



A Closer Look at Air Pollution in Houston: **Identifying Priority Health Risks**

Report of the **Mayor's Task Force on the
Health Effects of Air Pollution**

Presented by Dr. Heidi Bethel
U.S. EPA Office of Water

Convened by the
Institute for Health Policy
The University of Texas School of Public
Health

Under the auspices of
The University of Texas Health Science Center at Houston
and the
City of Houston




In April 2005, the Mayor of Houston, the Honorable Bill White, asked the UT Health Science Center at Houston to help answer a critical science-policy question for action based on scientific judgment:

“Which ambient air pollutants are most likely to cause significant health risks for current and future residents of Houston?”

The Task Force on the Health Effects of Air Pollution was formed under the auspices of the **Institute for Health Policy** based at the University of Texas School of Public Health composed of environmental health experts from:

The University of Texas School of Public Health
The University of Texas Medical Branch at Galveston
The University of Texas M.D. Anderson Cancer Center
Baylor College of Medicine
Rice University

Pollutants Included in the Assessment

- **Criteria Pollutants** 
 - Ozone
 - Fine Particulate Matter (PM_{2.5})
- **188 Hazardous Air Pollutants (HAPs)**
- **Diesel Particulate Matter**

Area of Study

Greater Houston

10 counties of Houston–Sugar Land–
Baytown MSA¹

- Harris
- Brazoria
- Chambers
- Fort Bend
- Galveston
- Liberty
- Montgomery
- Waller
- San Jacinto
- Austin

Total population = 5 million

East Houston

28 census tracts in
9 Superneighborhoods

- Denver Harbor/Port Houston
- Pleasantville
- Clinton Park
- Harrisburg Manchester
- Pecan Park
- Park Place
- Meadowbrook/Allendale
- Magnolia Park
- Lawndale/Wayside

Total population = 127,497

¹Defined by the U.S. Census as of 2003

Data Sources – EPA's Air Quality System 2004

- Measured annual pollutant concentrations
- 49 HAPs + Diesel Surrogate (Elemental Carbon)
- Ozone and fine particulate matter (PM_{2.5})
- 20 monitors (subset of Houston monitoring sites)
- 2004 was the most complete year of available data
- Monitoring Sites
 - 14 Harris County (ship channel area and largest county)
 - 4 Galveston County
 - 1 Brazoria County
 - 1 Montgomery County

Data Sources – EPA's NATA 1999

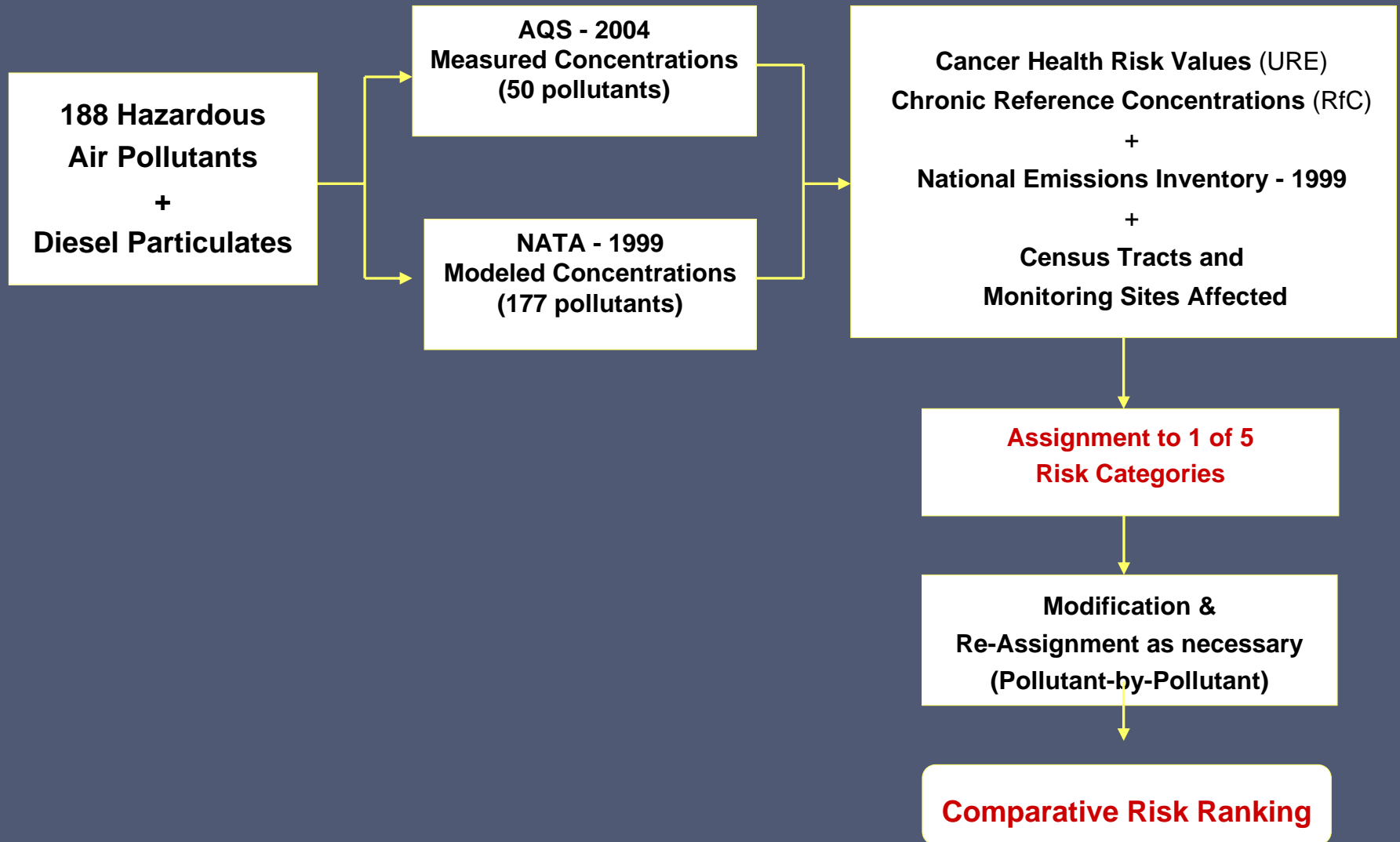
National-Scale Air Toxic Assessment 1999 Released Spring 2006

