South Coast AQMD Plug-in Sprinter Van Program

ZEV Symposium
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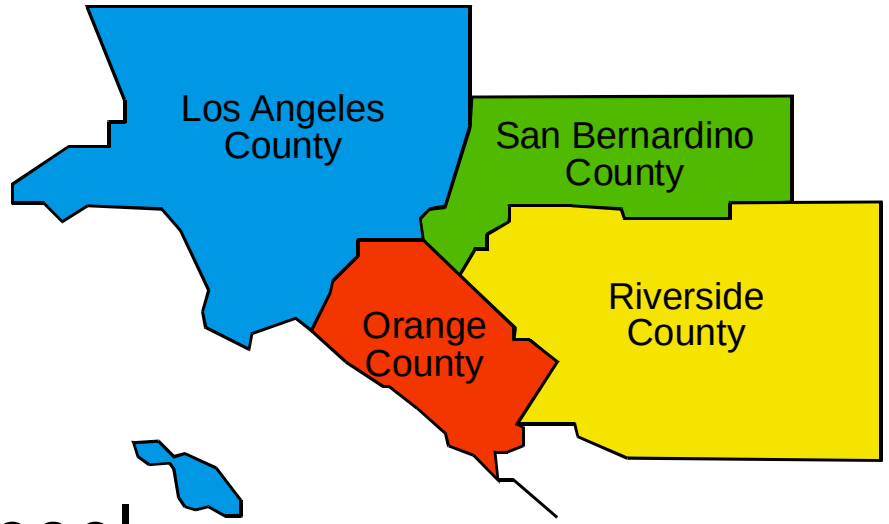
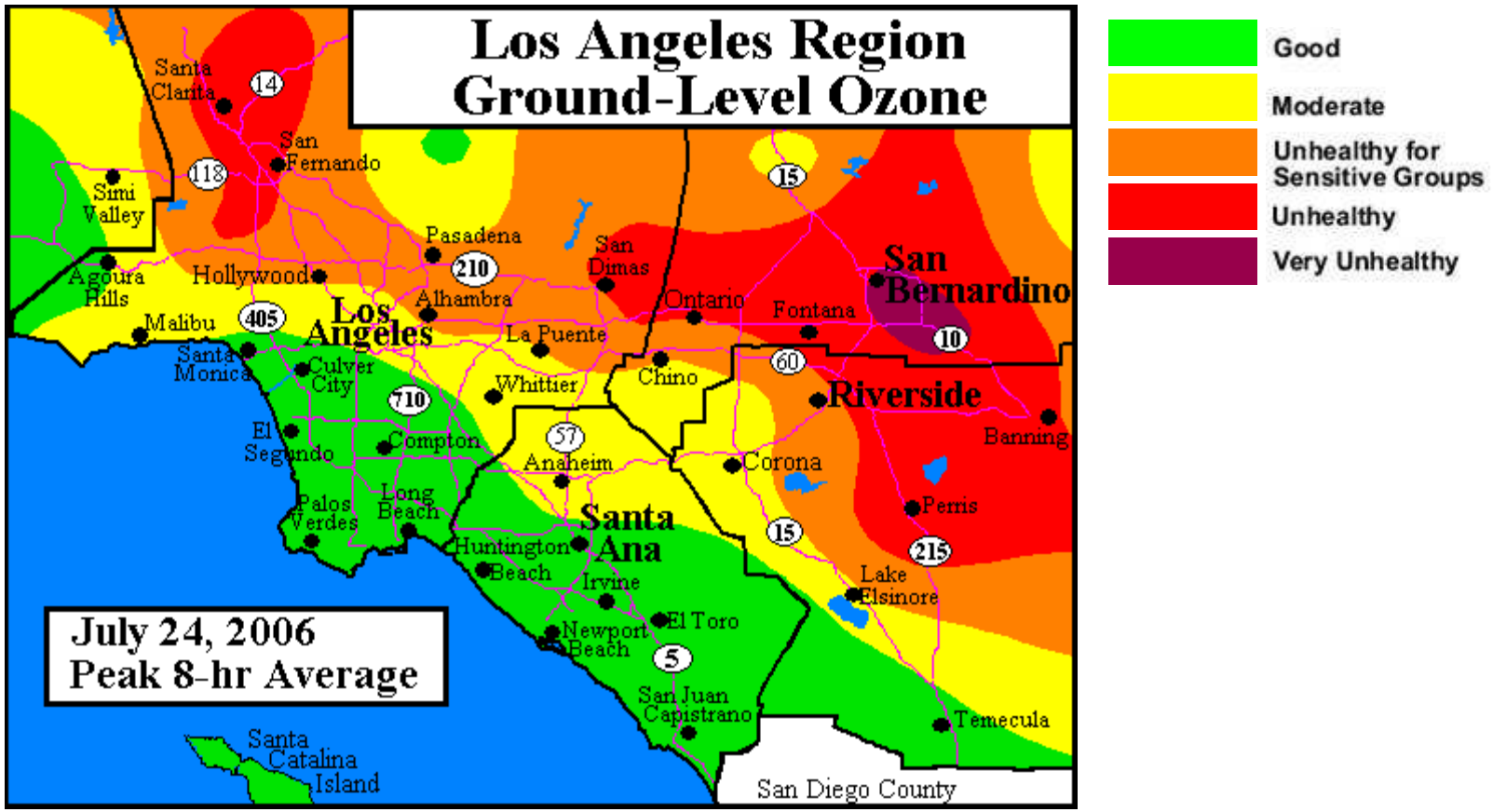
AQMD Background Setting

