

Linkage Studies of Incident Cancers and Air Toxics in New Jersey

Jerald Fagliano, MPH, PhD

New Jersey Department of Health and Senior Services

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EPHT Demonstration Project Team: Cancer

New Jersey Department of Health and Senior Services *Consumer and Environmental Health Services*

- Jerald Fagliano, M.P.H., Ph.D.
- Michael Berry, M.P.H.,
- Perry Cohn, Ph.D., M.P.H.
- Barbara Goun, M.P.H., Ph.D.
- Patricia Haltmeier, L.P.N.,
- Richard Opiekun, M.S., M.A., Ph.D.

Cancer Epidemiology Services

- Kevin Henry, Ph.D.,
- Lisa Roché, M.P.H., Ph.D.

New Jersey Department of Environmental Protection

- Steven Anderson, M.S.
- Linda Bonanno, Ph.D.
- Judith Klotz, M.S., Dr.P.H (consultant)

New Jersey Demonstration Projects

Air Toxics and Cancer Incidence

- Benzene with leukemia
- Vinyl chloride with liver angiosarcoma
- Vinyl chloride with brain/central nervous system cancer

Demonstration Project Design

- Ecologic analysis at the census tract level (2000)
- Case counts in period 1979 through 2002
 - Source: New Jersey State Cancer Registry
- Population: US Census 1980-1990-2000
- Exposure estimates for census tracts
- Rate ratios for levels of air pollutant estimated with a Poisson regression model, adjusted for age, race, poverty level

Some Epidemiologic Issues

- Confounding
 - Does exposure gradient co-vary with other risk factors?
- Selection Bias
 - Is completeness of health outcome surveillance data related to the exposure gradient?
- Misclassification
 - How well does exposure classification represent true exposure?
 - Accuracy (absolute or relative)
 - Geographic resolution
 - Relevant time period
- Exposure distribution

Air Toxics Exposure Assessment

- Cumulative individual exposures over points and times a function of:
 - Concentrations in air (ambient, indoor)
 - Individual behavior
 - Inhalation rate, time/activity patterns
- Exposure assessment in linkage studies:
 - Estimated annual average concentration in ambient air for large area for one time period

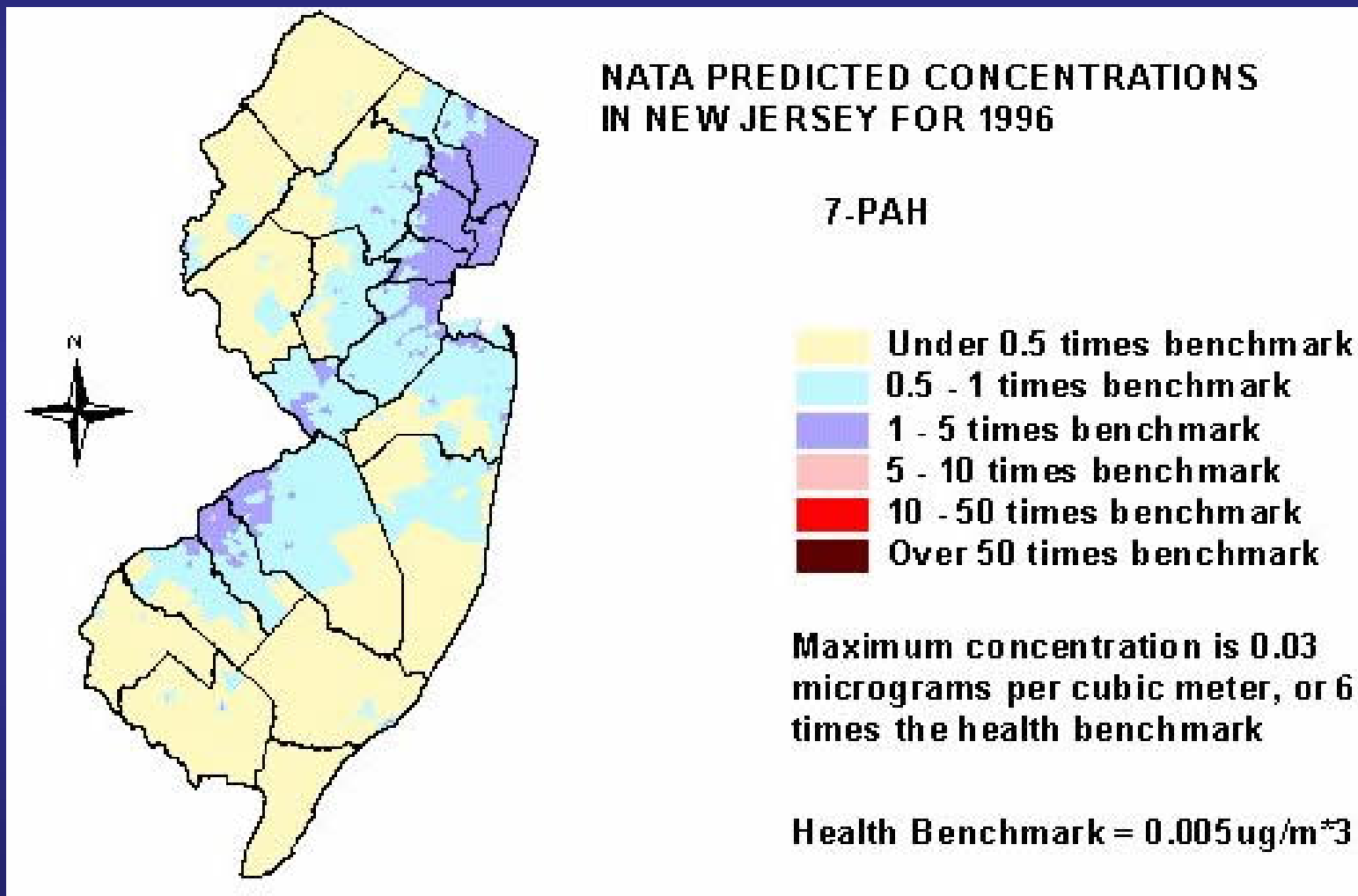
Sources of Air Toxics Data

- Ambient air monitoring
- Environmental modeling
 - Stationary point sources
 - Mobile sources
 - “Area” sources
 - “Background”

