

# **Regional Toxics Modeling and Cancer Risk Evaluation**

## **CARE Task Force Meeting**

Saffet Tanrikulu, Research and Modeling Manager  
Phil Martien, Senior Advanced Projects Advisor

*September 17, 2008*

# Contributors

## ***Emissions inventory preparation***

- *Cuong Tran, BAAQMD*
- *Amir Fanai, BAAQMD*
- *Michael Nguyen, BAAQMD*
- *Steve Reid, Sonoma Technology, Inc.*

## ***Meteorological and toxics modeling***

- *Yiqin Jia, BAAQMD*
- *Steve Soong, BAAQMD*
- *Chris Emery and Greg Yarwood, Environ International Corporation*

## ***Model evaluation***

- *David Fairley, BAAQMD*
- *Scott Beaver, BAAQMD*

# Presentation Outline

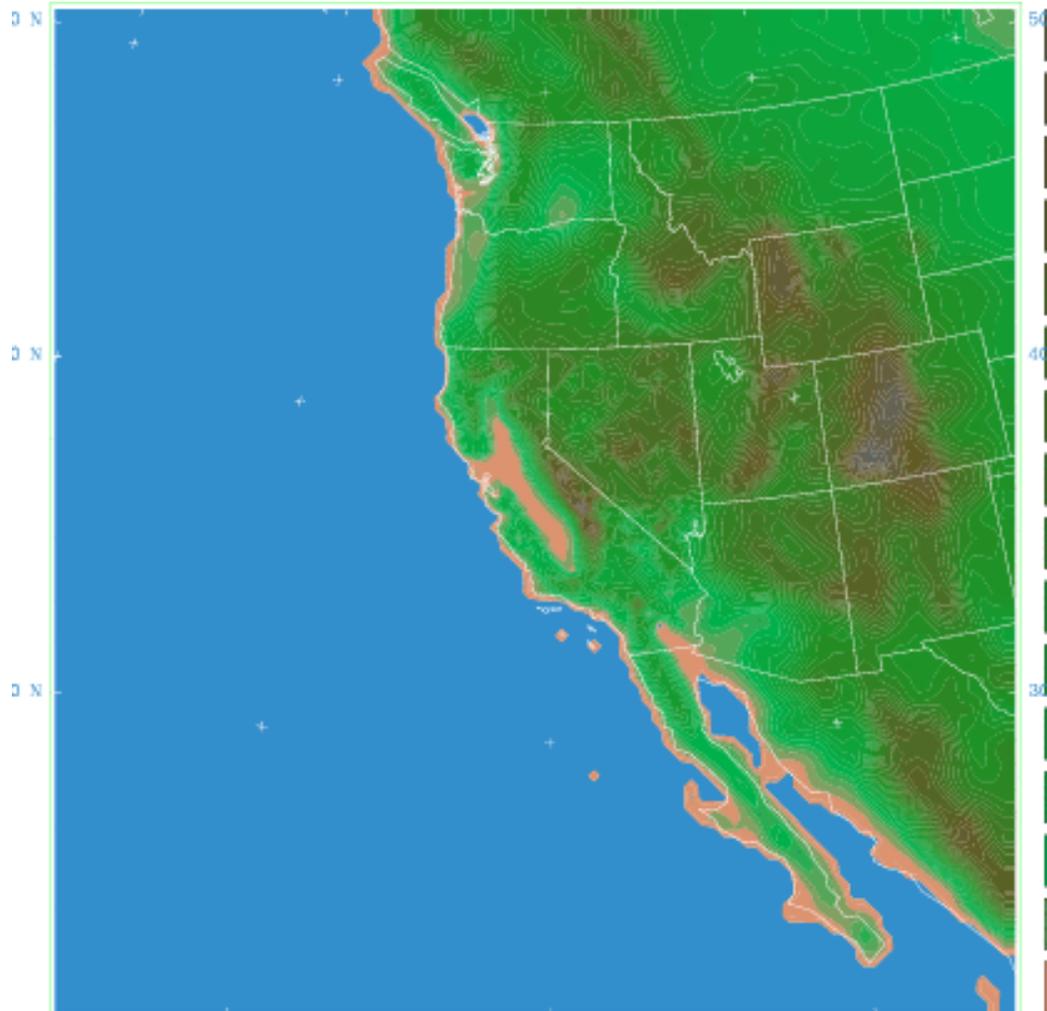
- Meteorological modeling
- Emissions inventory preparation
- Regional toxics modeling
  - Diesel PM (DPM) only
  - Major reactive toxic compounds
- Risk evaluation

# Meteorological Modeling

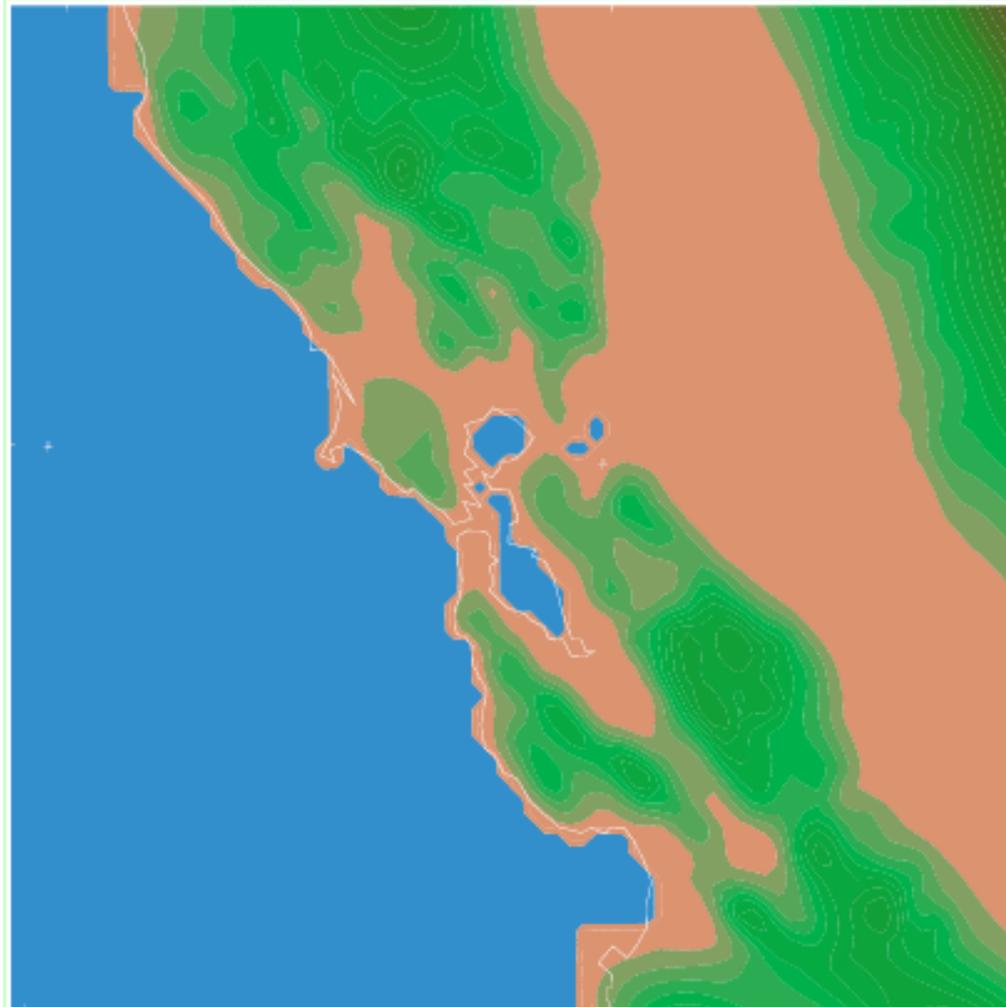
- MM5 model
- Three nested domains
  - 36, 12 and 4 km horizontal grid resolutions
- 50 vertical layers

