Challenges and Strategies: Meeting the 8-Hour Ozone Standard

December 6, 2006

2006 San Joaquin Valley Air Quality Symposium

Atmospheric Science Challenges

Evan M. Shipp
Planning Department

Why Is The Reduction of Ozone in the SJV So Challenging?

- Photochemistry
- Transport and Dispersion
- Emissions

Basic Ozone Chemistry

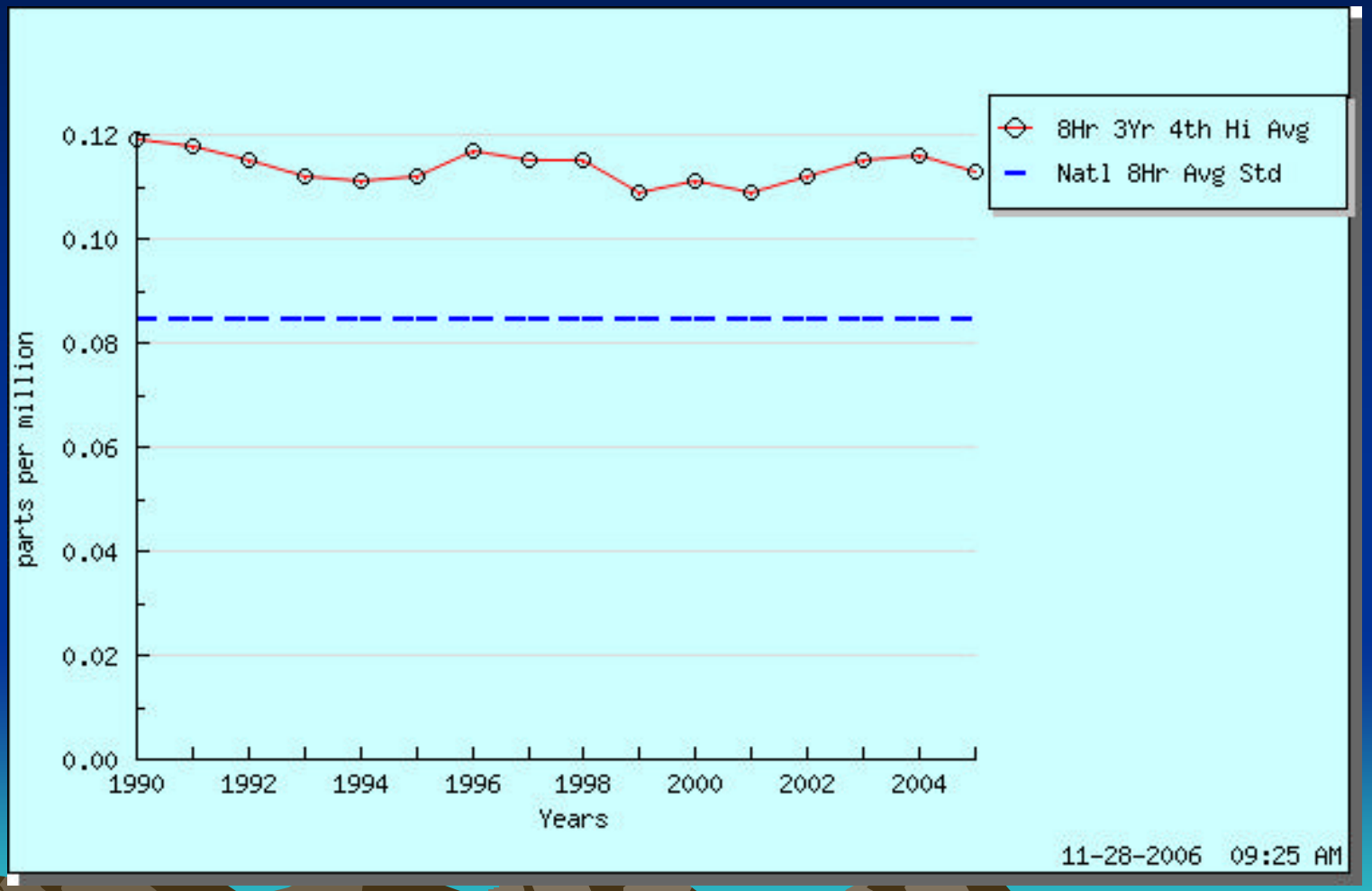
- $NO_2+O_2<->NO+O_3$ Involves Hydrocarbons and Sunlight