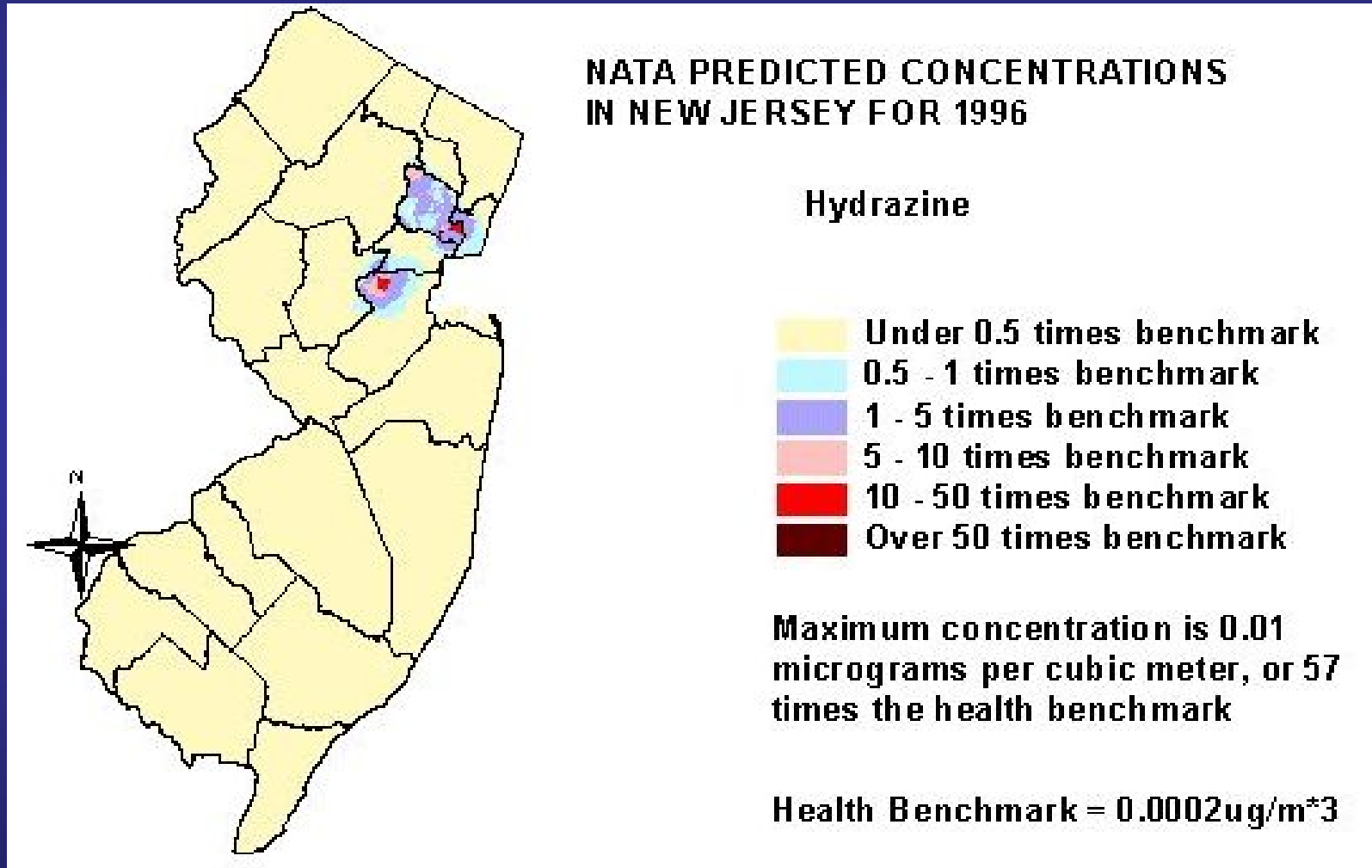
Air Toxics Multi-source Modeling: National Air Toxics Assessment

- USEPA conducted national-scale multi-source modeling of estimated concentrations of 32 air toxics + diesel PM for year 1996
- Assessment steps:
 - Compile national emissions inventory
 - Point, area and mobile sources
 - Estimate ambient concentrations by census tract
 - ASPEN dispersion model
 - Estimate population exposure
 - HAPEM4 model
 - Characterize risk