Simulation period: July and December 2000

# 36 km meteorological modeling domain terrain elevation map



**4 km meteorological modeling domain  
terrain elevation map,  
regional toxics modeling domain**



# Emissions Inventory Preparation

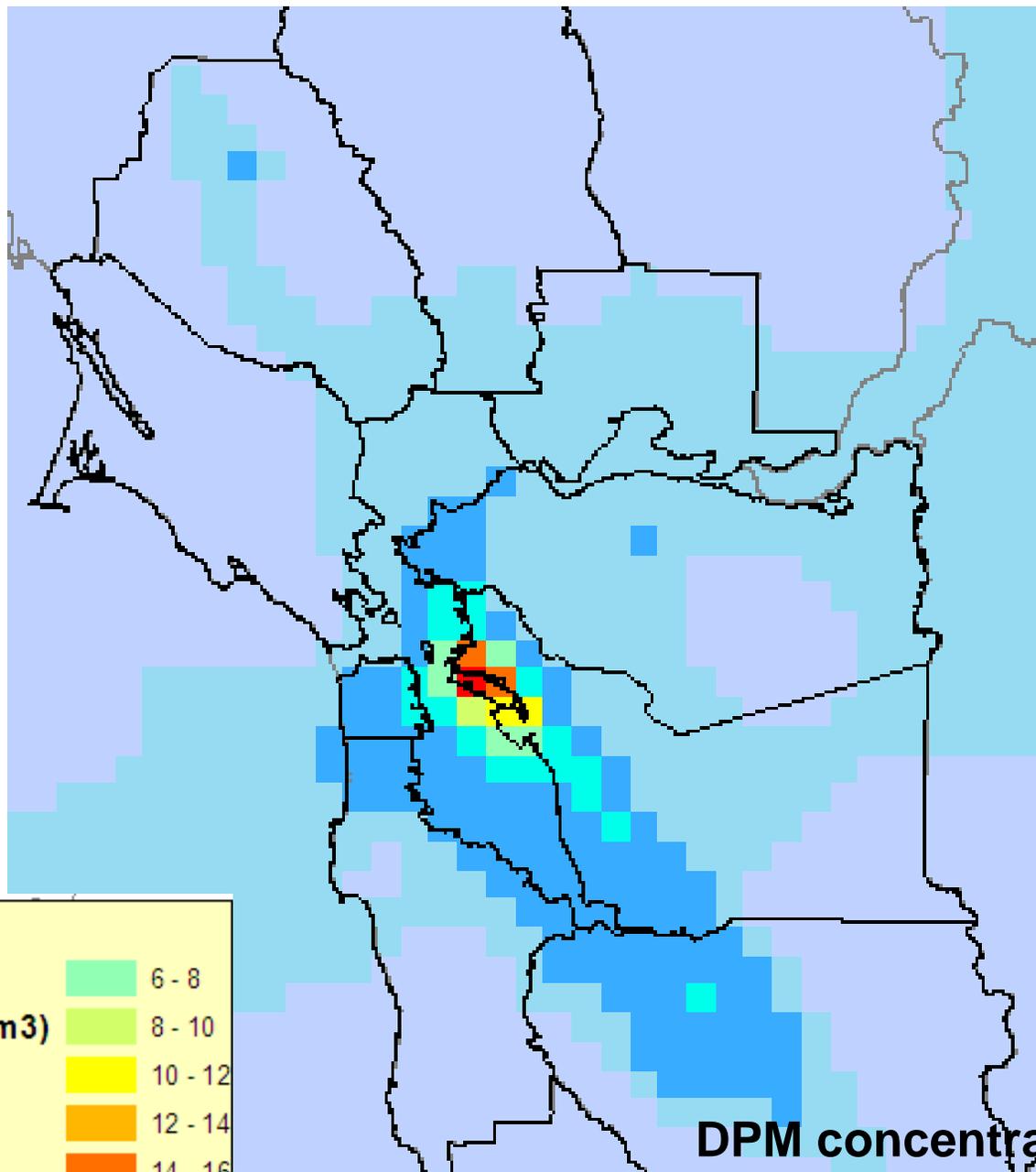
- 2005 CARE inventory converted to modeling inventory
- Anthropogenic emissions only from Bay Area
- Biogenic emissions from the entire 4 km domain

# Regional Toxics Modeling

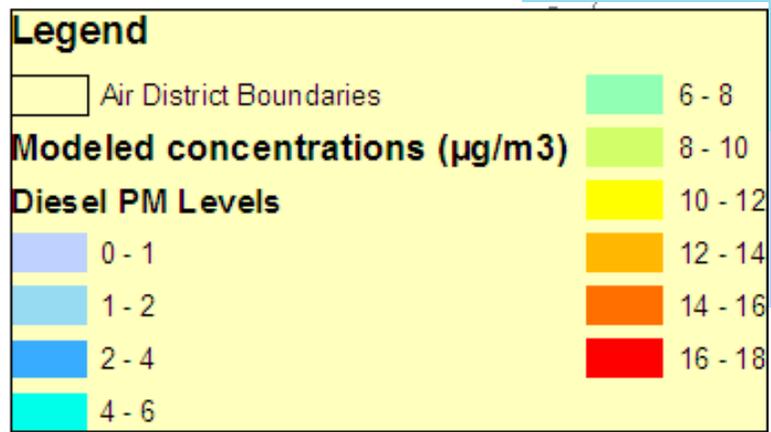
- CAMx model
- 4 km horizontal grid resolution