Less Basic Ozone Chemistry

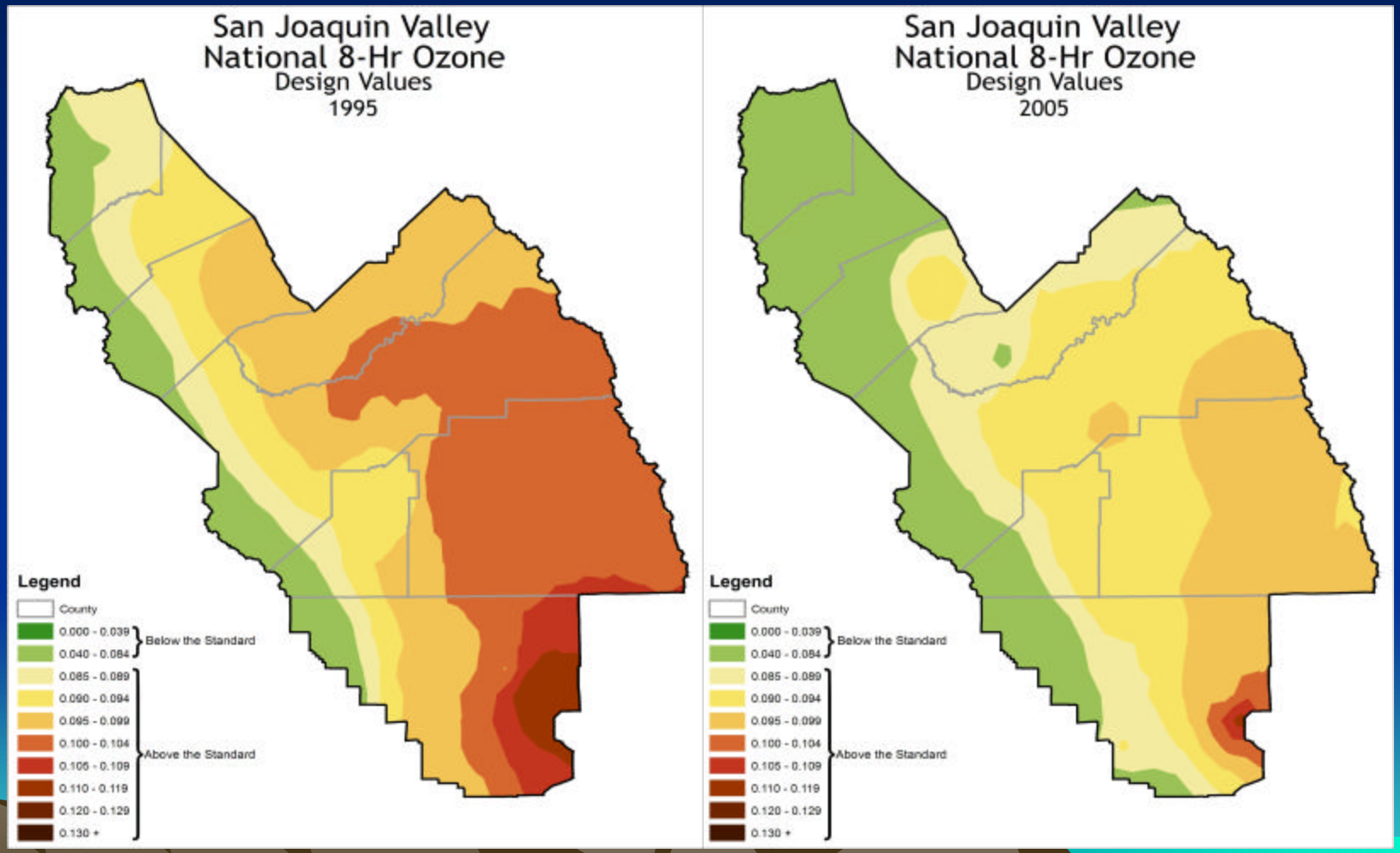
- NO_2+hv->NO+O
- O+O_2+M->O_3+M
- O_3+NO->NO_2+O_2
- O_3+hv->O(1D)+O_2
- O(1D)+M->O+M
- O(1D)+$H_2$0->2OH-
- CO+OH->CO_2+HO_2
- HO_2+NO->NO_2+OH-
- HO_2+NO->NO_2+OH
- OH+NO_2->HNO_3

- **Inorganic Reactions**
- **Aldehyde Reactions**
- **PAN Formation**
- **A-Dicarbonyl Chemistry**
- **Toluene Abstraction Pathway**
- **Conjugated a-Dicarbonyl Chemistry**

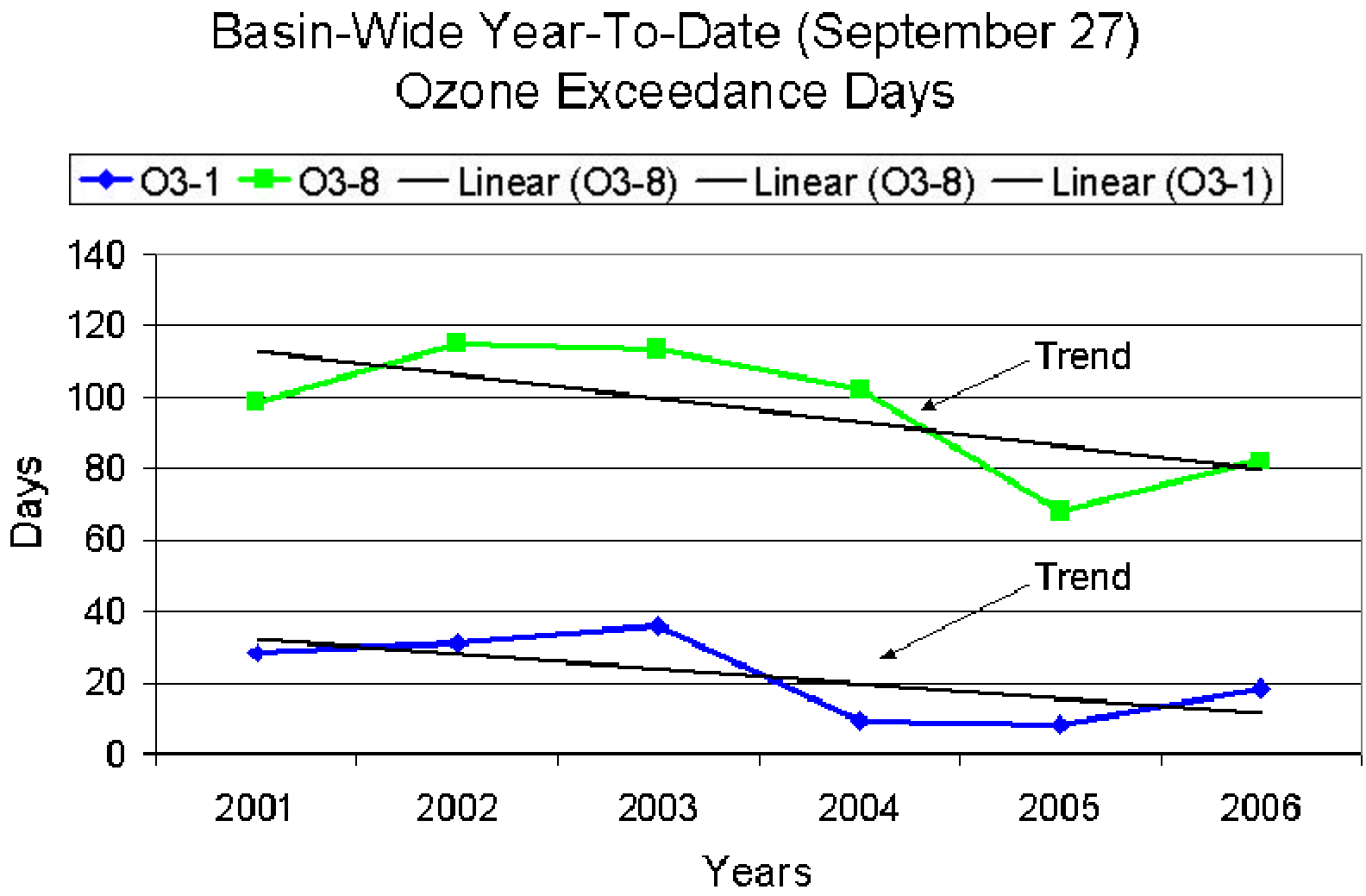
Trend of 8-Hour Ozone Design Value at Arvin