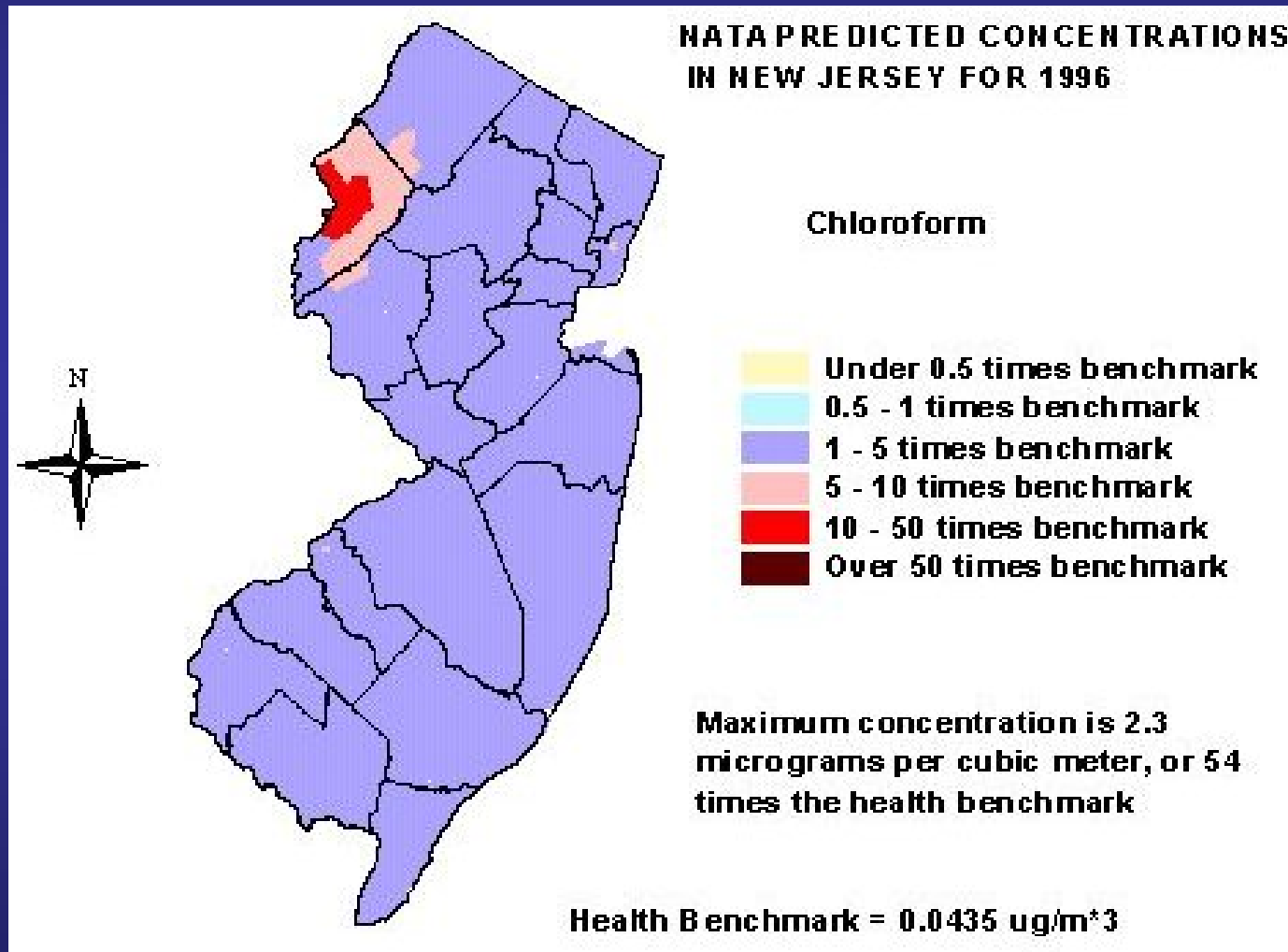
Low Background and Area Sources



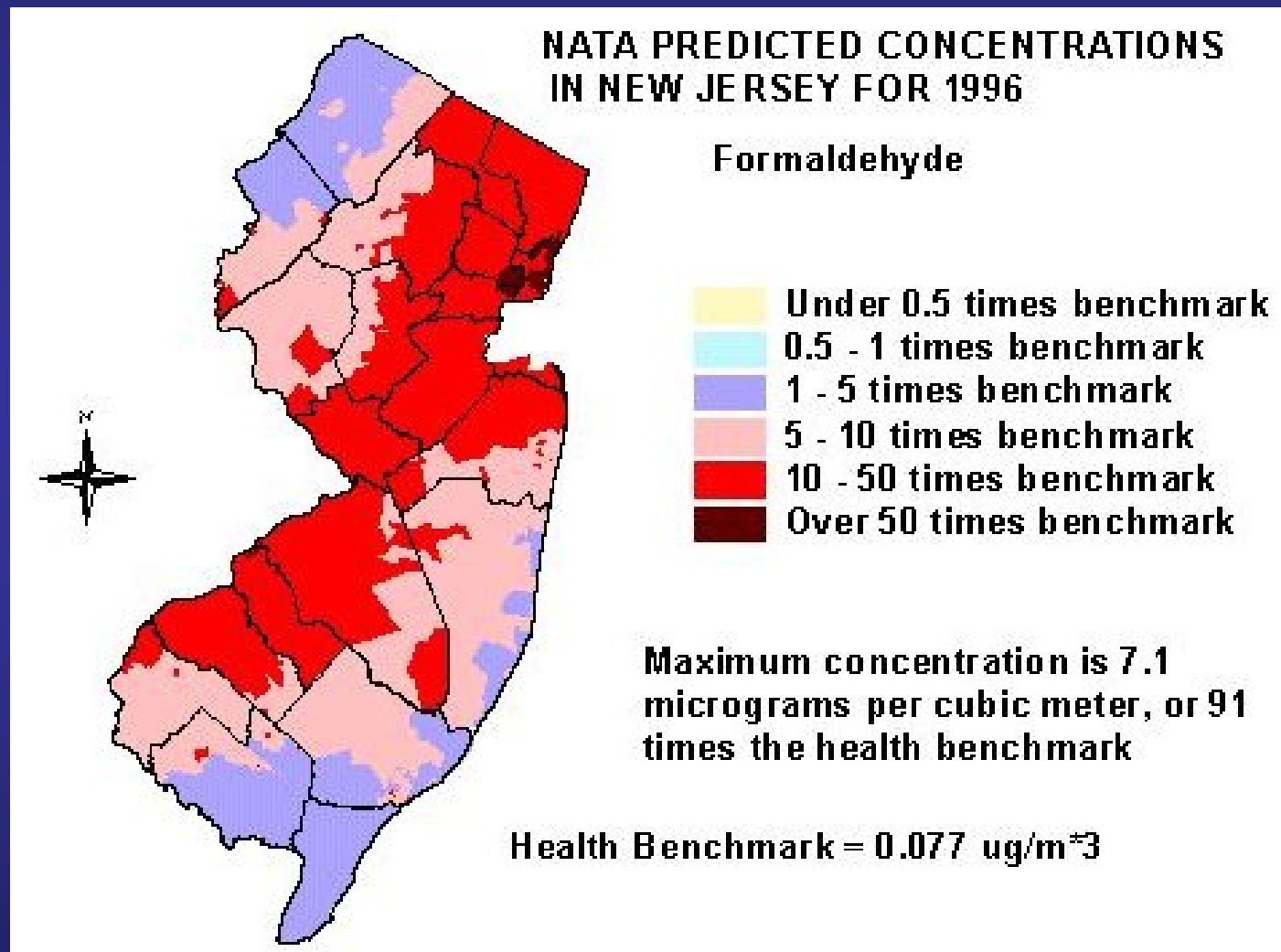
Low Background and Point Sources



High Background and Point Sources

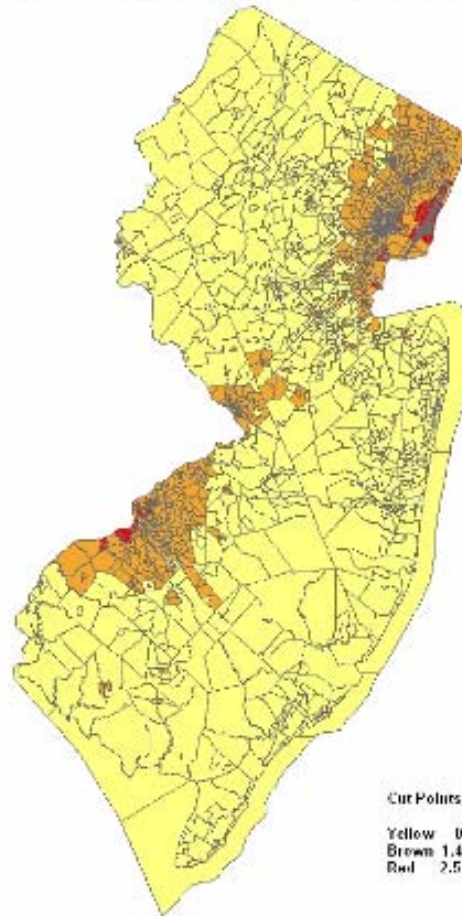


High Background and Mobile Sources



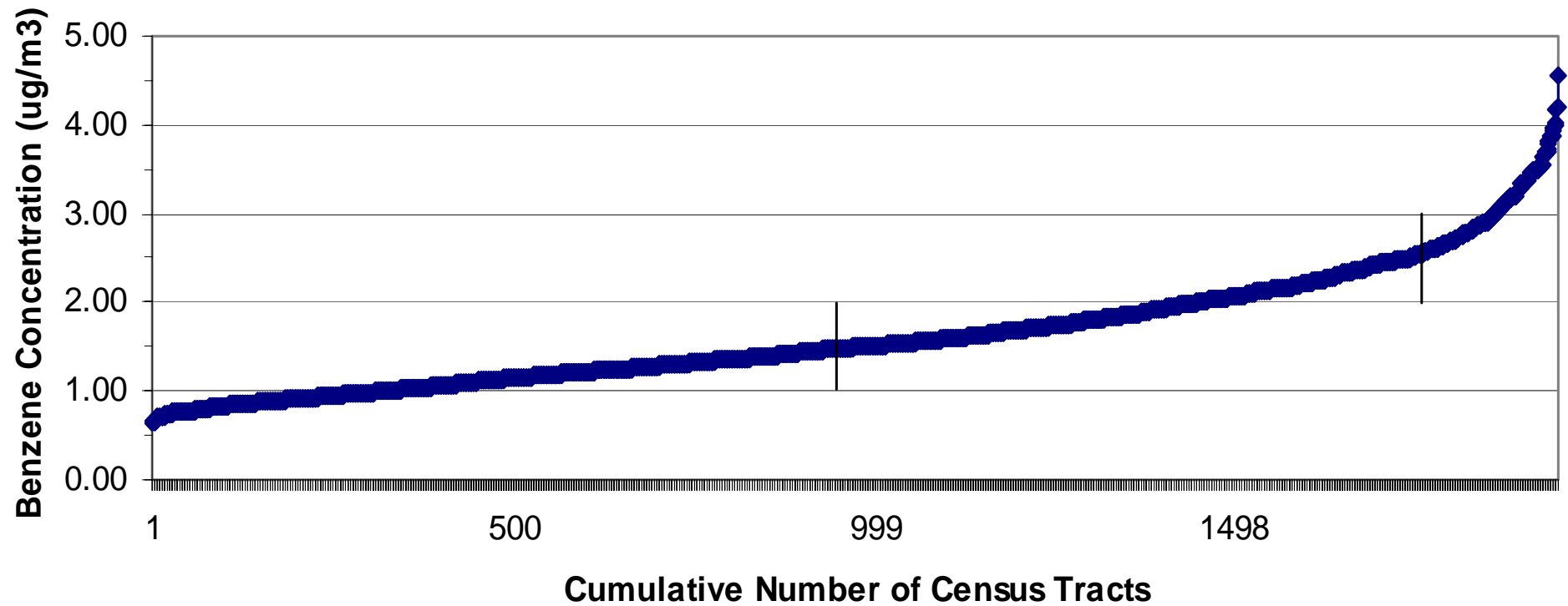
Geographic Distribution of Benzene by Selected Cut Points

1996 NATA Benzene levels by Census Tract



NATA (1996)