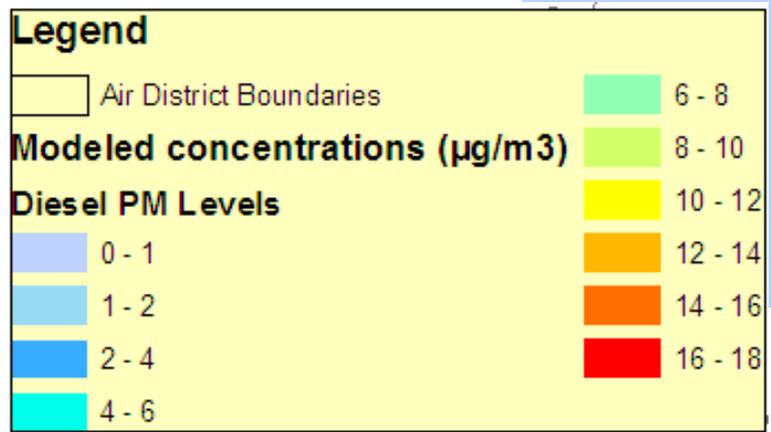
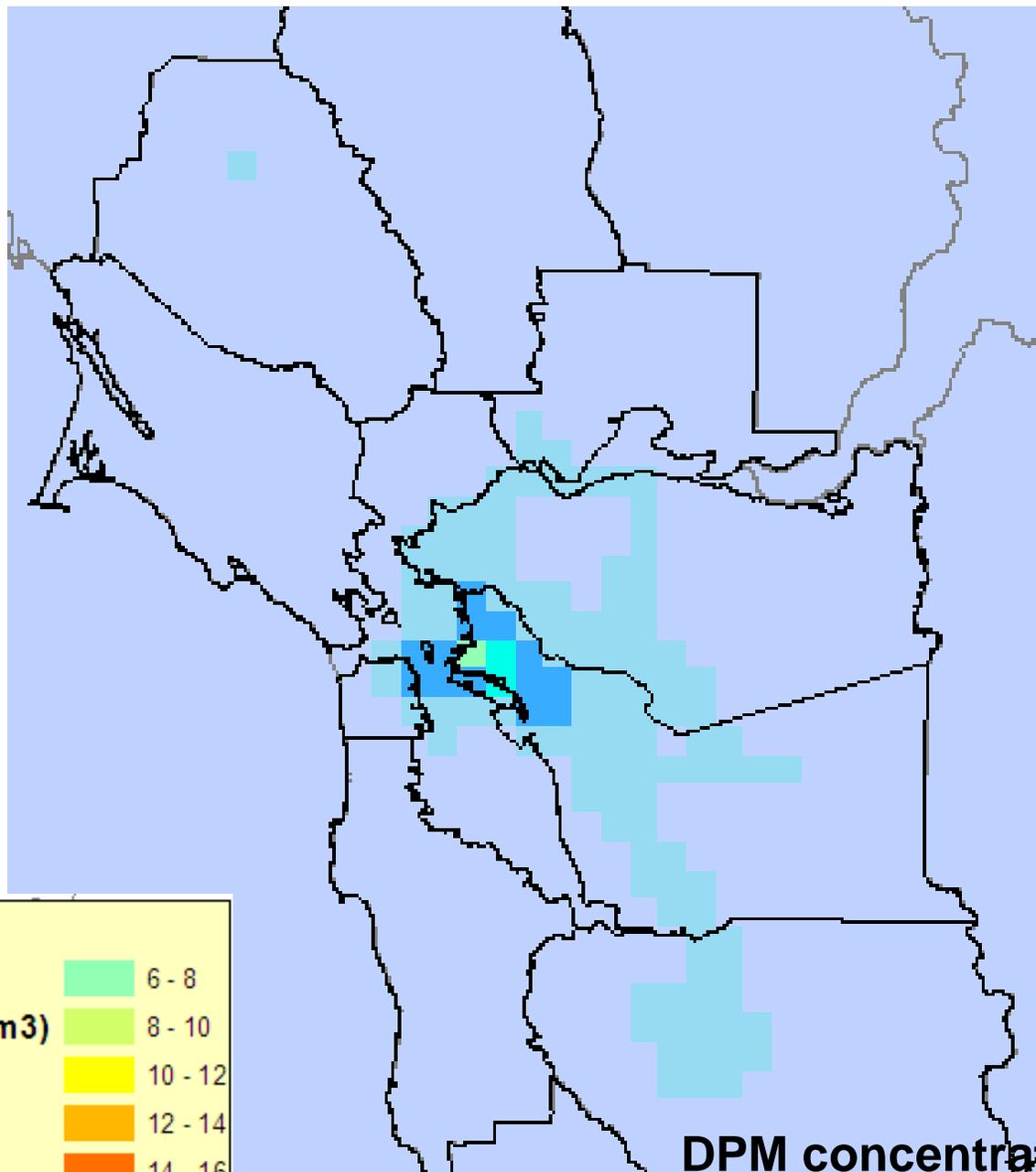
## Simulation periods:

- DPM simulation: July and December 2000
- Reactive toxics simulation: July 12-18 and December 12-18, 2000