South Coast Basin:

- 4-county region
- 11,000 sq. miles
- 16+ million residents
- Hundreds of thousands diesel vehicles
- Millions of gasoline vehicles
- Combined Ports of Long Beach and Los Angeles are 5th largest cargo gateway



Severe Air Quality Problem Requires Cleaner Mobile Technologies



Most Particulate-Polluted Counties (annual avg PM2.5)

1. **Riverside, CA**
2. **San Bernardino, CA**
3. **Los Angeles, CA**
4. Kern, CA
5. Tulare, CA
6. Allegheny, PA
7. Fresno, CA
8. Wayne, MI
9. **Orange, CA**
10. Kings, CA

American Lung Association: State of the Air 2005 (Table 3a)

- Atherosclerosis (hardening of the arteries)
- Ischemic Heart Disease

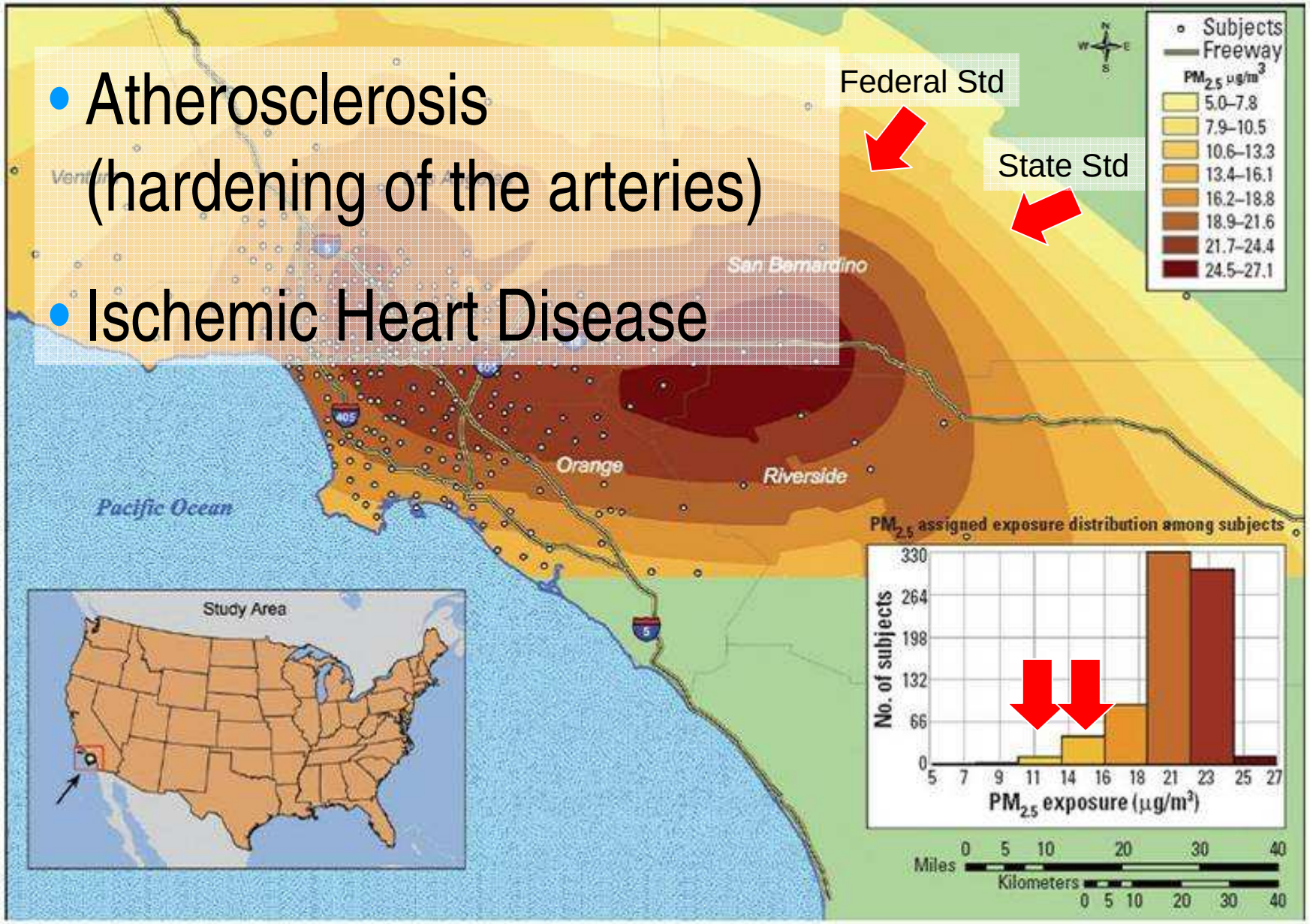


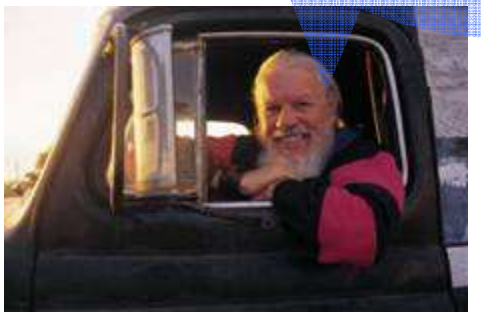
Figure 1. ZIP code locations of the study population geocoded on the $PM_{2.5}$ surface, modeled with 2000 $PM_{2.5}$ data, and distribution of individually assigned concentrations.