- Modeled annual pollutant concentrations
- 176 Hazardous Air Pollutants (HAPs), diesel particulate matter
- 895 Census Tracts – Approx. 4000 inhabitants each
- Computerized air dispersion model using emissions data from outdoor sources:
 - Point
 - Mobile (on-road and non-road)
 - Area
 - Background
- Model accounts for:
 - Meteorological variance
 - Breakdown
 - Deposition
 - Transformation of pollutants in the atmosphere after their release

Health Risk Values for Chronic Effects Used

- **Sources**
 - U.S. Environmental Protection Agency
 - California Environmental Protection Agency
- **Carcinogens - Unit Risk Estimates (URE)**
 - Available for 84 pollutants.
- **Noncarcinogens - Reference concentrations (RfC)**
 - Available for 105 pollutants. Respiratory, cardiovascular, immune, reproductive effects.
- **Strategy**
 - The most health protective value was chosen in each category

Flow Chart of Risk Ranking



Sorting into Risk Categories

Category	Cancer Risk	Non-Cancer
Definite (12)	$> 10^{-4}$	$> 100\% \text{ RfC}$
Probable (9)	$10^{-4} - 10^{-5}$	$75 - 100\% \text{ RfC}$
Possible (24)	$10^{-5} - 10^{-6}$	$50 - 75\% \text{ RfC}$
Uncertain (118)	$< 10^{-6}$	$< 50\% \text{ RfC}$
Unlikely (16)	No Emissions	Not measured

Air in Greater Houston Area

Ozone and PM_{2.5}

- Houston air meets the standards for 5 of 6 criteria pollutants: carbon monoxide, sulfur dioxide, nitrogen dioxide, lead and PM_{2.5}
 - Particulate matter
 - The largest metropolitan area to meet standards for PM_{2.5}
 - **But** growing evidence relates PM_{2.5} with significant health effects at concentrations below existing NAAQS
 - **Ozone – out of NAAQS attainment**
 - Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller designated by the EPA as a 'severe ozone nonattainment area' for one hour standard and 'moderate nonattainment' for eight hour standard

Definite Risk Pollutants

Criteria pollutants

- Ozone
- Fine Particulate Matter (PM_{2.5})

Hazardous Air Pollutants

- Diesel Particulate Matter
- 1,3-Butadiene
- Benzene
- Formaldehyde
- Acrolein
- Chromium VI
- Ethylene Dibromide
- Acrylonitrile
- Chlorine
- Hexamethylene Diisocyanate