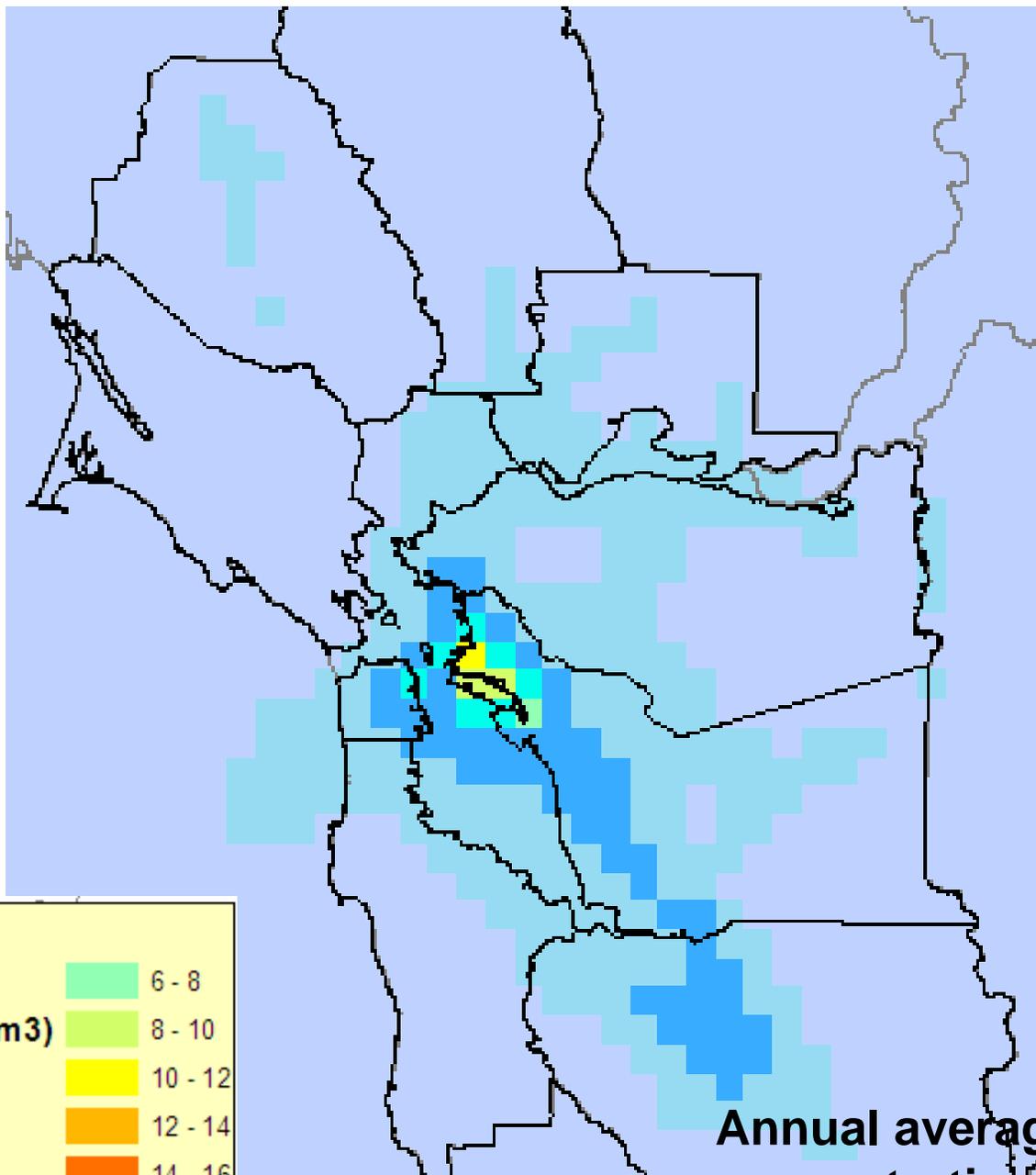


**DPM concentrations  
for December**

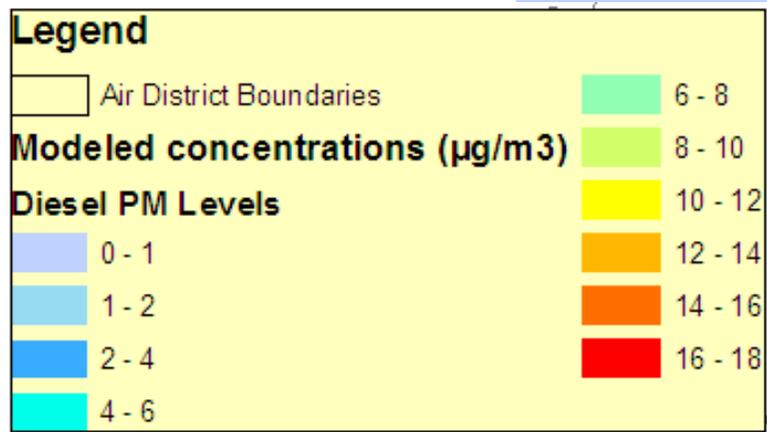




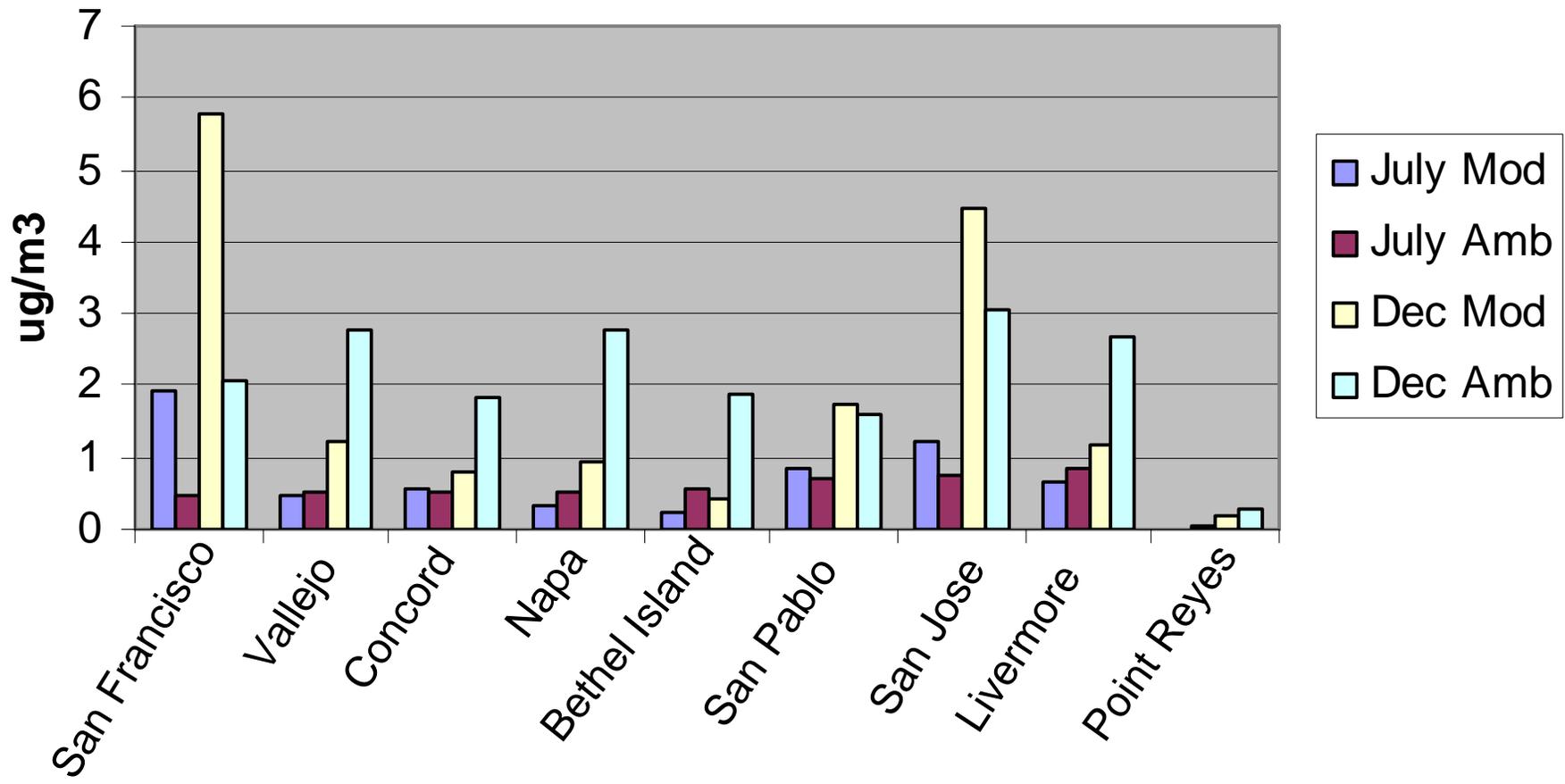
**DPM concentrations for July**

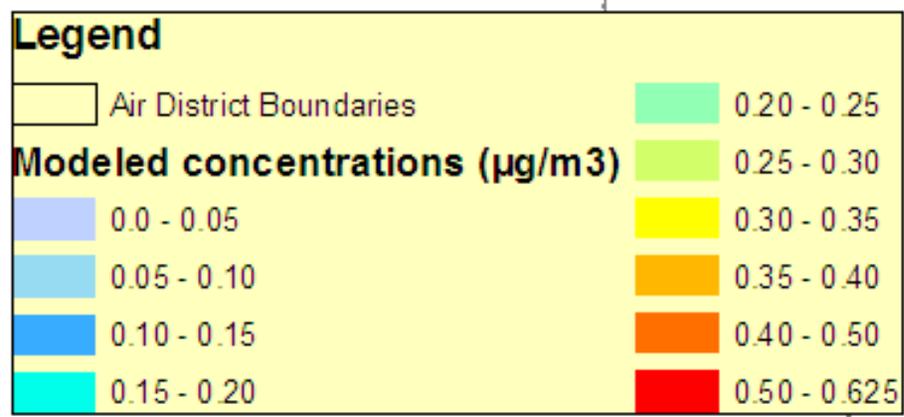
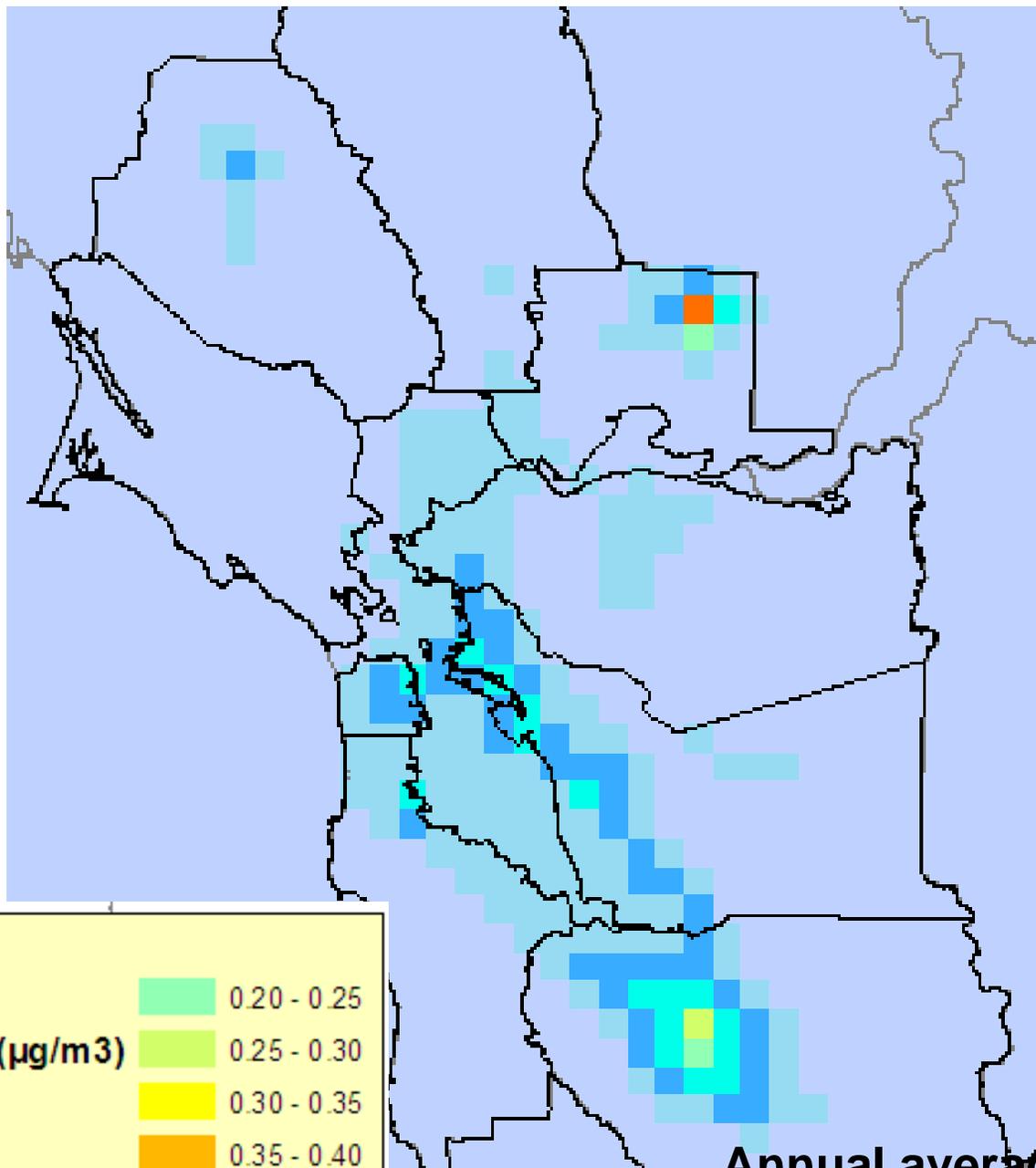


**Annual average DPM concentrations**



# Comparison between modeled **DPM** and observed **ambient elemental carbon** concentrations at nine BA sites for July and December





**Annual average 1,3-butadiene concentrations**

# Summary of Toxics Modeling

- Preliminary model performance look good