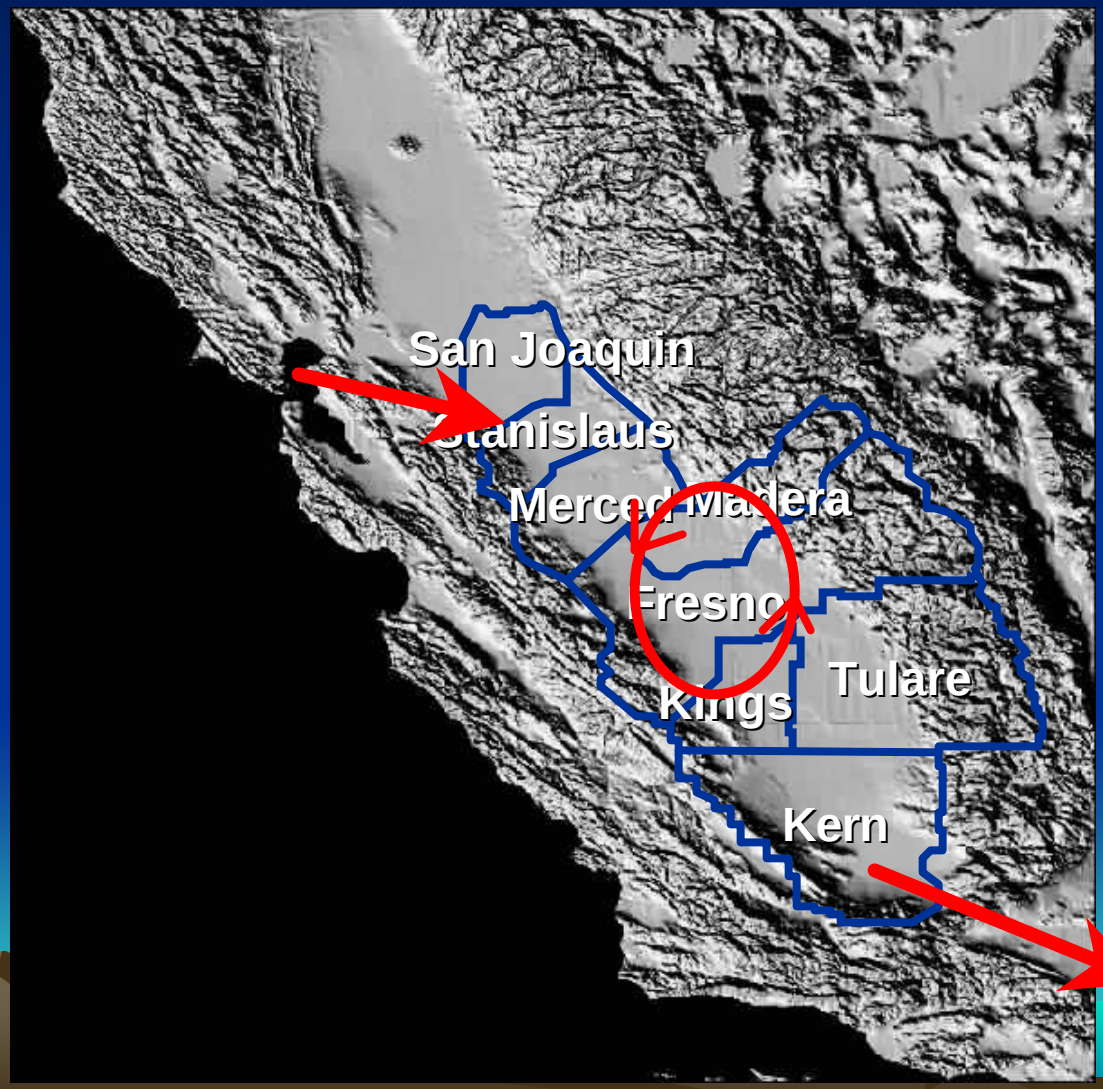
8-Hour Ozone Design Value Trends

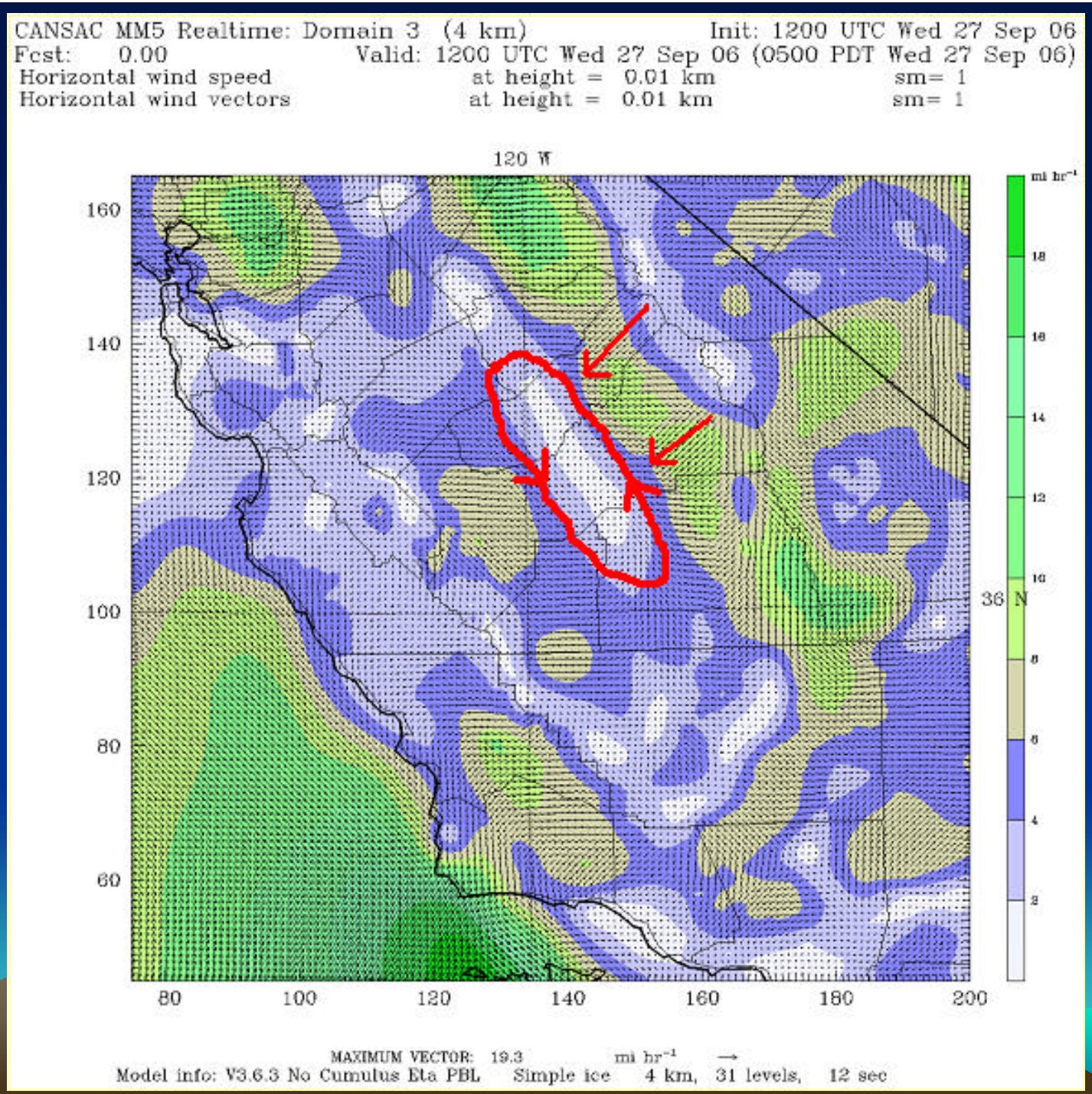


Trends in Ozone As Of September 27, 2006

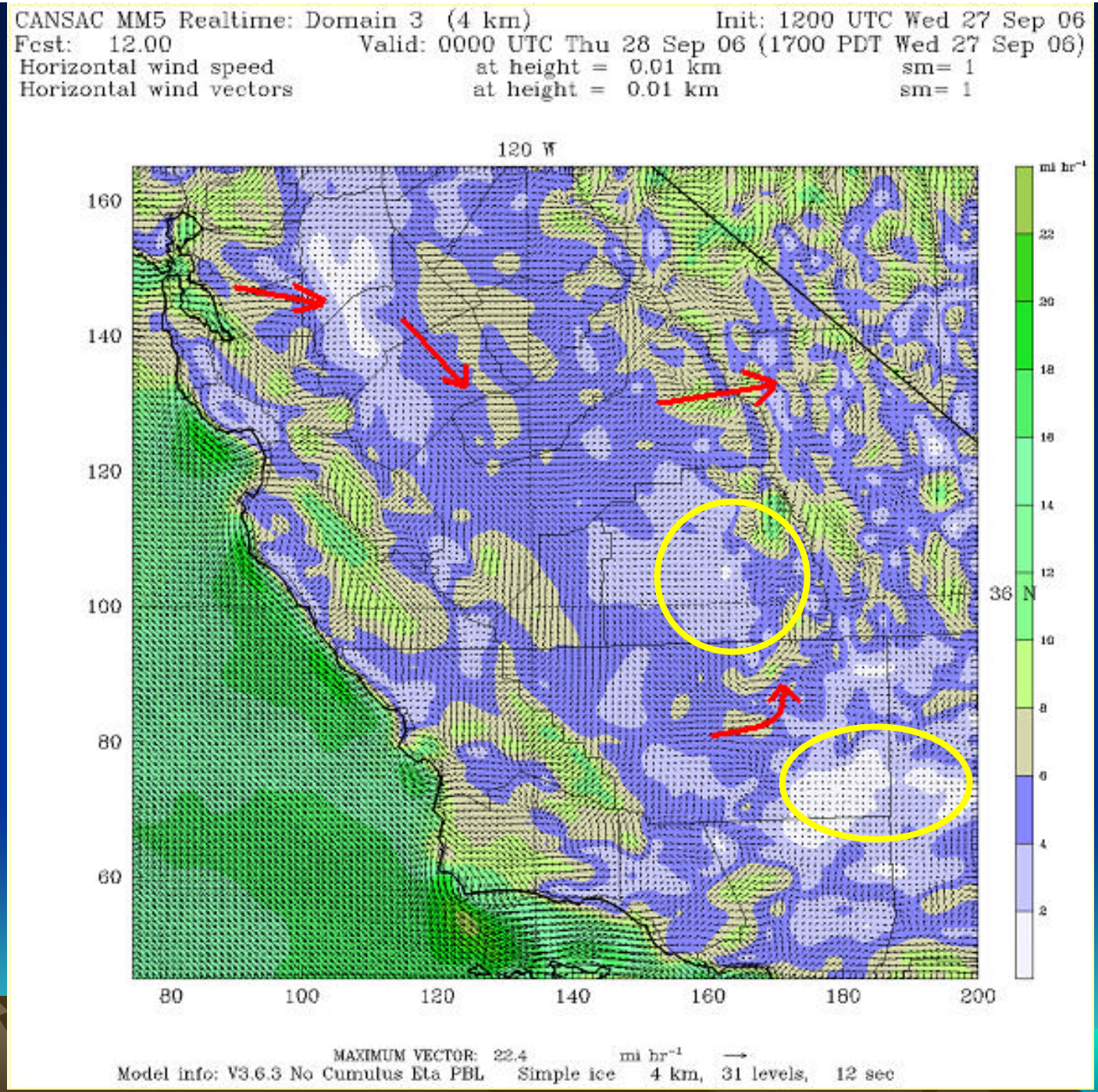