Strategy for Technology Advancement

Regulate

Incentives & Funding

Technology Providers



End-Users

Current Technologies & Market Do Not Reflect Urgency

- 2nd Highest Air Toxics
- 6,500 Deaths/year
- 89% Toxics Risk due to Mobile Sources

Clean Technology that can Satisfy All Stakeholders?

- High Efficiency
- Low Incremental cost
- Abundant Infrastructure
- Vehicle Performance
- Value-added for user

- Low/Zero Emissions
- Societal Benefits

Plug-in Hybrids May be One Solution

- EPRI Market Study (2000)
- UC Davis (2000 & 2003)
- SCE Utility Truck (2001)
- AC Propulsion Tri-fuel Jetta (2001 & 2005)
- EnergyCS Prius conversions (2005)
- EPRI/DaimlerChrylser Sprinter Vans (2003 & 2005)

Sprinter Van Program

EPRI ELECTRIC POWER RESEARCH INSTITUTE

DAIMLERCHRYSLER

SOUTHERN CALIFORNIA EDISON

PG&E Pacific Gas and Electric Company

SMUD SACRAMENTO MUNICIPAL UTILITY DISTRICT The Power To Do More.

AUSTIN ENERGY

NewYork Power Authority

LIPA Long Island Power Authority

SOUTHERN COMPANY Energy to Serve Your World

FirstEnergy

California Environmental Protection Agency AIR RESOURCES BOARD

- Phase I
  - AQMD: 2 prototype vans
- Phase 2
  - 30 vehicle fleet worldwide
  - AQMD: 5 passenger vans in fleet service

Phase 1 Objectives

In order to accelerate PHEV deployments:

- Develop PHEV technology with major automaker
- Build and demonstrate prototype vehicles in demanding real-world applications
- Validate benefits, performance, reliability, and customer acceptance
- Develop customer champions for PHEVs

Prototype Deployments

- Four prototypes in US
- Two gasoline vans to CA
- Demonstration in AQMD fleet
  - Feedback for Phase 2
  - Outreach
  - Inspector/Monitoring

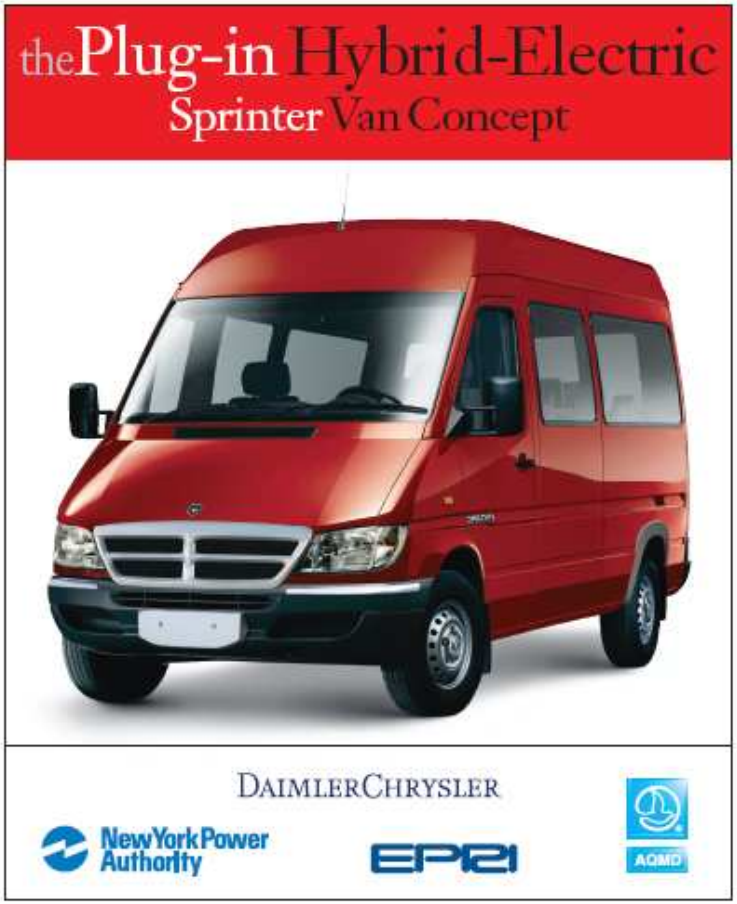
Motivation for Customers

- "Emission-free and low-noise driving in sensitive areas
- Less fuel consumption due to intelligent combination of ICE and electric motor
- Maintenance saving caused by using electric brake and lower ICE duty cycles
- Potential advantages in cost, comfort, and energy security by recharging the traction battery via the grid"

D. Portmann, "Lessons Learned in Developing the DaimlerChrysler Plug-in Hybrid"
DOE Meeting May 4-5, 2006

Schedule

- First AQMD van at SCE for testing
  - Varta NiMH, air-cooled
- Second AQMD van in New York for outreach
  - Saft Li-Ion, liquid-cooled