- Modeling document is being prepared
- 1 km resolution simulations underway
- Schedule for 1 km modeling-early 2009
- More focused maps will be prepared
- Risk evaluation to follow

# Risk Evaluation

## Cancer risk evaluation

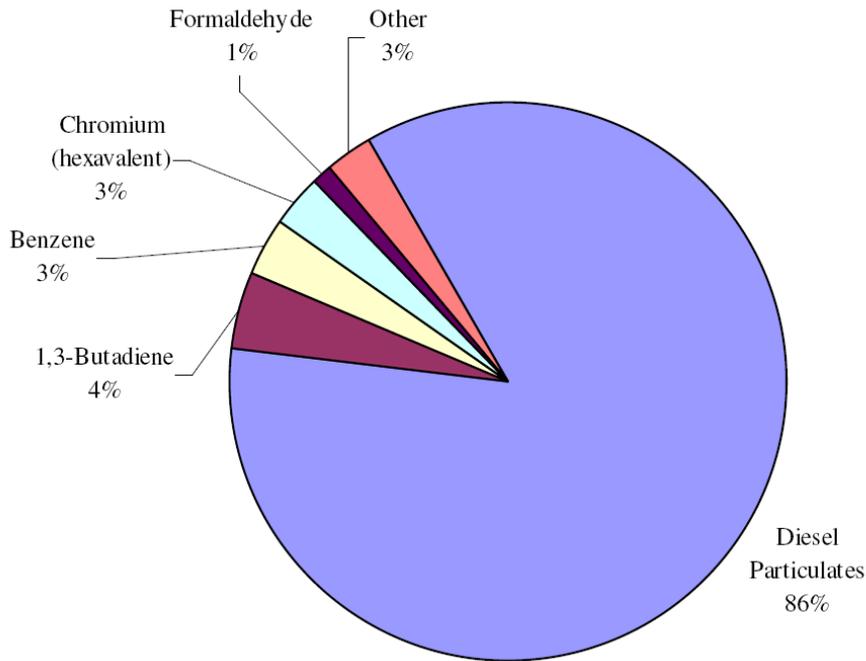
- DPM, 1,3-butadiene, benzene, formaldehyde, acetaldehyde
- Each compound scaled by its unit risk factor → expected cancer incidents per million people over a 70-year exposure
- Potential cancer incidents based on total population within the Bay Area