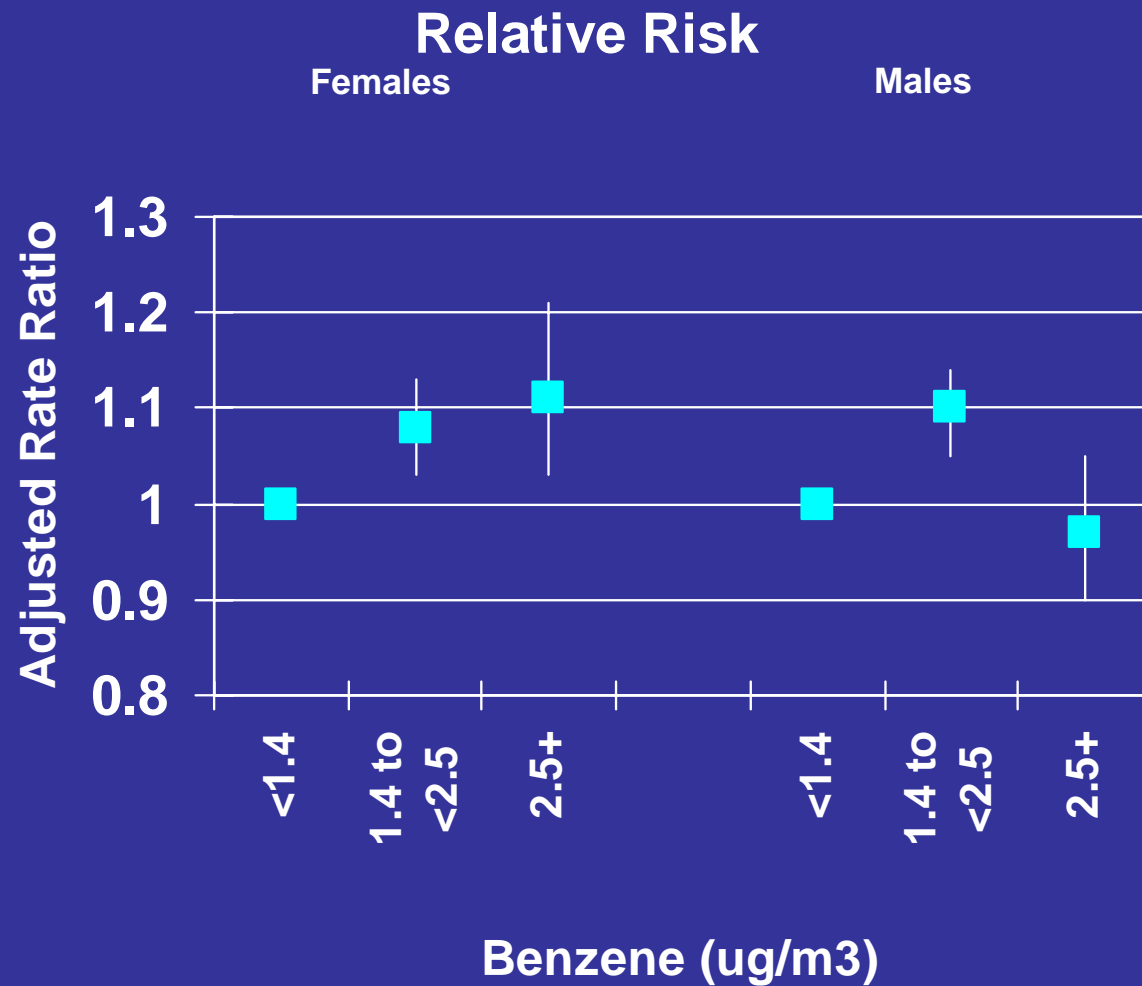
Benzene Cumulative Distribution for New Jersey Census Tracts



Leukemia Cases

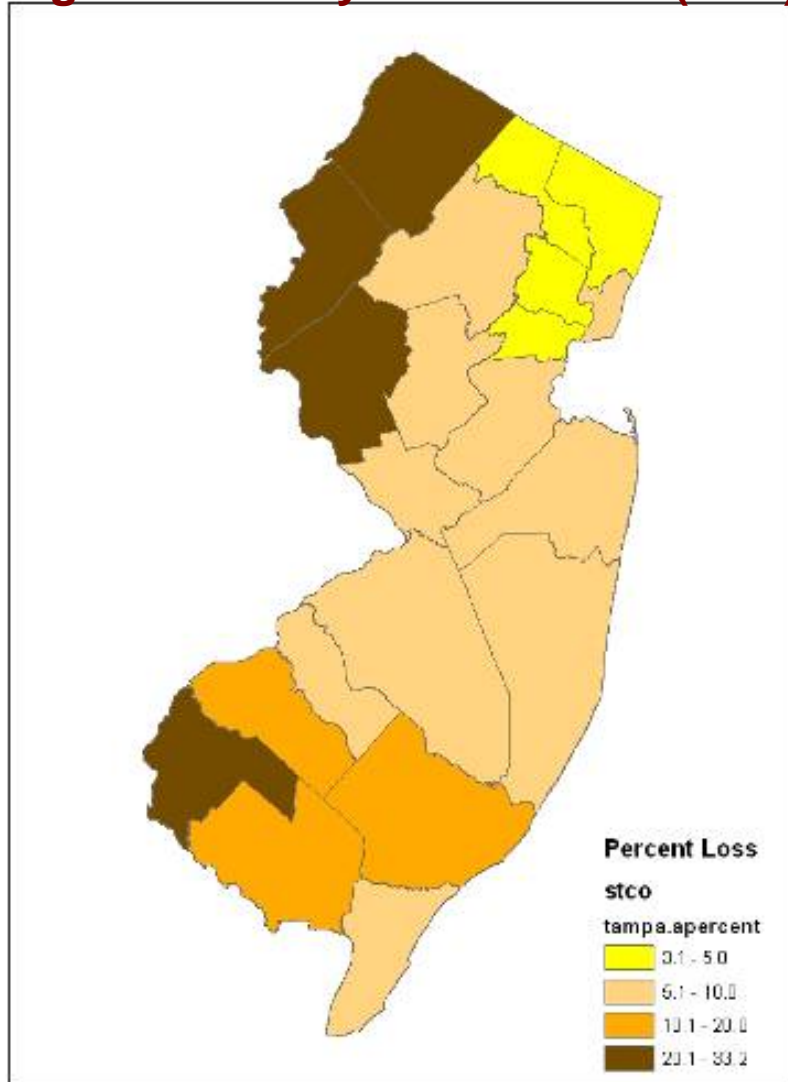
- Study population: 7,800,000 (average)
- Study period: 1979-2002
- Nearly 22,000 incident leukemia cases, excluding those from death certificate only
- Geocoding to census tract:
 - 92% geocoded using full address
 - 7% geocoded using zip centroid
 - <1% not geocoded