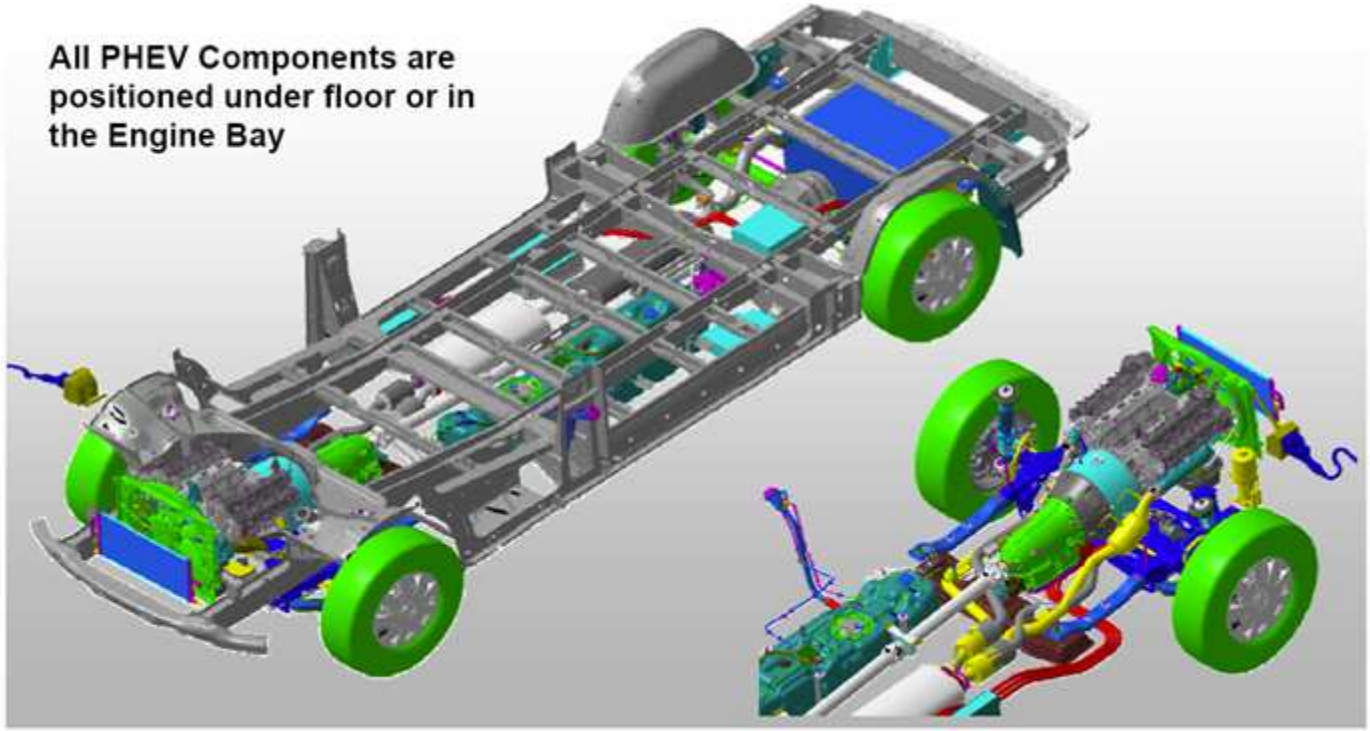


Phase 2 Objectives

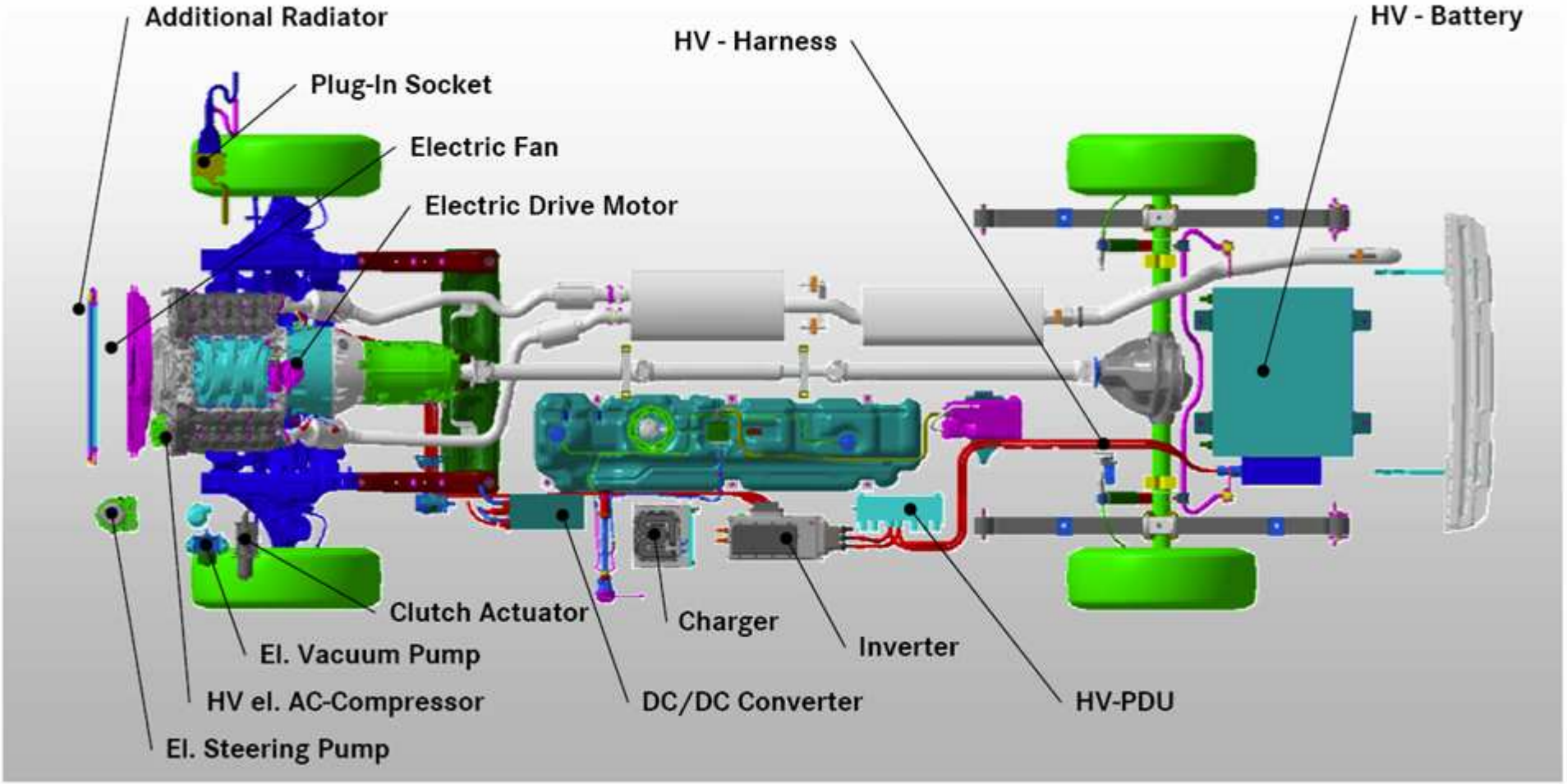
- Next generation development
- Focus on key technologies
  - Electric drive system
  - Li-Ion battery
  - Control system
- Expanded fleet demonstration program (30 vehicles U.S. & Europe)