## Chronic risk evaluation

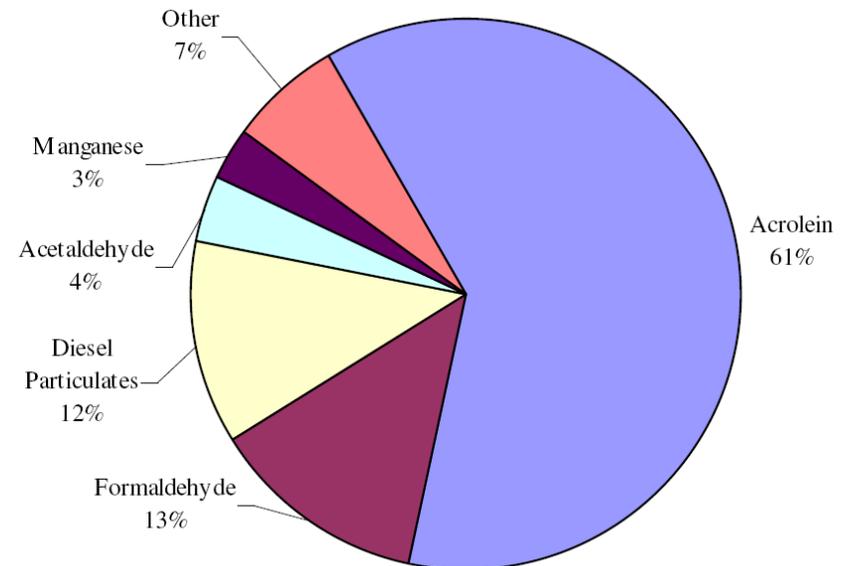
- Acrolein
- Compared to its reference exposure level

# Toxicity-Weighted Emissions: Bay Area (2005)

## Cancer Toxicity Weighting

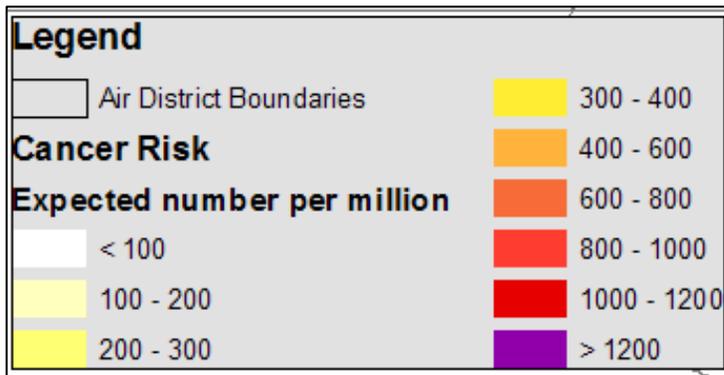
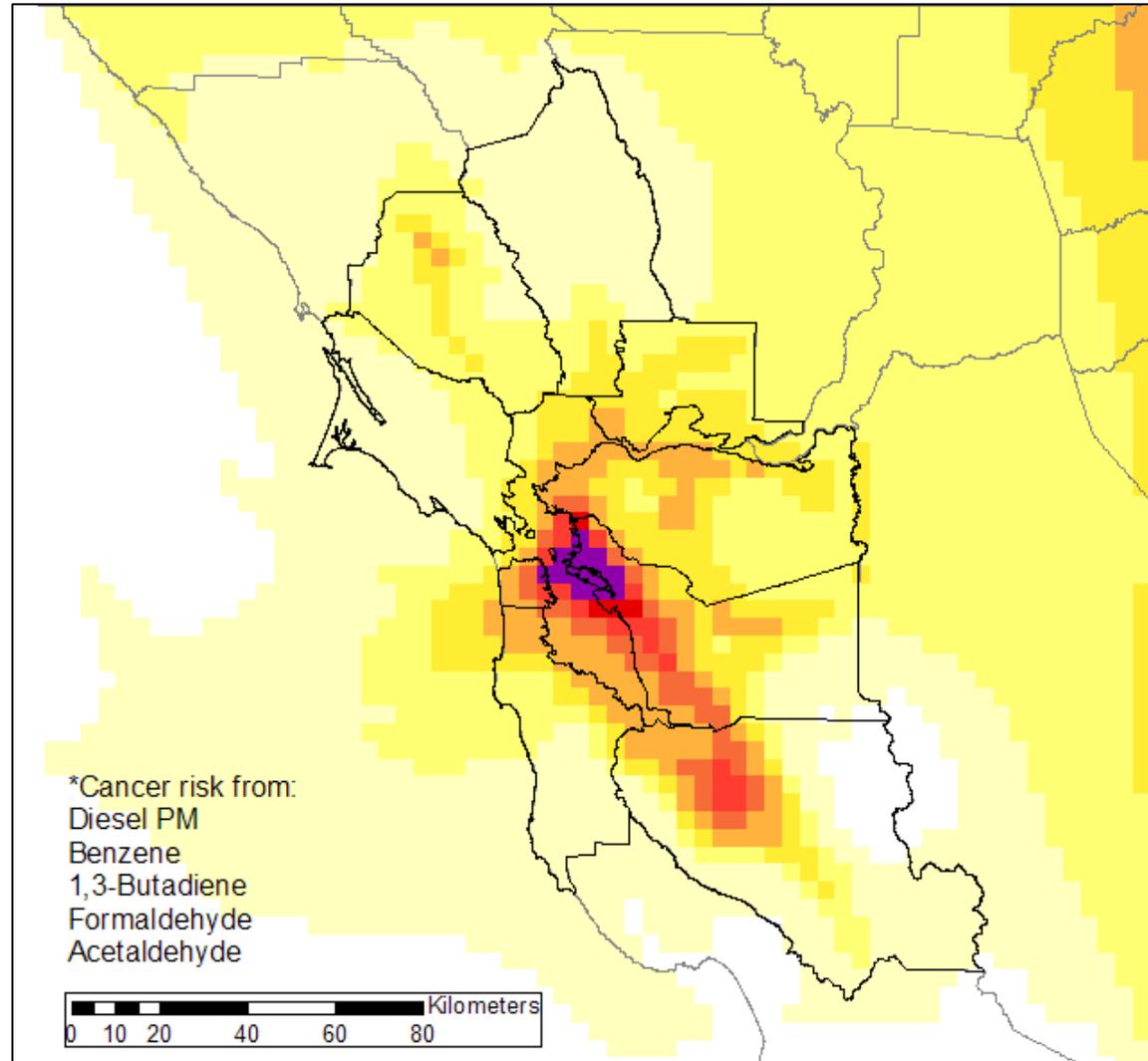