Benzene and Leukemia Incidence: Only Cases Geocoded to CT by Full Street Address

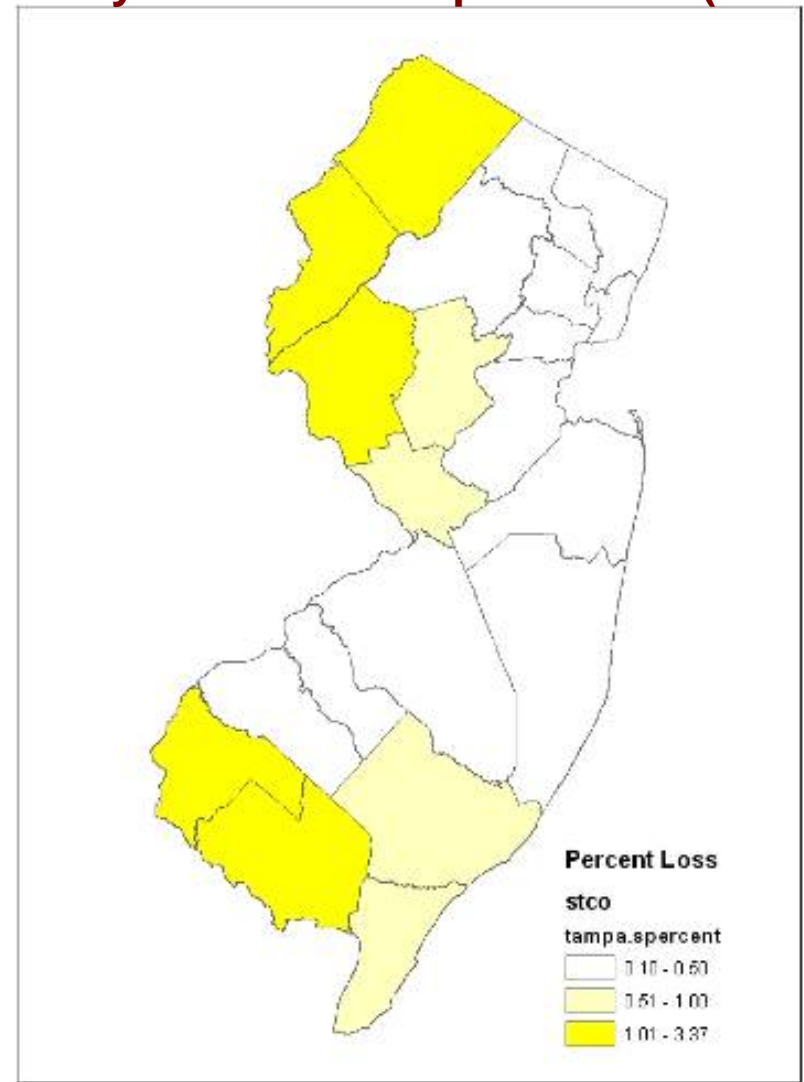


Percent Case Loss by County

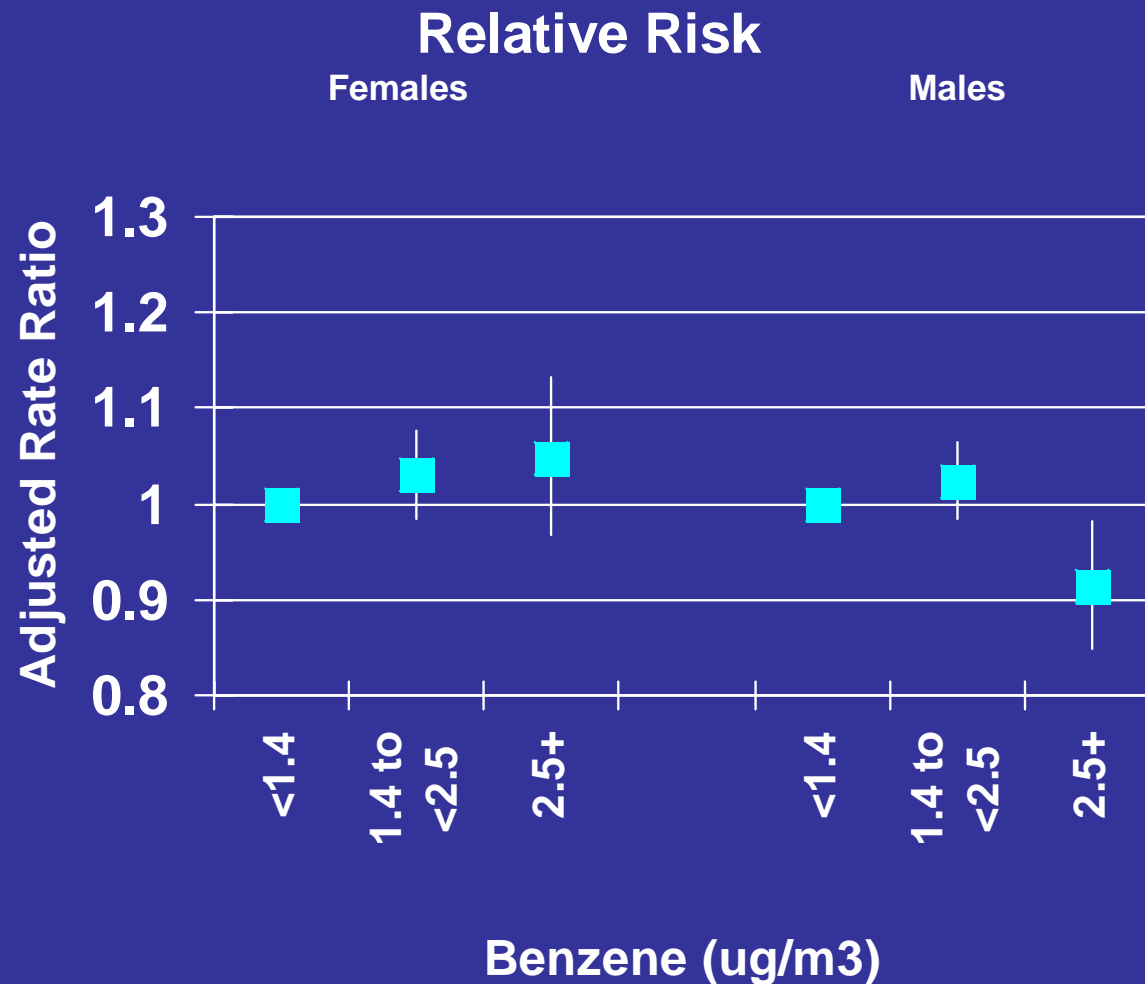
Leukemia Cases Unable to be Assigned to CT by Full Address (~8%)



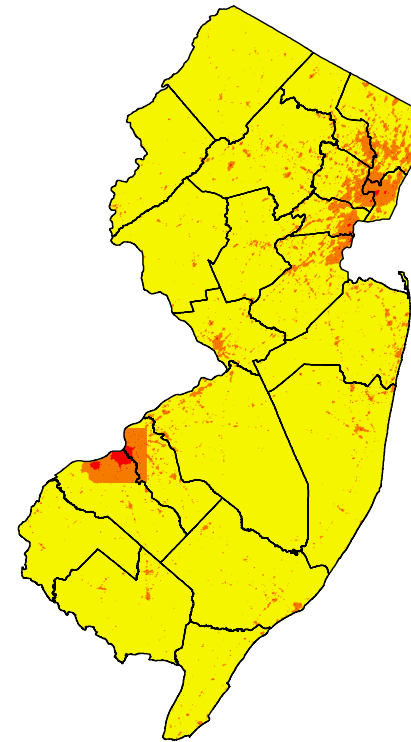
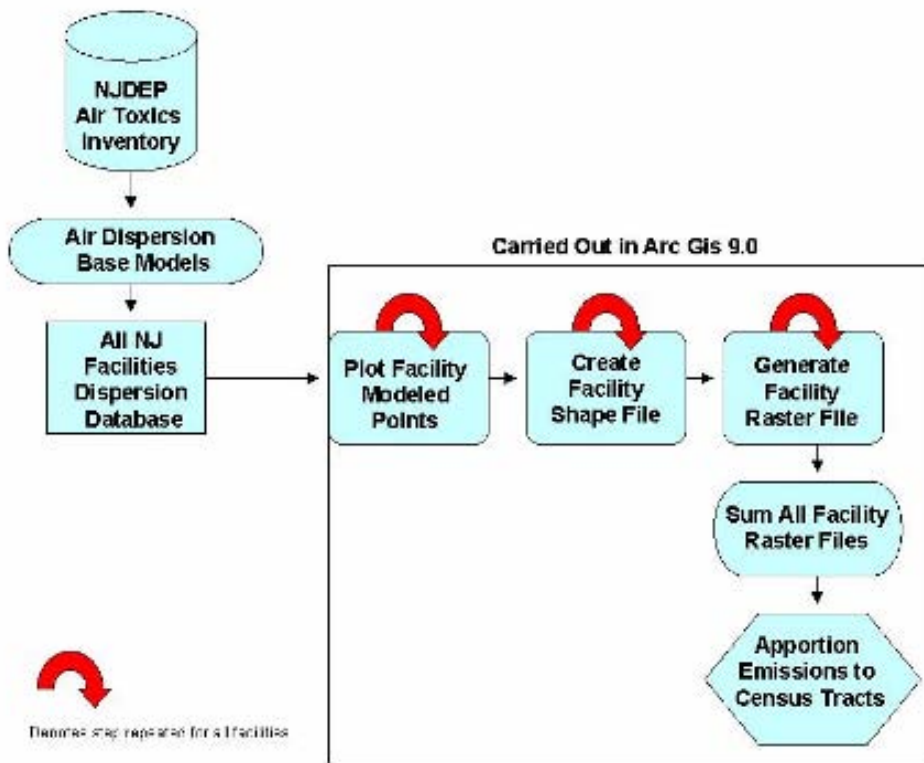
Leukemia Cases Unable to be Assigned to CT by Address or Zip Centroid (<1%)



Benzene and Leukemia Incidence: Cases coded to CT by Full Address or by Zipcode Centroid