Phase 2: Preliminary Design

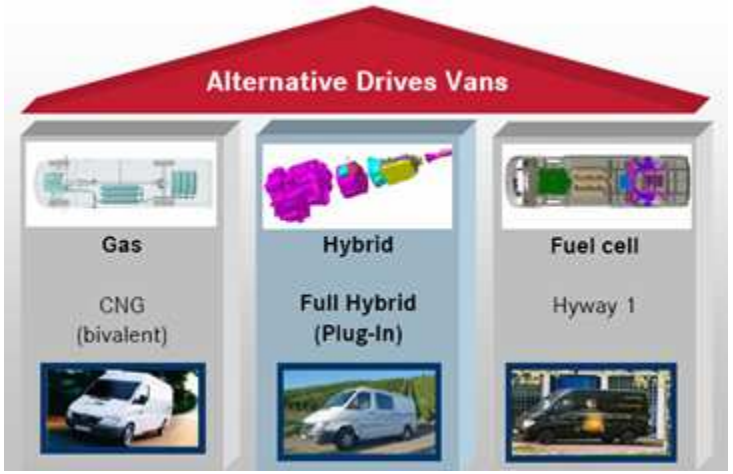
- Thirty vehicles worldwide – 18 in US
  - 6 cylinder gasoline engine
  - 14 kWh Li-Ion Saft Battery