Definite Risk Pollutants – Health Effects

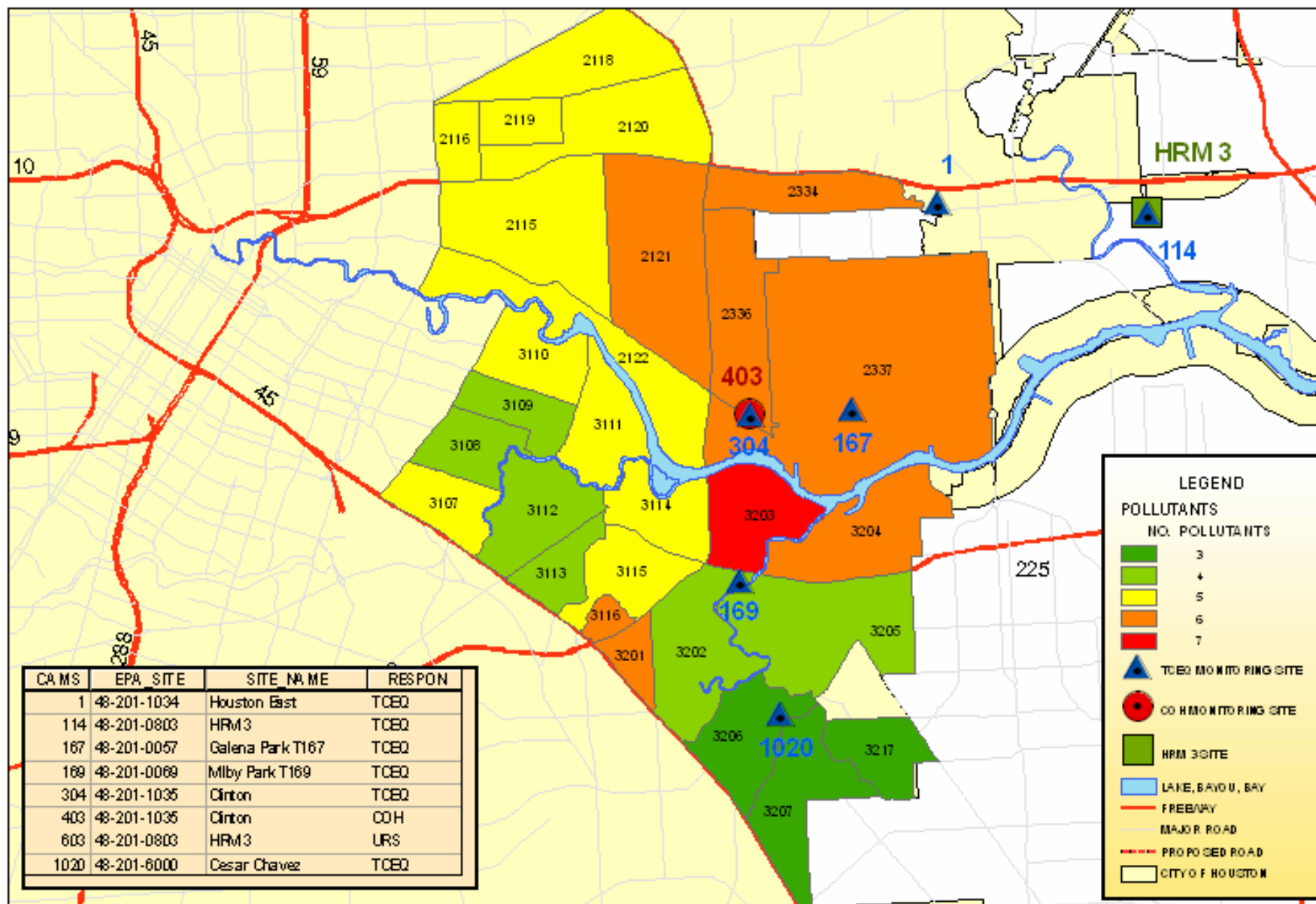
Air Pollutant	Health Effects	
	Cancer Endpoint	Chronic Endpoint
Ozone		Respiratory/Cardiovascular /Immune
Fine Particulate Matter (PM _{2.5})		Respiratory/Cardiovascular
Diesel Particulate Matter	✓	Respiratory
1,3-Butadiene	✓	Female Reproductive
Chromium VI	✓	Respiratory
Benzene	✓	Immune
Ethylene Dibromide	✓	Male Reproductive
Acrylonitrile	✓	Respiratory
Formaldehyde	✓	Respiratory; Eyes
Acrolein	No	Respiratory
Chlorine	No	Respiratory
Hexamethylene Diisocyanate	No	Respiratory