NJDEP Modeling of Benzene Based on Stationary Emission Sources



Legend

100 meter grid

Benzene Concentration ug/m3

0 - 0.013

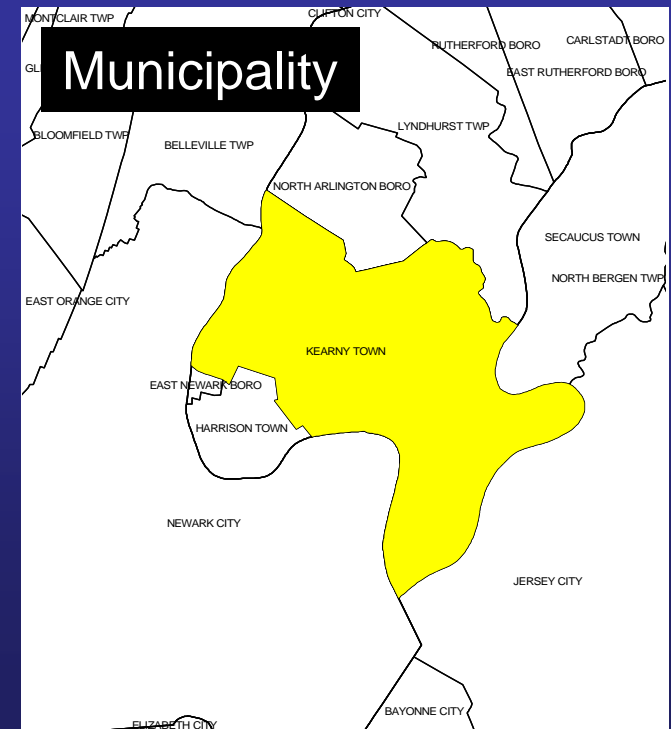
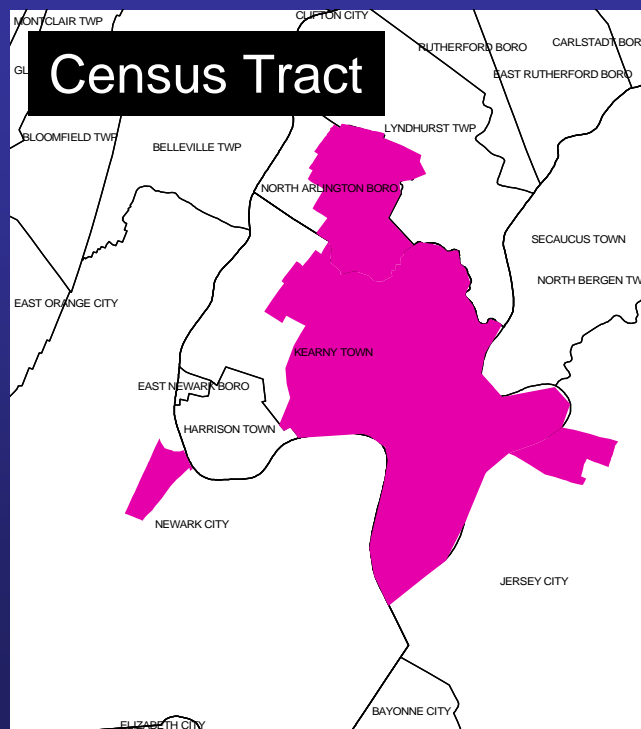
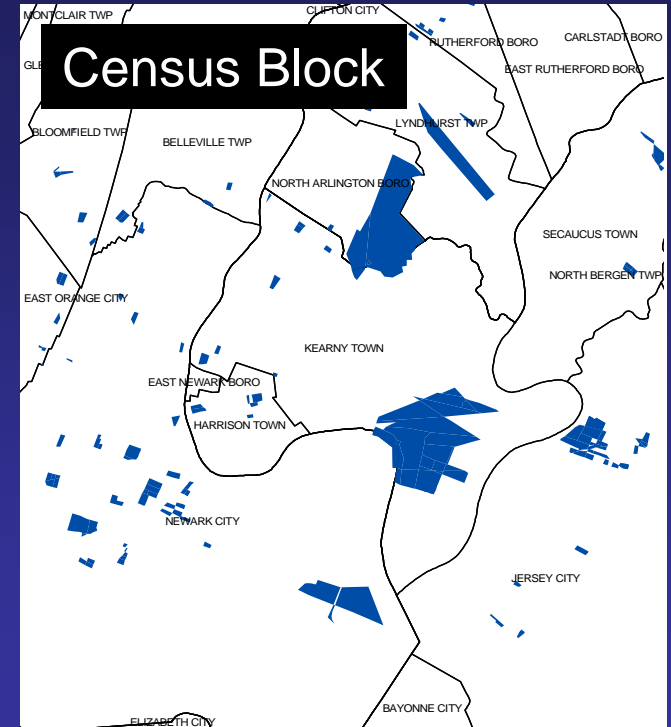
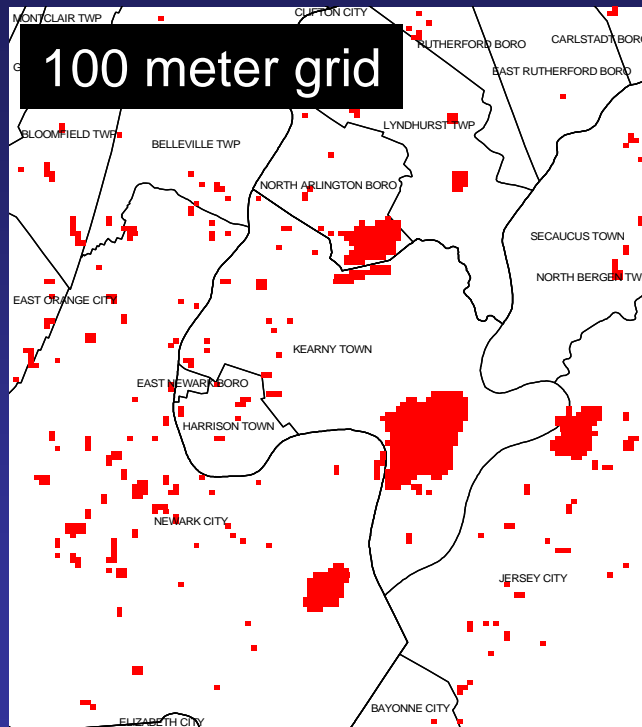
0.013 - 0.13

0.13 - 354.04

Counties

1:1,437,828

Comparison of NJDEP's benzene assessment at several geographic scales



Exposure Classification and Choice of Scale

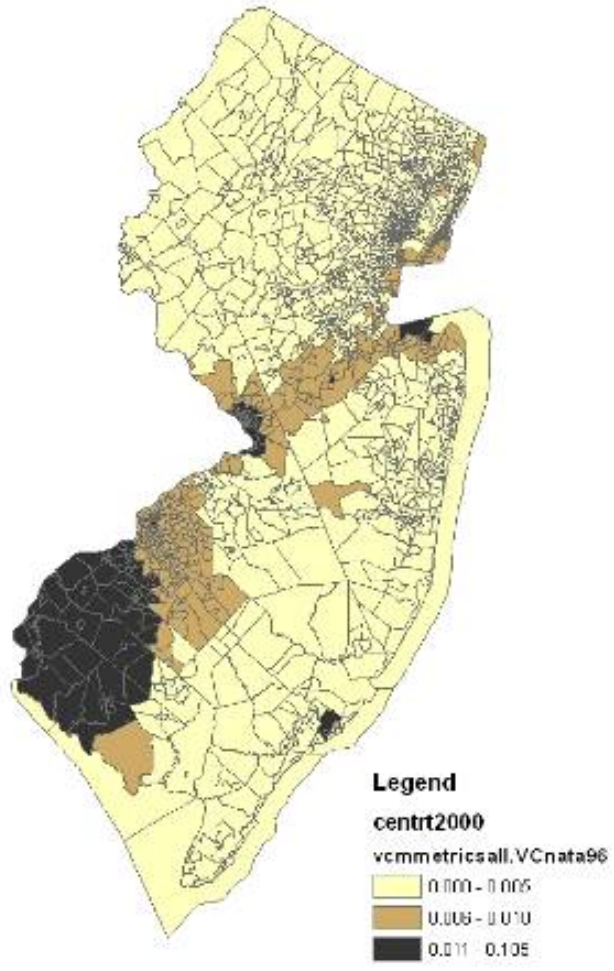
- Agreement (4-level classification)
 - Grid vs Block: 88%, K=0.77
 - Grid vs Tract: 78%, K=0.57
 - Grid vs Municipality: 73%, K=47%