Hybrid System Schematic

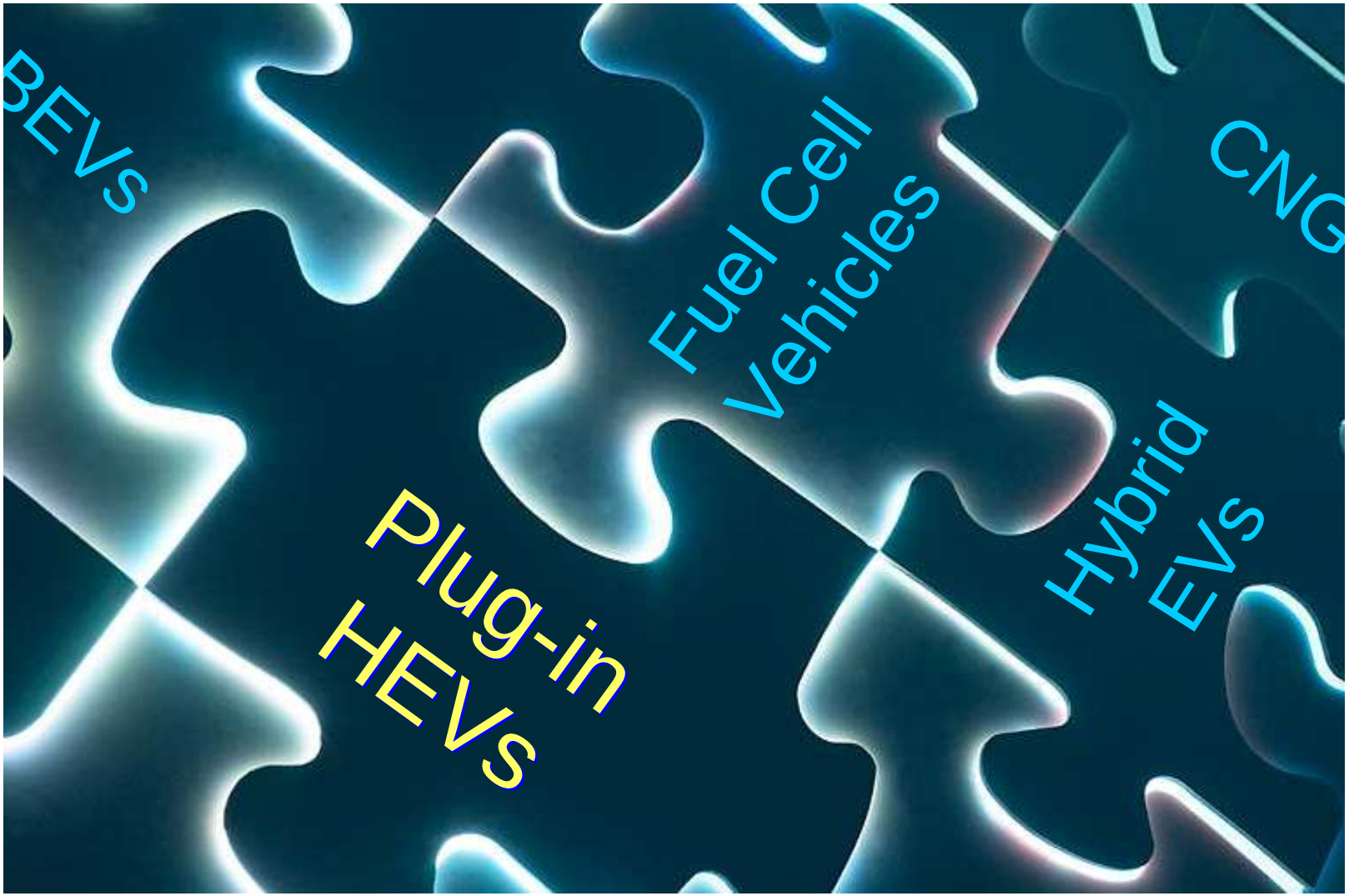


AQMD Perspective



- OEM involvement crucial
  - Production line capable
  - Modularity
- Optimize driving mode strategies
  - AER
  - Green zone
  - Blended
- Characterize emissions benefits

One Piece of the Puzzle (Air Quality, GHGs, Energy Diversity)



PHEVs Can be an Enabling Technology

- Very expensive
- Limited H2 storage capability
- No commercial product yet

Fuel Cell Vehicles

- Less $ than FCVs but
- Storage is still an issue
- H2 is expensive
- Low but measurable emissions

Hydrogen ICEs

H2 PHEVs

- Increased range
- Reduced H2 components
- More mature battery tech
- Even lower emissions

Together We Can Make It Work

- Need long-term and near-term solutions
- Invest now in research-demonstration technologies
- Public-private partnership
- Collaborative efforts to leverage and accelerate deployment

Backup Slides

Looming Health Crisis

LA Times March 25, 2006

Study Doubles Estimate of Smog Deaths

USC researchers amass measurements of lethal particulate matter from ons in e may ures.

State's Air Is Among Nation's Most Toxic

Only New York has a higher risk of cancer caused by airborne chemicals, the EPA says.