Transport and Dispersion of Pollutants Limited By Topography in the SJV



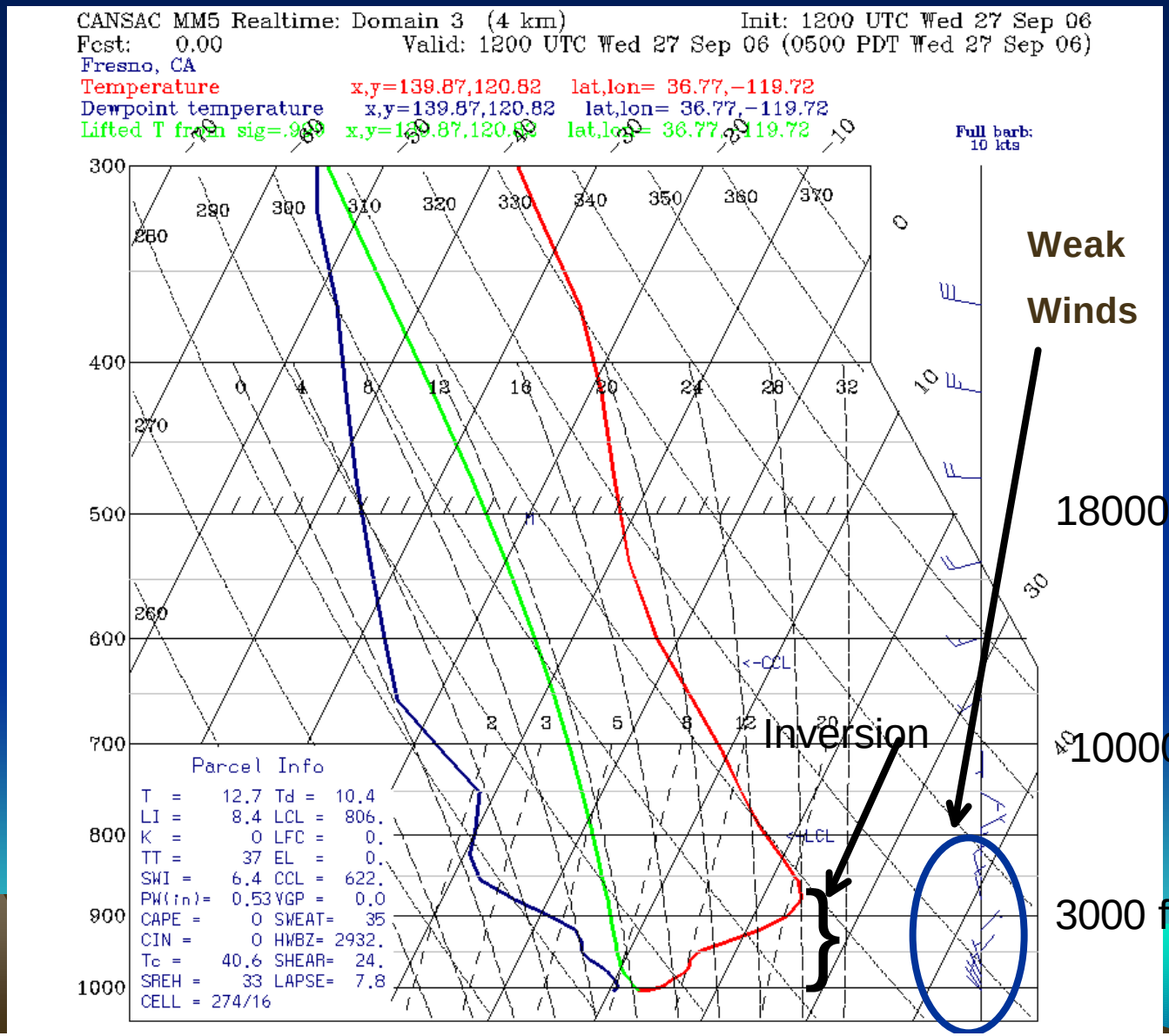


Morning Wind Field During High Ozone 9/27/06