## Chronic, Non-Cancer Toxicity Weighting



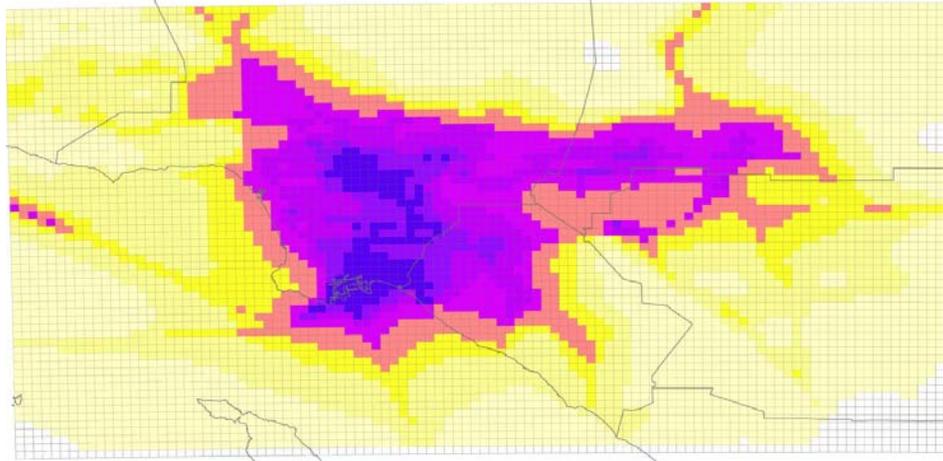
# Model Estimated Cancer Risk\*

- Expected cancer incidents per million people
- Modeled concentrations weighted by health risk of each compound