By Marla Cone

LA Times March 22, 2006

A22 WEDNESDAY, MARCH 22, 2006

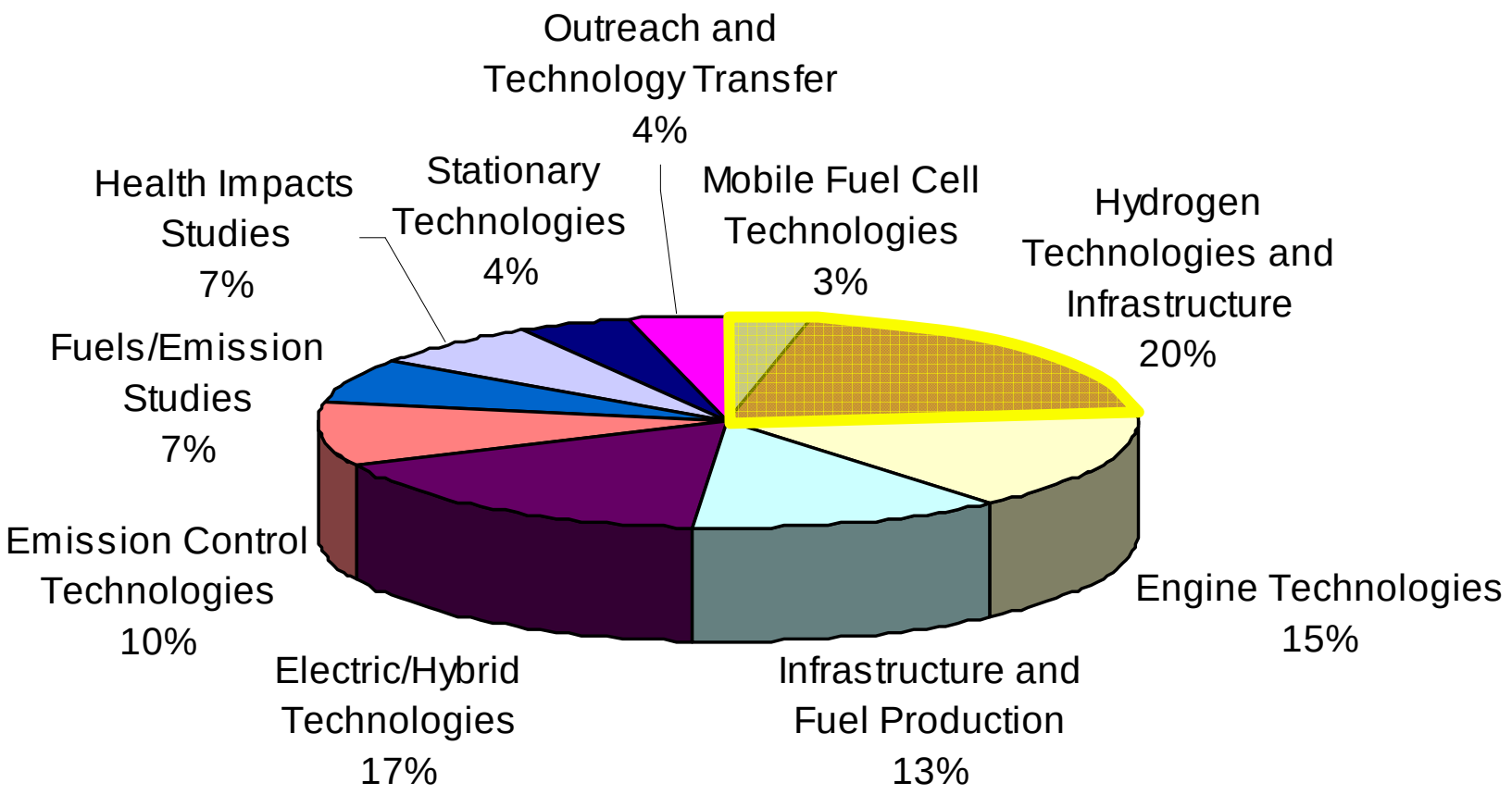
Cars, Trucks Key Culprits in Toxic Air

[*Fumes, from Page A1*]

side and San Bernardino counties are near the U.S. average.

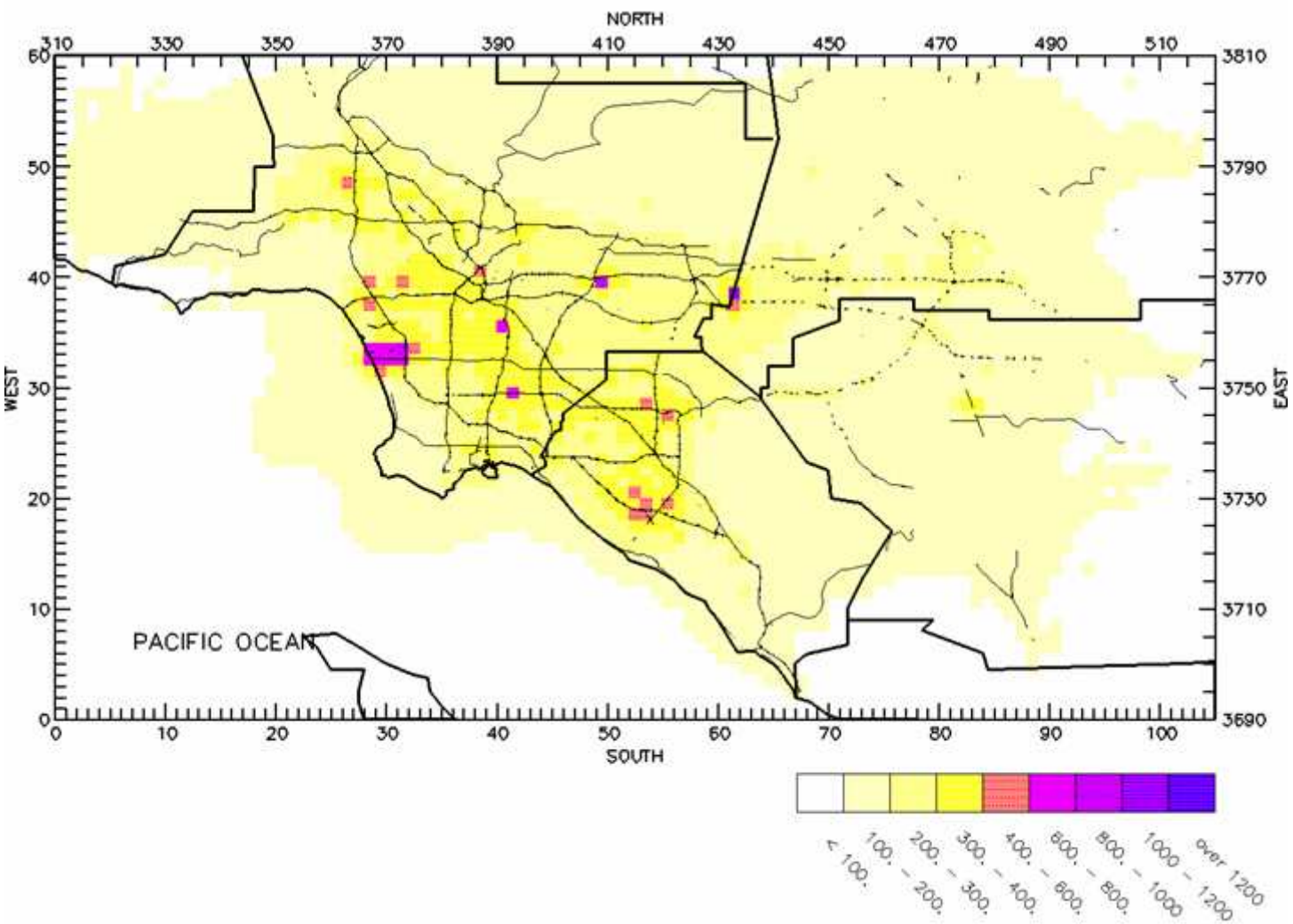
Although a tiny fraction of all cluded diesel exhaust, which was excluded from the EPA's numbers, and ranked other chemicals as more potent than the