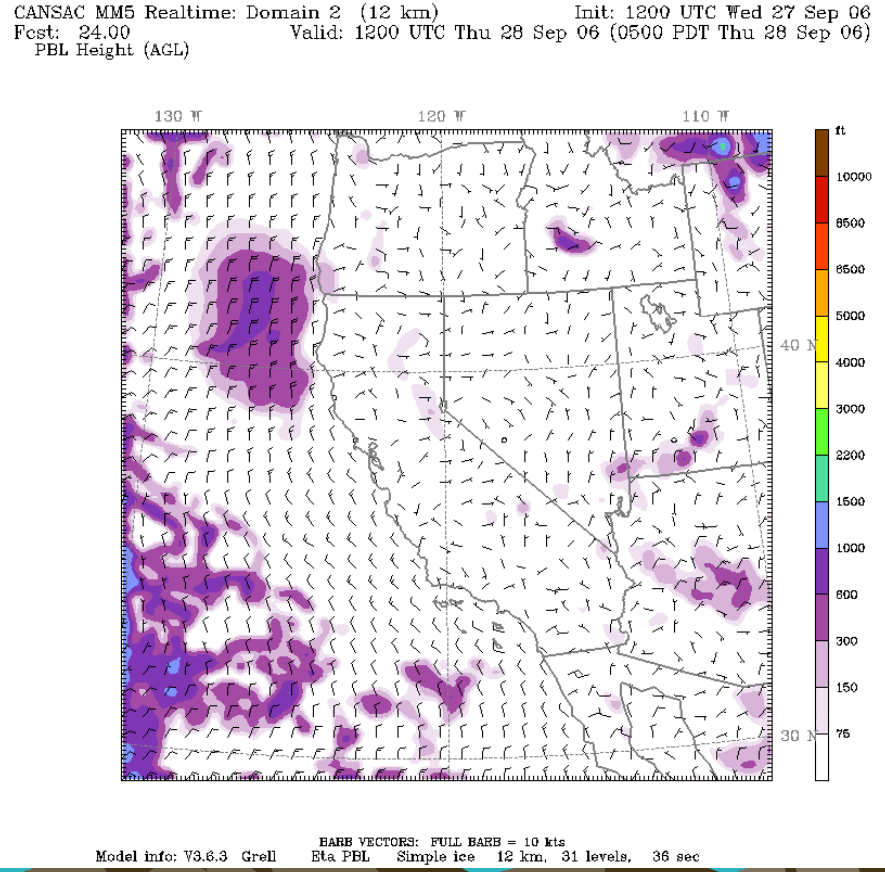
After-Noon Wind Field During High Ozone 9/27/06

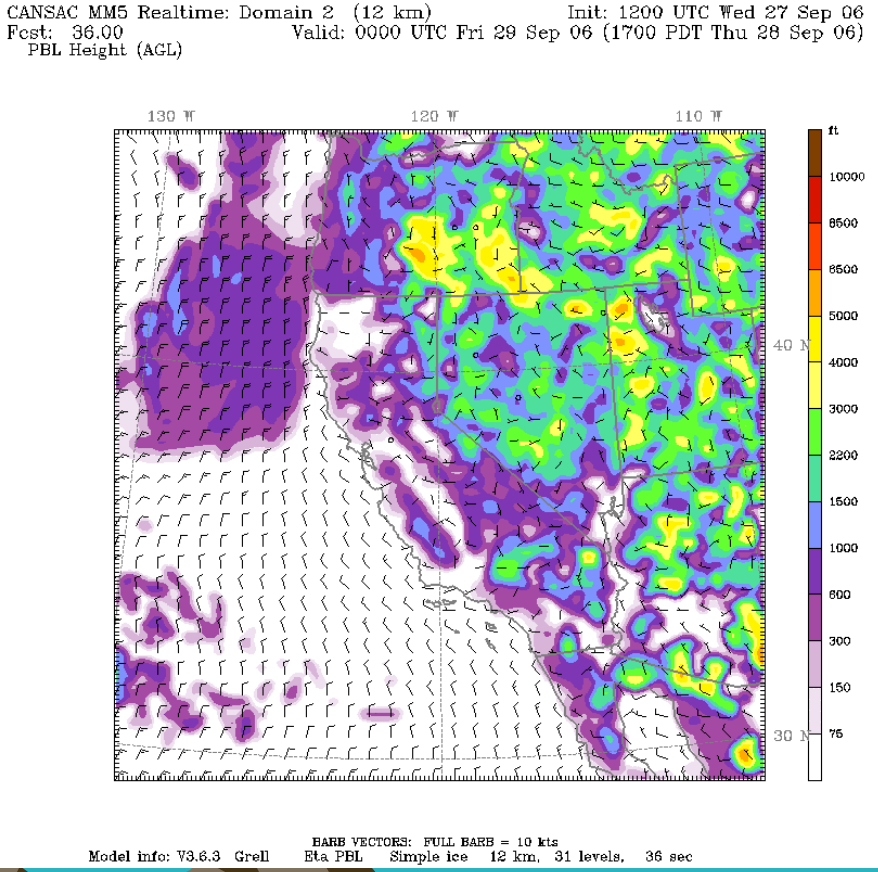
An Inversion Limits Atmospheric Mixing (CANSAC Predicted Temperature Sounding)