Definite Risk Pollutants – Sources

Air Pollutant	Emission Source			
	Point	Mobile		Area
		On Road	Off Road	
Ozone	N/A	N/A	N/A	N/A
Fine Particulate Matter (PM _{2.5})	X	X	X	X
Diesel Particulate Matter		X	X	
1,3-Butadiene	X	X	X	X
Chromium VI	X	X	X	X
Benzene	X	X	X	X
Ethylene Dibromide	X			X
Acrylonitrile	X			X
Formaldehyde	X	X	X	X
Acrolein	X	X	X	X
Chlorine	X			X
Hexamethylene Diisocyanate	X			X



POLLUTANTS IN EAST HOUSTON CENSUS TRACTS



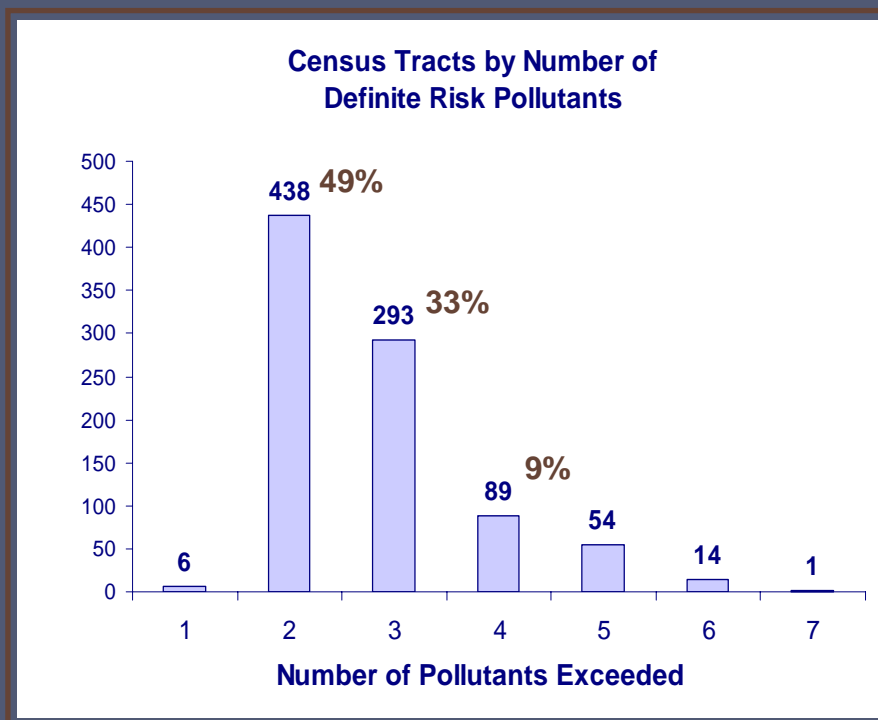
Prepared By: Larry B. York
pj SPH 5

0 0.25 0.5 1 1.5 2 Miles

CITY OF HOUSTON
DEPT. OF HEALTH AND HUMAN SERVICES
MAP DATE: MAY 23, 2006

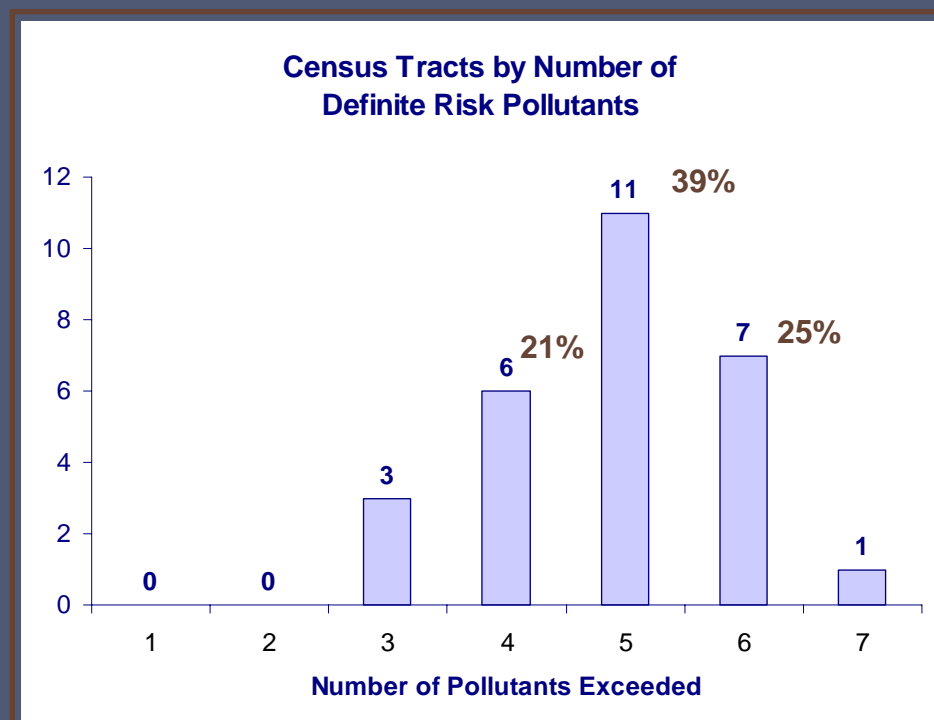
East Houston – High Risk Category Pollutants