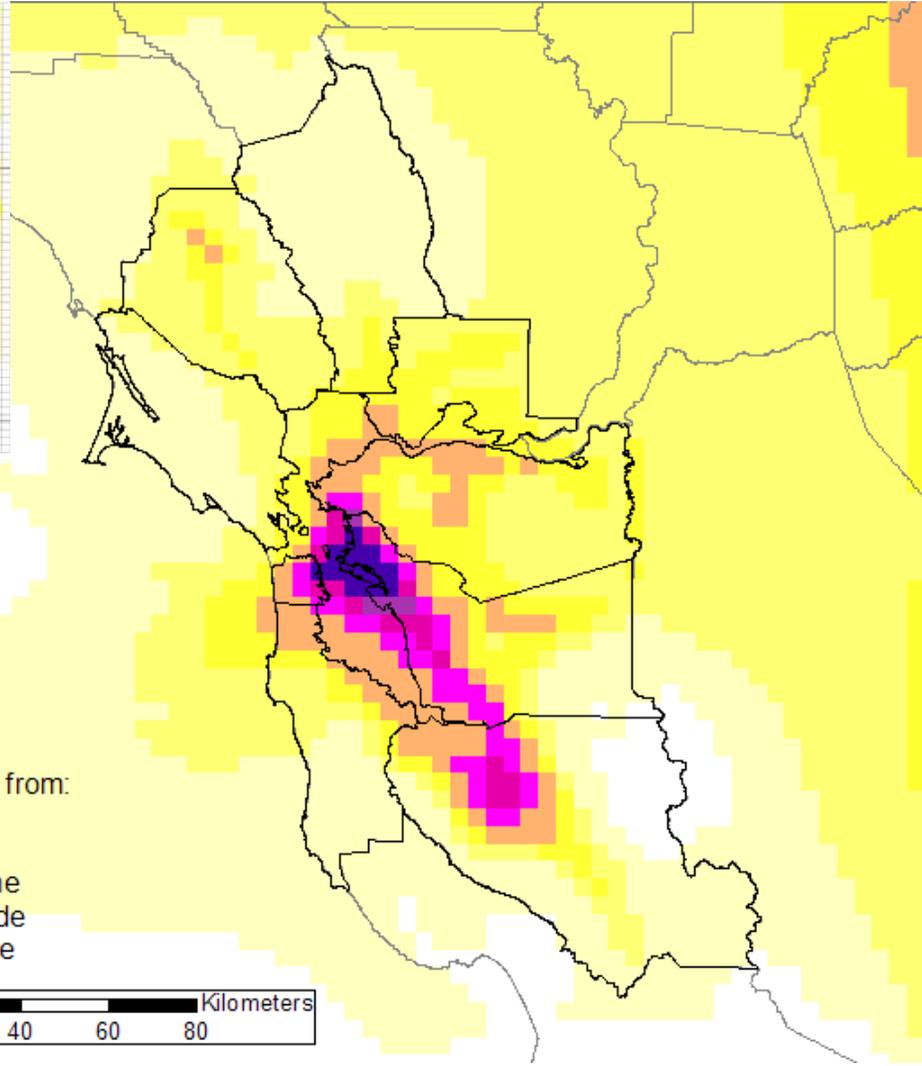


# Comparison: Bay Area Estimated Risk vs. South Coast Estimated Risk

## MATES III Model Estimated Risk



## CARE Model Estimated Risk



### Legend

 Air District Boundaries

### Cancer Risk

Expected number per million

 < 100

 100 - 200

 200 - 300

 300 - 400

 400 - 600

 600 - 800

 800 - 1000

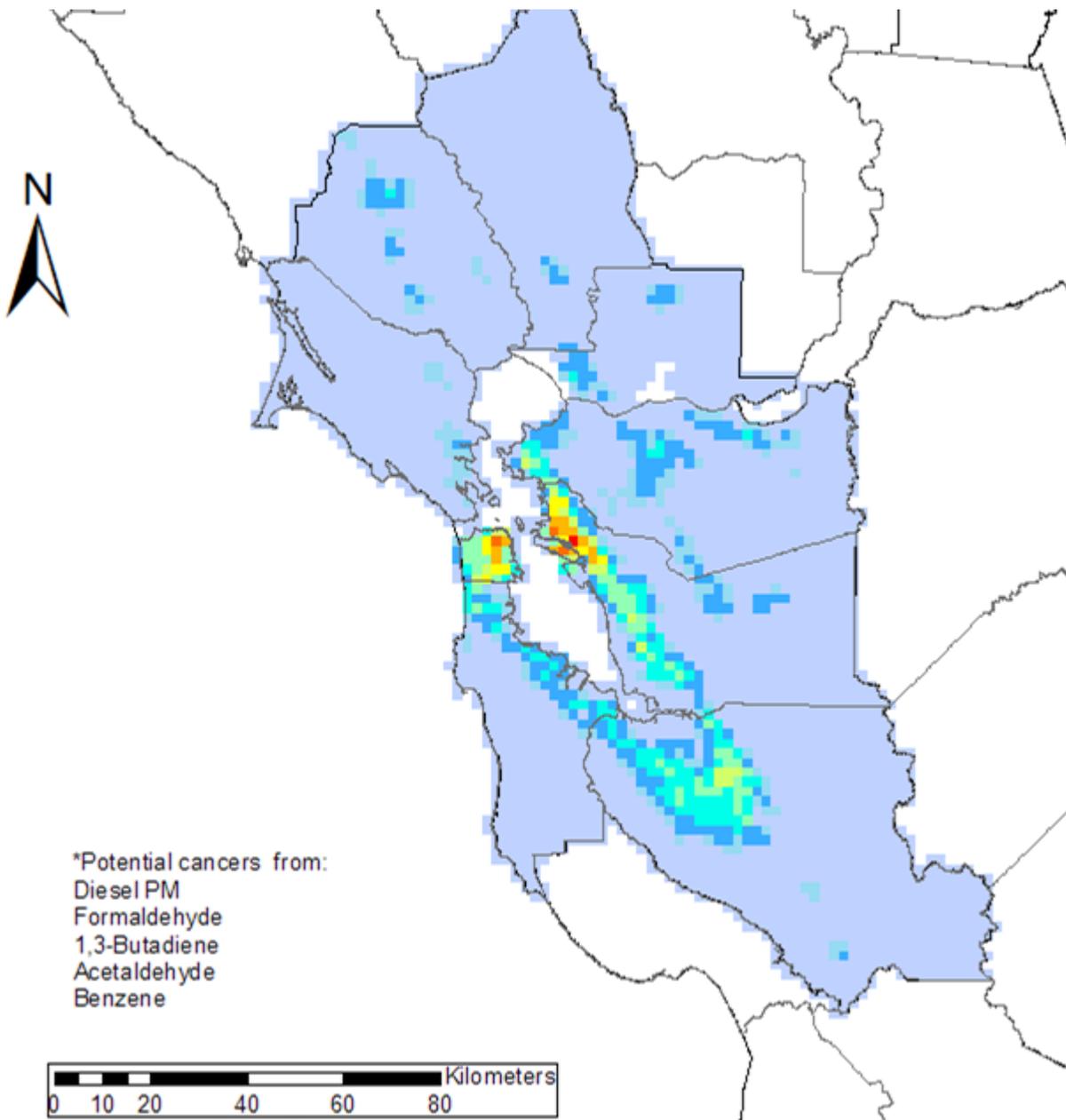
 1000 - 1200

 > 1200

\*Cancer risk from:  
Diesel PM  
Benzene  
1,3-Butadiene  
Formaldehyde  
Acetaldehyde



September 17, 2008



**Legend**

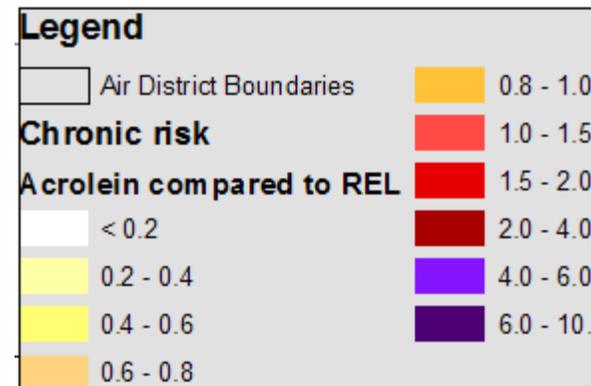
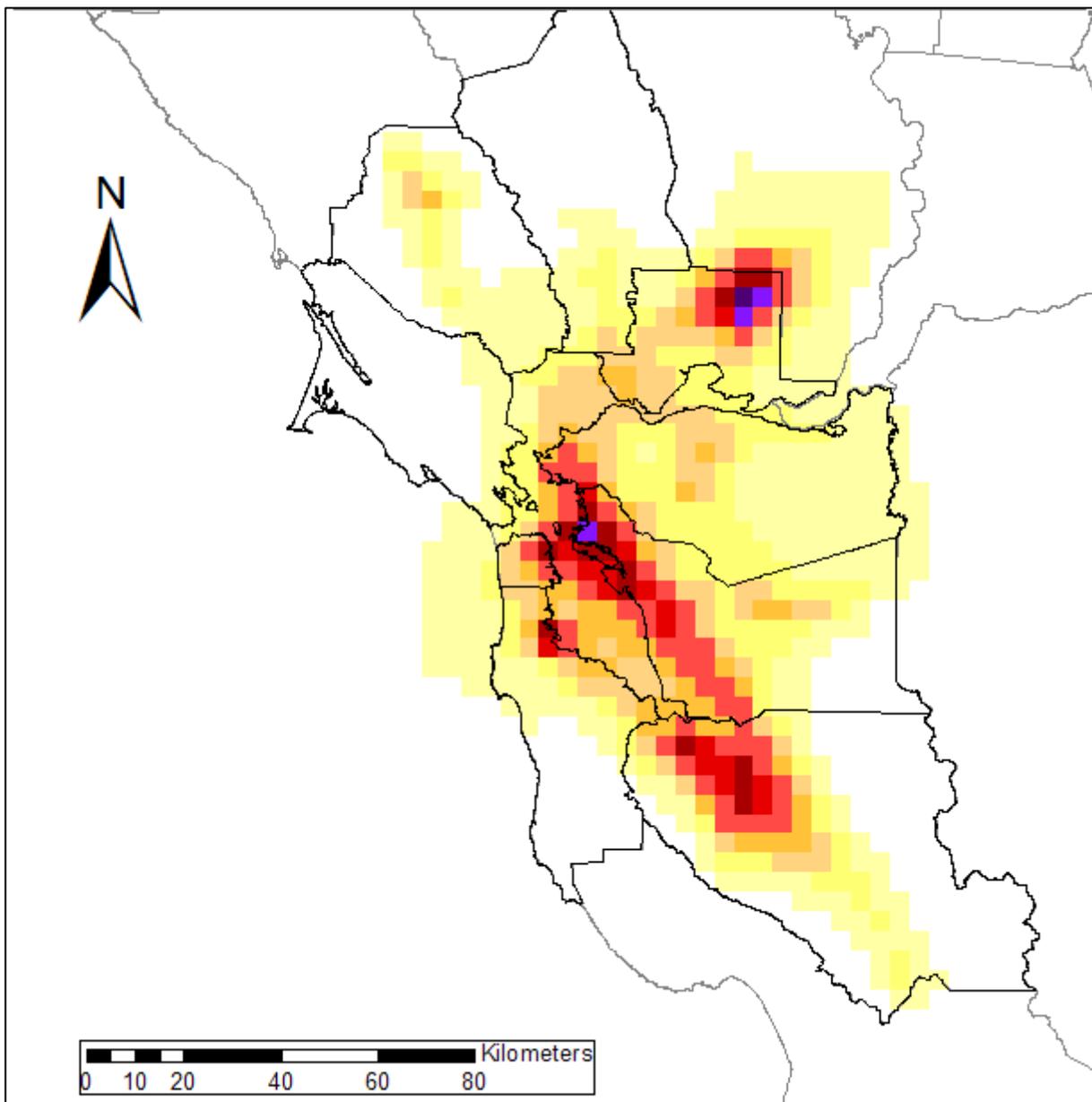
	County Boundaries		10-15
	Air District Boundaries		15-20
<b>Potential Cancer Cases</b>			
	< 1		20-30
	1-2		30-45
	2-5		45-100
	5-10		> 100

**Modeled potential excess cancers\* in 70-year period based on Bay Area's population**

\*Potential cancers from:  
 Diesel PM  
 Formaldehyde  
 1,3-Butadiene  
 Acetaldehyde  
 Benzene



September 17, 2008



**Modeled chronic,  
non-cancer risk  
from acrolein:  
Concentration  
compared to  
reference exposure  
level (REL)**

September 17, 2008