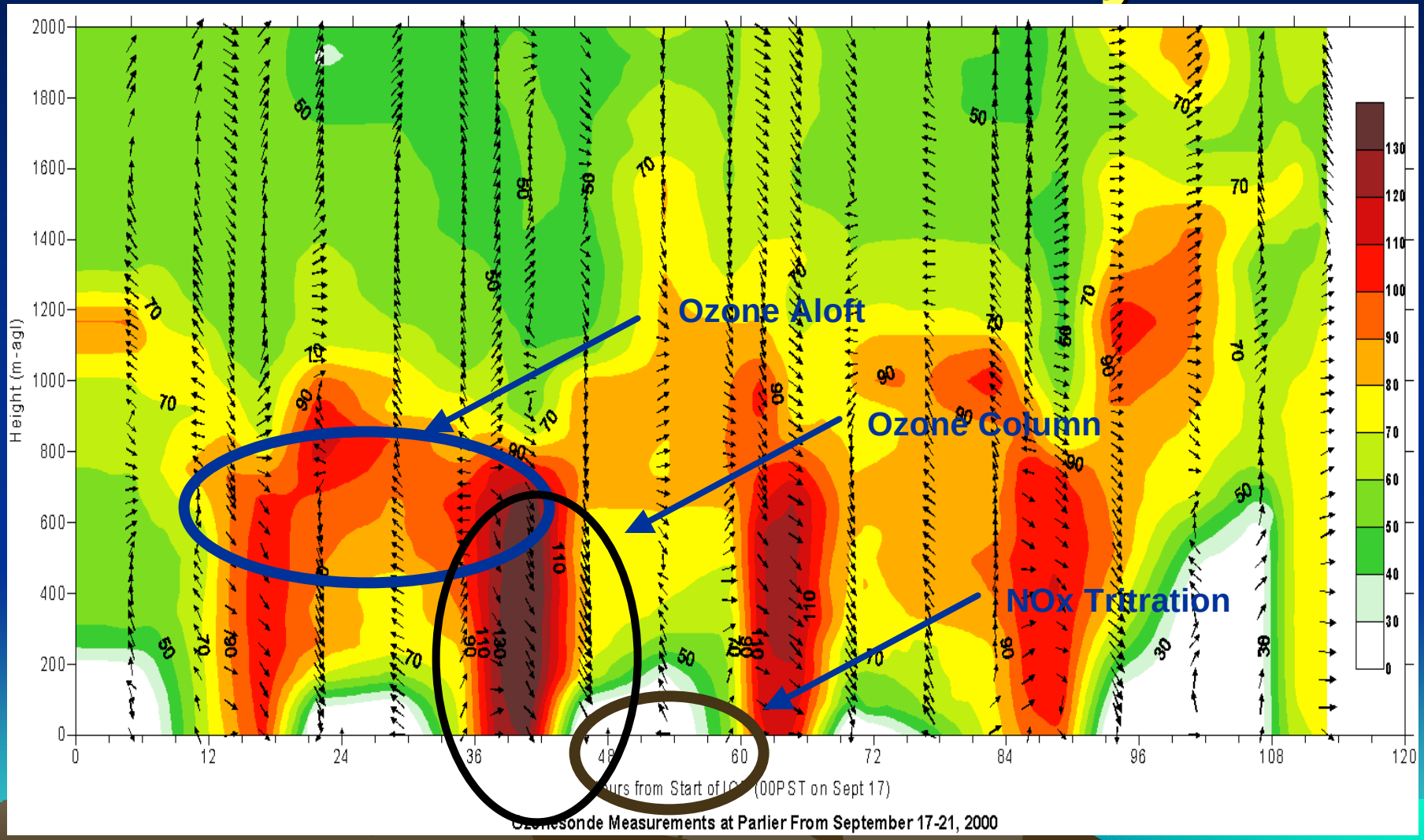
Mixed Layer Morning and Afternoon

(CANSAC Prediction)