Greater Houston Area profile



- NATA - 3 of top 12 pollutants from point sources
- 1 pollutant in definite risk category from area source
- 3/4 of total diesel concentrations attributed to non-road mobile sources

East Houston Area profile



- NATA - 7 of top 12 pollutants from point sources
- No pollutants in definite risk category from area sources
- Over 90 % of diesel concentrations attributed to non-road mobile sources

Report Limitations

- Only chronic concentrations examined
- Only health effects via inhalation
- No cumulative risks from multiple toxics exposure
- Did not consider bioaccumulative chemicals
- Outdoor air only
- Relationships to hospital admissions, morbidity and mortality not examined
- Data limitations – pollutant concentrations (modeled and monitored) and health values
- No recommendations on how to reduce toxics

Recommendations of Task Force

- Control efforts should be focused on the twelve “definite risk” pollutants in 10 County Area
- Special efforts to control the twelve pollutants in neighborhoods with the highest relative exposures – East Houston Neighborhoods and others
- Use report as ‘decision tool’ for organizing and analyzing information about air pollution to better direct decision making process and resource allocation

For More Information



- Heidi Bethel, bethel.heidi@epa.gov, 202-566-2054
- <http://www.sph.uth.tmc.edu/ihp/content.asp?id=621>
- Comparative Air Pollution Risks in Houston, *Environmental Health Perspectives*, in press, 2007, Sexton, et al.

Chronic Health Risk Categories

Definite Risk (12)	Compelling and convincing evidence they represented significant risk to the general population or vulnerable subgroups at current ambient concentrations
Probable Risk (9)	Substantial corroborating evidence they were likely to represent a significant risk under the right conditions
Possible Risk (24)	Partial or limited evidence suggested they might constitute a significant risk under certain circumstances
Uncertain Risk (118)	Inadequate or insufficient evidence to ascertain whether they pose a significant risk to the general population and vulnerable subgroups
Unlikely Risks (16)	Suggestive evidence they posed negligible or insignificant risk to the general population and vulnerable subgroups

Definite Risk Pollutants – Data for Ranking

Air Pollutant	Data Source for Classifying as 'Definite Risk'			
	AQS 2004		NATA 1999	
	Monitors in Exceedance		Census Tracts Concentration Exceedance	
	Cancer	Chronic	Cancer	Chronic
Ozone		X	N/A	N/A
Fine Particulate Matter (PM _{2.5})			N/A	N/A
Diesel Particulate Matter	X (estimated conc)		X	X
1,3-Butadiene	X	X	X	X
Chromium VI			X	
Benzene	X		X	
Ethylene Dibromide	X			
Acrylonitrile			X	
Formaldehyde		X		X
Acrolein		X		X
Chlorine				X
Hexamethylene Diisocyanate				X

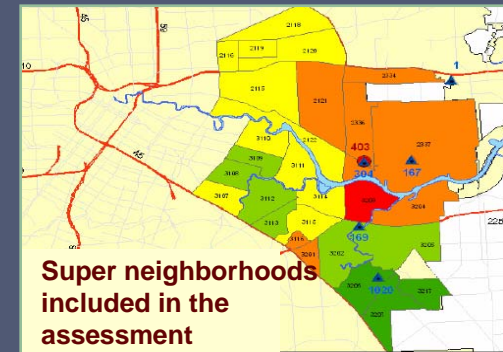
East Houston - A Case Study

Emissions Characterization

- 1/2 point sources of Greater Houston located in East Houston
- Over 20 large industrial sources located in East Houston
- The Port of Houston, and the Ship Channel generate a variety of pollutants
- Interstate Highways 10, 610 and 45 and State Highway 225 intersect this area

EAST HOUSTON

Denver Harbor/Port Houston, Pleasantville, Clinton Park/Tri-Community, Magnolia Park, Lawndale/Wayside, Harrisburg/Manchester, Pecan Park, Park Place, and Meadowbrook/Allendale



- Average family income more than 30% lower than City of Houston
- Over 1/4 of the residents fall below the poverty level
- Almost 20% of the residents have less than a 9th grade education
- Some of the highest uninsured rates for health coverage in Harris County

Sociodemographics