	**2.49**	0.74	1.16	3.82	20.61
District of Columbia	192	**2.97**	**2.75**	1.53	2.38	3.26	5.60
Florida	2448	**1.60**	**1.42**	0.49	0.92	2.09	8.71
Georgia	1470	**1.48**	**1.10**	0.55	0.77	1.94	6.56
Idaho	269	**1.36**	**1.08**	0.56	0.74	1.72	5.01
Illinois	2841	**1.94**	**1.76**	0.53	1.03	2.64	16.95
Indiana	1383	**1.50**	**1.25**	0.54	0.78	1.99	6.80
Iowa	784	**0.93**	**0.74**	0.50	0.54	1.21	4.30
Kansas	684	**1.04**	**0.85**	0.48	0.56	1.47	4.15
Kentucky	997	**1.24**	**0.85**	0.56	0.65	1.60	11.58
Louisiana	1105	**2.26**	**1.87**	0.50	0.91	3.03	35.66
Maine	384	**1.07**	**0.74**	0.49	0.61	1.01	6.55
Maryland	1151	**2.29**	**1.94**	0.54	1.24	2.76	16.88
Massachusetts	1331	**1.95**	**1.67**	0.59	1.16	2.40	21.61
Michigan	2550	**1.85**	**1.51**	0.48	0.87	2.56	18.15

United States – Summary

1990 Modeled Concentration of HAP benzene in µg/m³

State	Tracts	Mean	Median	Min	P25	P75	Max
District of Columbia	192	**2.97**	**2.75**	1.53	2.38	3.26	5.60
Rhode Island	235	**1.92**	**1.77**	0.82	1.22	2.44	5.93
Delaware	175	**2.86**	**2.49**	0.74	1.16	3.82	20.61
New Jersey	1938	**3.30**	**2.82**	0.71	1.80	4.33	40.98
Connecticut	834	**2.13**	**1.80**	0.69	1.31	2.64	6.69
Massachusetts	1331	**1.95**	**1.67**	0.59	1.16	2.40	21.61
South Carolina	854	**1.37**	**1.09**	0.56	0.80	1.63	6.54
Idaho	269	**1.36**	**1.08**	0.56	0.74	1.72	5.01
Tennessee	1221	**1.62**	**1.15**	0.56	0.78	2.01	28.06
Kentucky	997	**1.24**	**0.85**	0.56	0.65	1.60	11.58
Georgia	1470	**1.48**	**1.10**	0.55	0.77	1.94	6.56
Alabama	1062	**1.40**	**1.02**	0.55	0.72	1.77	14.38
Ohio	2862	**1.85**	**1.66**	0.55	1.03	2.41	18.35
Mississippi	581	**1.25**	**0.89**	0.54	0.65	1.41	17.67
Maryland	1151	**2.29**	**1.94**	0.54	1.24	2.76	16.88
Indiana	1383	**1.50**	**1.25**	0.54	0.78	1.99	6.80
Virginia	1673	**1.60**	**1.26**	0.54	0.85	2.01	78.80
West Virginia	473	**1.53**	**0.93**	0.53	0.72	1.68	16.39
Pennsylvania	3167	**2.50**	**2.07**	0.53	1.21	3.08	18.91
Illinois	2841	**1.94**	**1.76**	0.53	1.03	2.64	16.95
Vermont	181	**1.07**	**0.66**	0.52	0.61	0.82	10.96
Missouri	1248	**1.58**	**1.18**	0.51	0.63	1.93	32.22

Rhode Island – Summary

1990 Modeled Concentration of HAP benzene in µg/m³

County	Tracts	Mean	Median	Min	P25	P75	Max
Bristol County	12	**1.61**	**1.24**	1.11	1.20	1.82	3.50
Kent County	36	**1.46**	**1.33**	0.94	1.17	1.79	2.56
Newport County	23	**1.93**	**1.37**	1.00	1.21	2.42	5.93
Providence County	138	**2.21**	**2.13**	0.85	1.66	2.66	4.83
Washington County	26	**1.19**	**1.00**	0.82	0.89	1.17	3.92

Tracts represents the number of census tracts in 1990 for each county.

Mean represents the arithmetic mean of all **1990 Modeled Concentrations** for each county and *Median* the median. *Min* represents the minimum **1990 Modeled Concentration** for each county, *P25* the 25th percentile, *P75* the 75th percentile, and *Max* the maximum. All concentrations are in *micrograms per cubic meter* [µg/m³].

There are 5 counties in this state.

Rhode Island – Summary

1990 Modeled Concentration of HAP benzene in µg/m³

County	Tracts	Mean	Median	Min	P25	P75	Max
Providence County	138	**2.21**	**2.13**	0.85	1.66	2.66	4.83
Newport County	23	**1.93**	**1.37**	1.00	1.21	2.42	5.93
Bristol County	12	**1.61**	**1.24**	1.11	1.20	1.82	3.50
Kent County	36	**1.46**	**1.33**	0.94	1.17	1.79	2.56
Washington County	26	**1.19**	**1.00**	0.82	0.89	1.17	3.92

Tracts represents the number of census tracts in 1990 for each county.

Mean represents the arithmetic mean of all **1990 Modeled Concentrations** for each county and *Median* the median. *Min* represents the minimum **1990 Modeled Concentration** for each county, *P25* the 25th percentile, *P75* the 75th percentile, and *Max* the maximum. All concentrations are in *micrograms per cubic meter* [µg/m³].

There are 5 counties in this state.

Rhode Island – Bristol_County

1990 Modeled Concentration of HAP benzene in µg/m³

Tract Code	Concentration	Lower Bound	Upper Bound
30100	1.2	0.6	4.6
30200	1.4	0.7	5.1
30300	1.2	0.6	4.5
30400	1.1	0.6	4.2
30500	2.5	1.2	9.4
30601	1.3	0.7	5.1
30602	2.3	1.1	8.7
30700	3.5	1.7	13.2
30800	1.2	0.6	4.7
30899	1.2	0.6	4.6
30901	1.2	0.6	4.5
30902	1.1	0.6	4.3

Concentration represents the **1990 Modeled Concentration**. The interval *(Lower Bound, Upper Bound)* represents the **90% Confidence Interval**. All concentrations are in *micrograms per cubic meter* [µg/m³].

There are 12 census tracts in this county.

Rhode Island – Bristol_County

1990 Modeled Concentration of HAP benzene in µg/m³

Tract Code	Concentration	Lower Bound	Upper Bound
30700	3.5	1.7	13.2
30500	2.5	1.2	9.4
30602	2.3	1.1	8.7
30200	1.4	0.7	5.1
30601	1.3	0.7	5.1
30800	1.2	0.6	4.7
30899	1.2	0.6	4.6
30100	1.2	0.6	4.6
30901	1.2	0.6	4.5
30300	1.2	0.6	4.5
30902	1.1	0.6	4.3
30400	1.1	0.6	4.2

Concentration represents the **1990 Modeled Concentration**. The interval *(Lower Bound, Upper Bound)* represents the **90% Confidence Interval**. All concentrations are in *micrograms per cubic meter* [µg/m³].

There are 12 census tracts in this county.

QUESTIONS ?