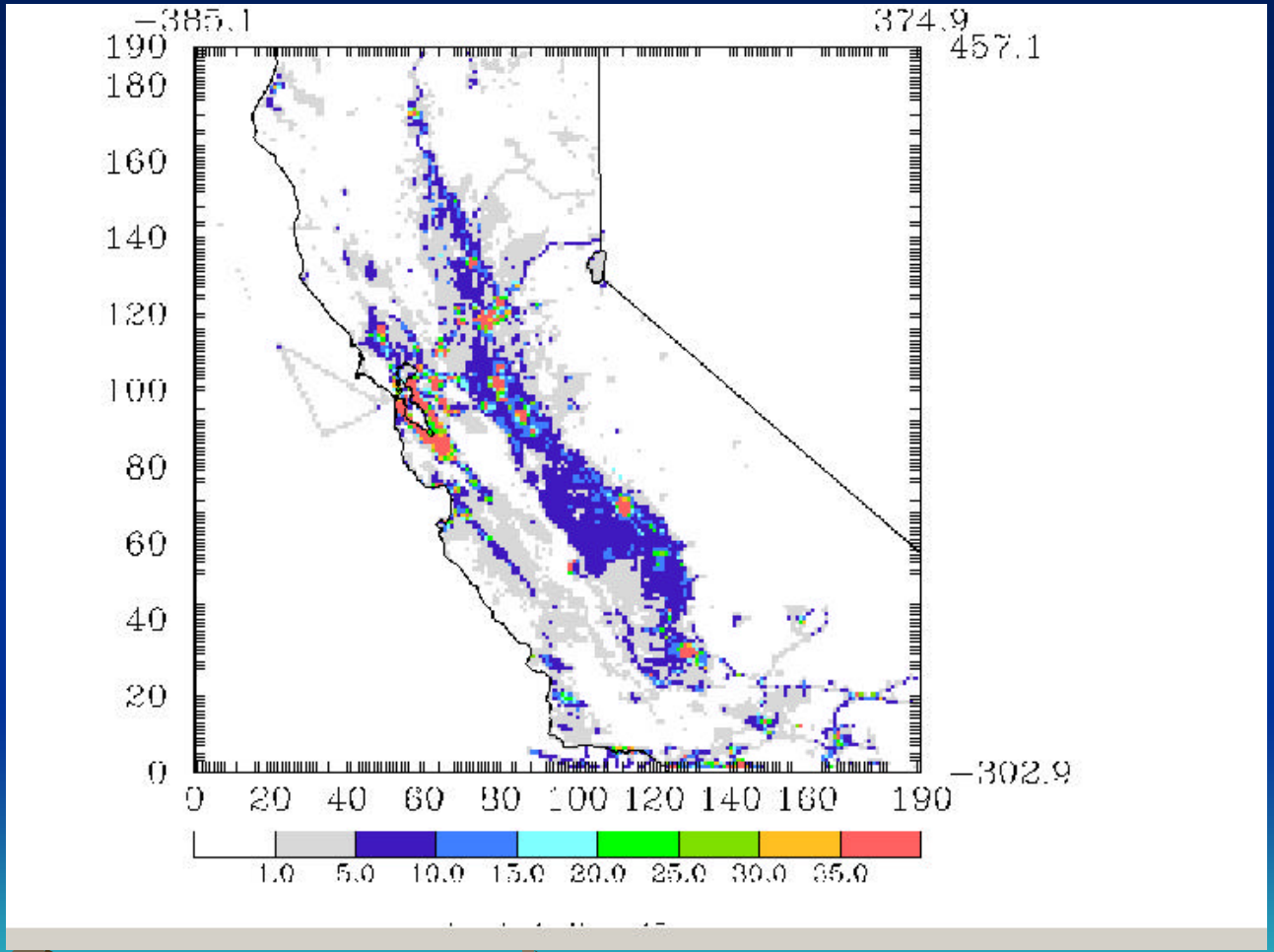




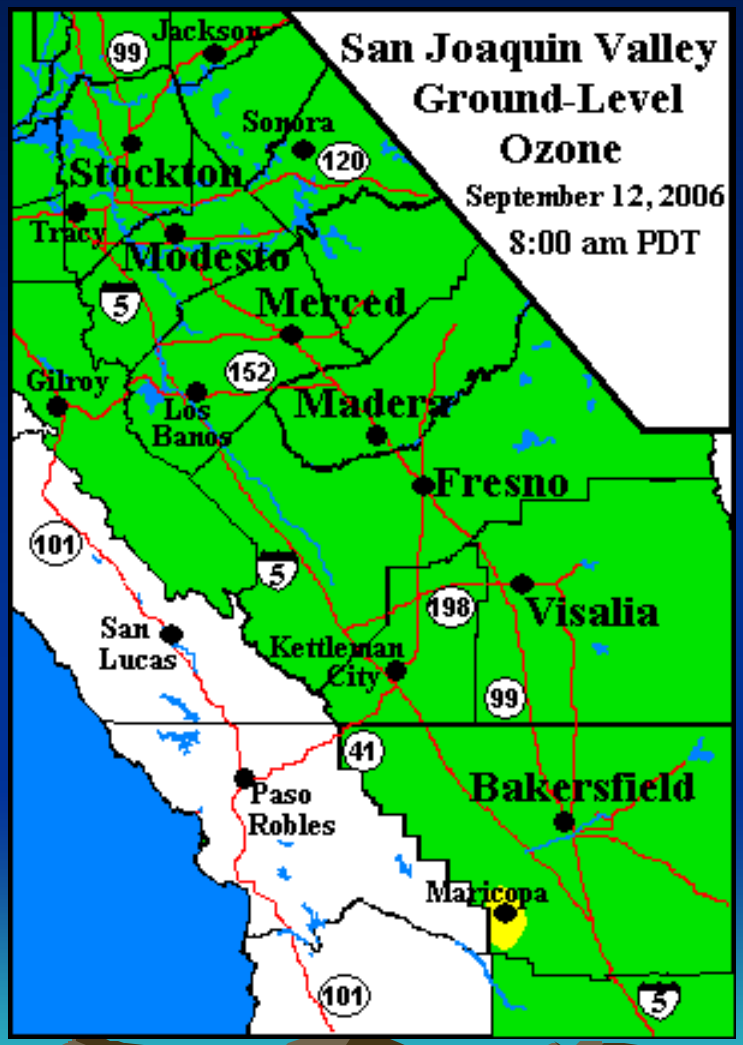
Ozone Aloft At Night