		TRACT				TOTAL		
		1	2	3	4	TOTAL		
Benzene Concentration (ug/m3)								
Category								
GRID	1	0.0-0.013	9,584	2,314		1	11,899	
	2	0.013-0.065	1,016	4,961	250	33	6,260	
	3	0.065-0.13	75	366	214	25	680	
	4	>0.13	36	144	46	123	349	
		TOTAL	10,711	7,785	510	182	19,188	

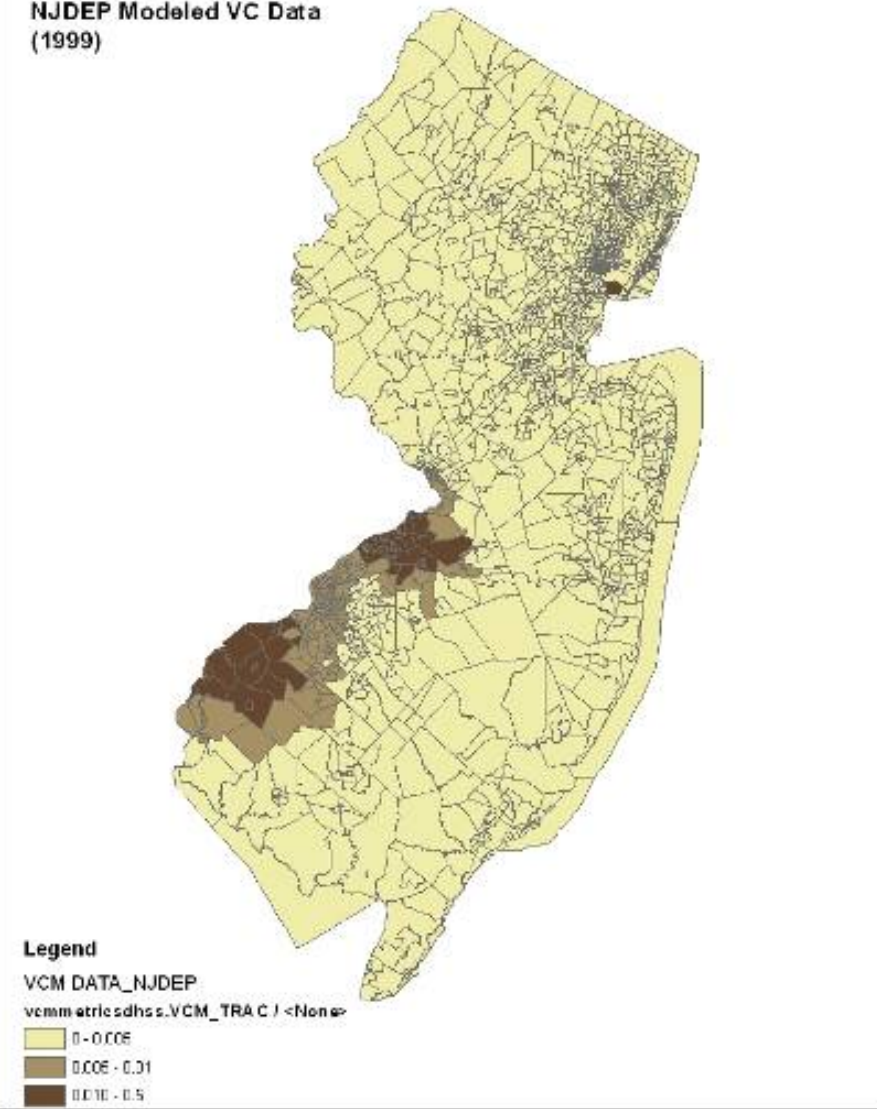
kappa: 0.569
 sig.: <0.0001
 % agreement: 77.6

Geographic Distribution of Vinyl Chloride

1996 NATA Vinyl Chloride levels by Census Tract

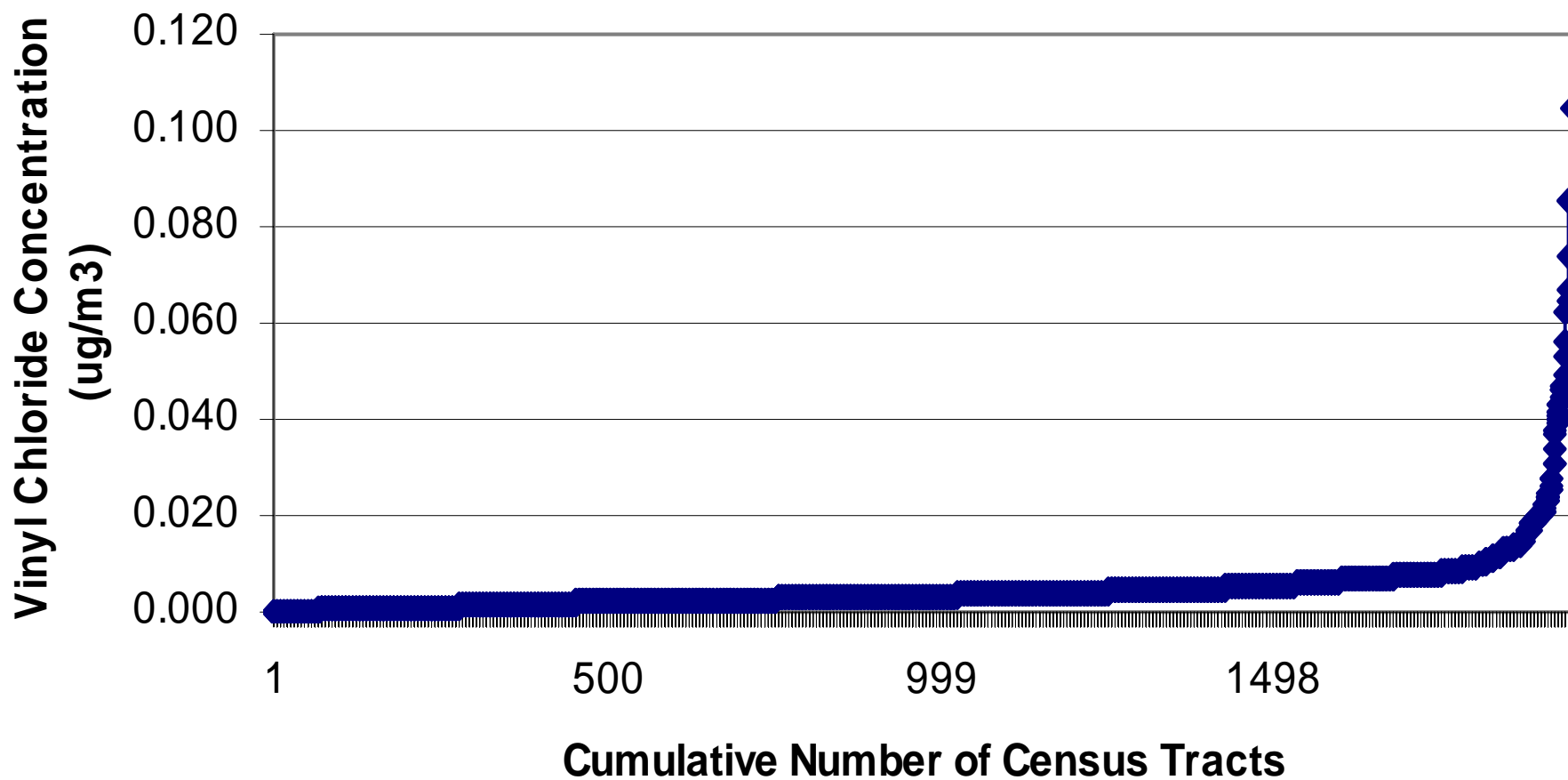


NJDEP Modeled VC Data (1999)