2006 Plan Update

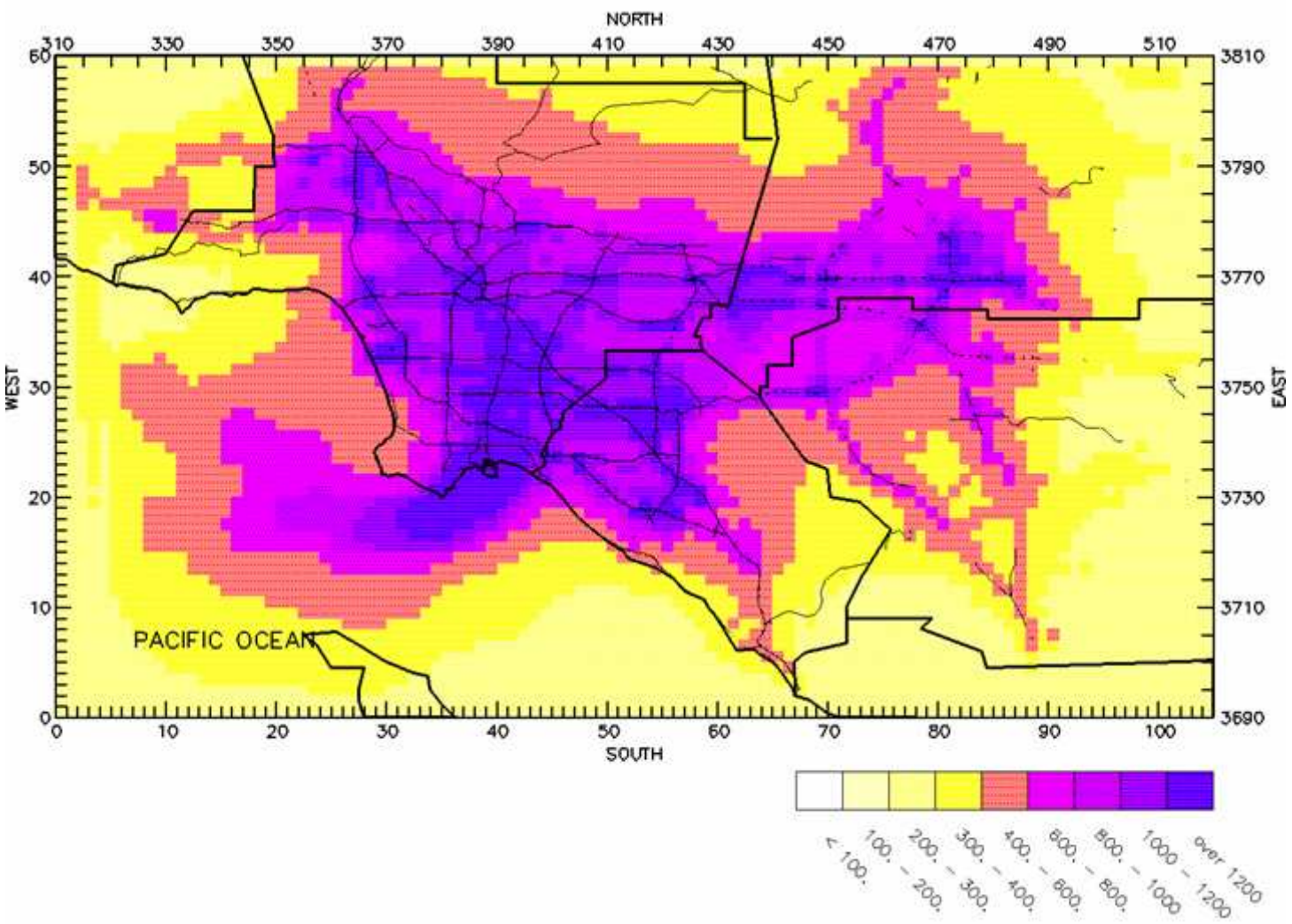


75% Toward Nearer-Term Projects, 25% for Longer-Term

MATES II – Estimated Risk Excluding Diesel Sources

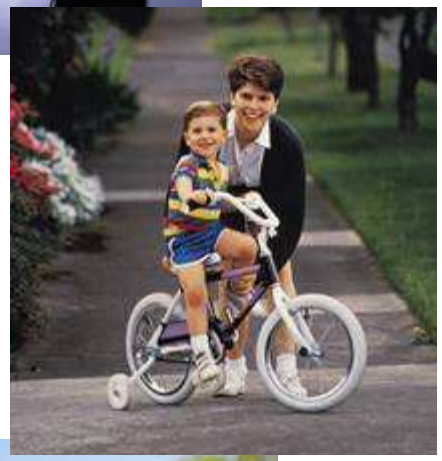


MATES II – Estimated Risk From All Emission Sources



PHEV Application

- Delivery Vans
- Shuttles
- Passenger Vans
- 90,050 Vehicles in Basin (8,501 – 10,000 lbs)



Phase 1 – Technical and Market Feasibility Study