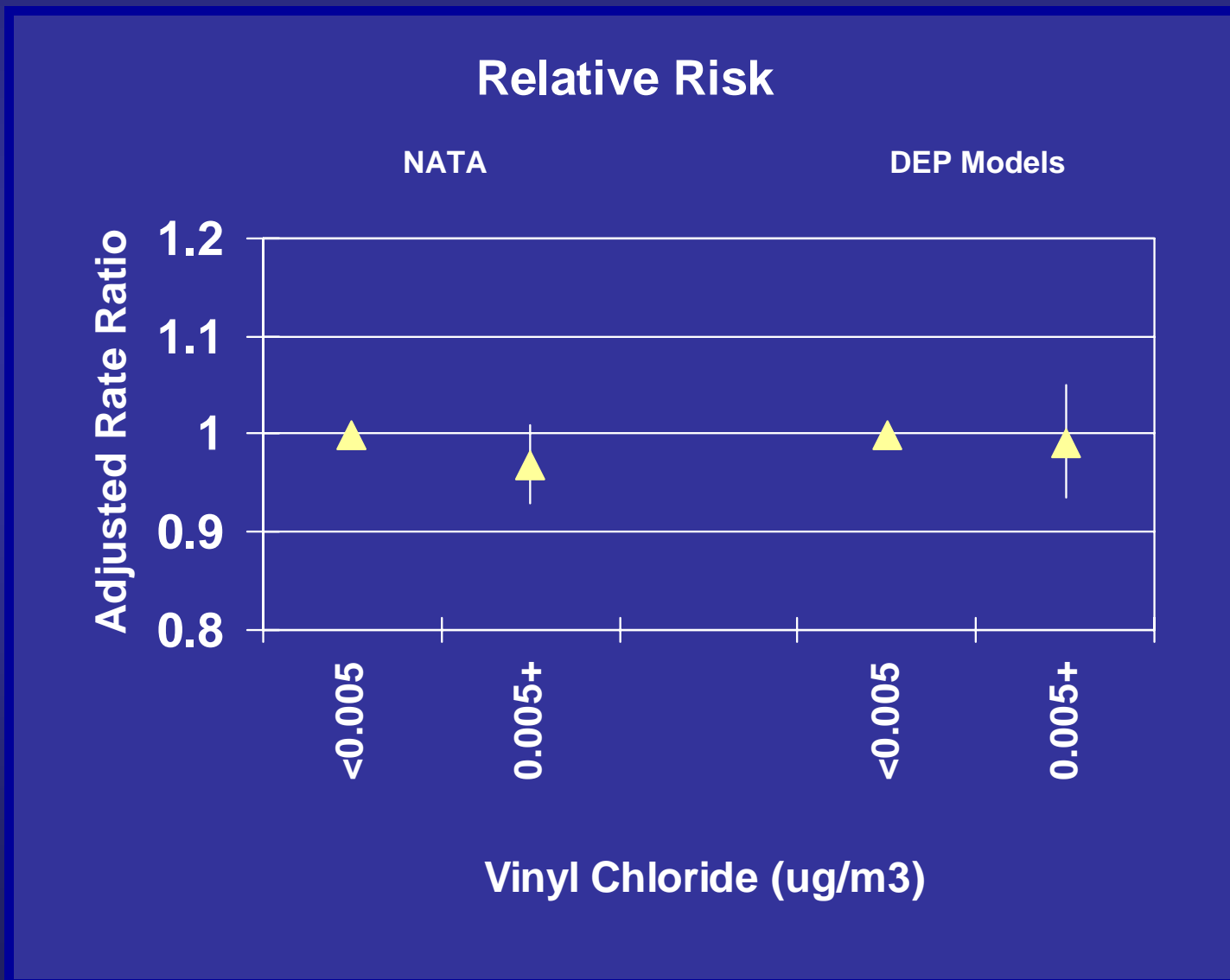
NATA (1996)

Vinyl Chloride Cumulative Distribution for New Jersey Census Tracts

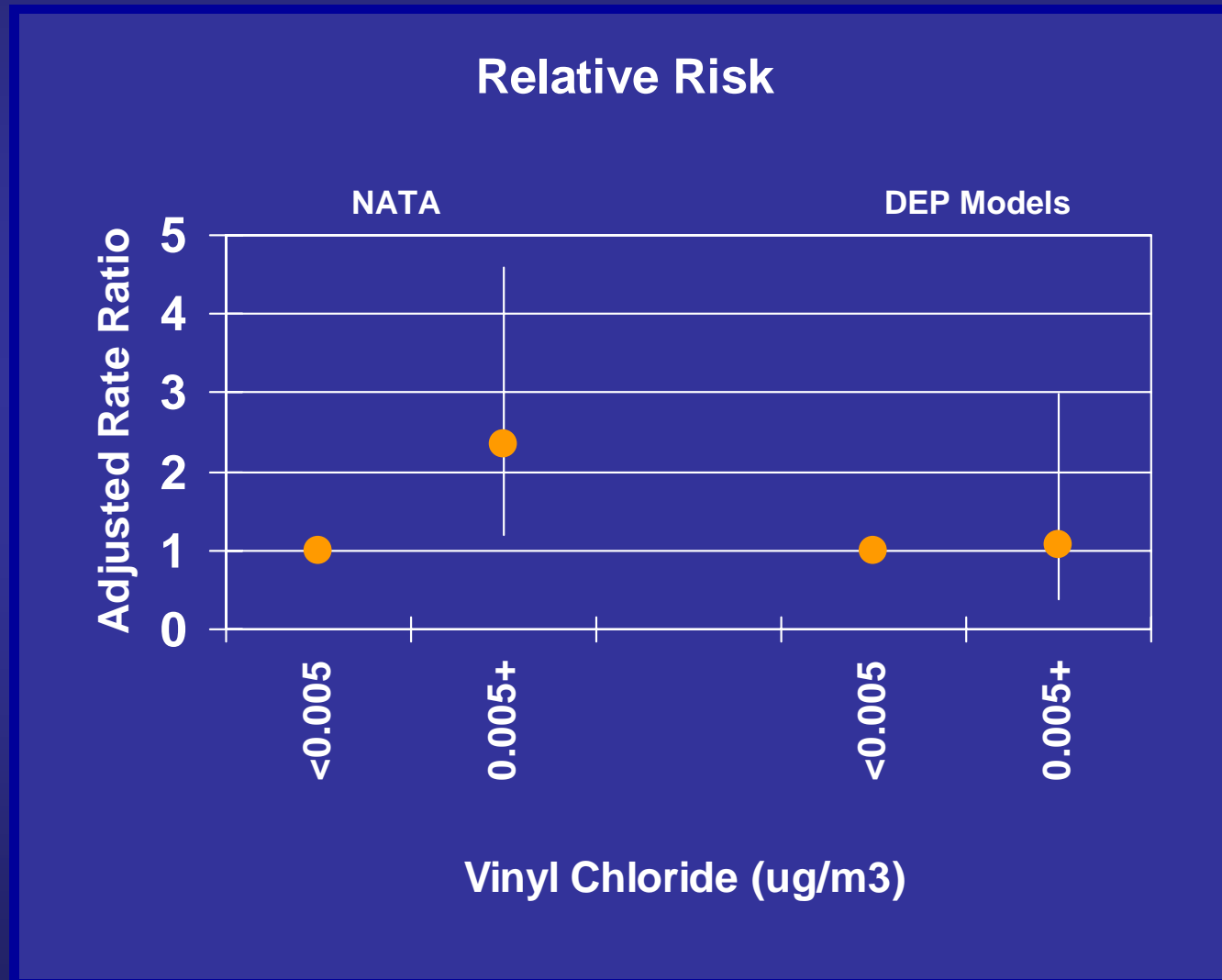


Vinyl Chloride and Brain Cancer

Cases coded to CT by
Full Address or by Zipcode Centroid



Vinyl Chloride and Angiosarcoma (n= 26 cases)



Observations

- **Confounding**
 - Other air toxics
 - Other risk factors
- **Exposure misclassification**
 - A given
 - Choice of models
 - Choice of geographic scale
 - Relevant time period for outcome of interest

Observations (continued)

- **Selection bias due to geocoding incompleteness**
 - Need to assess completeness of geocoding
 - Consider if loss to analysis is associated with exposure
 - Potential problem for ecologic analysis of rates or in case-control sampling if address information from different sources
- **Other sources of selection bias**
 - Diagnosis and reporting patterns
 - Loss due out-of-state diagnosis