Can Mix to the Surface in the Daytime

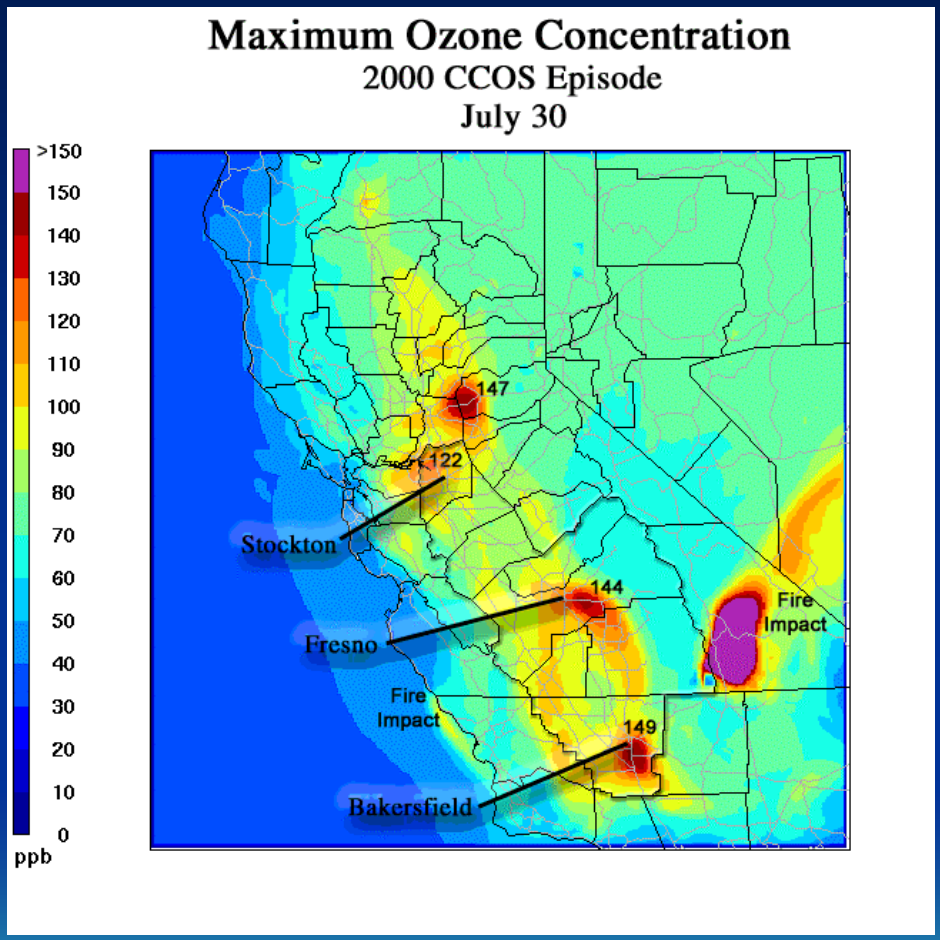


SJV Emissions Inventory



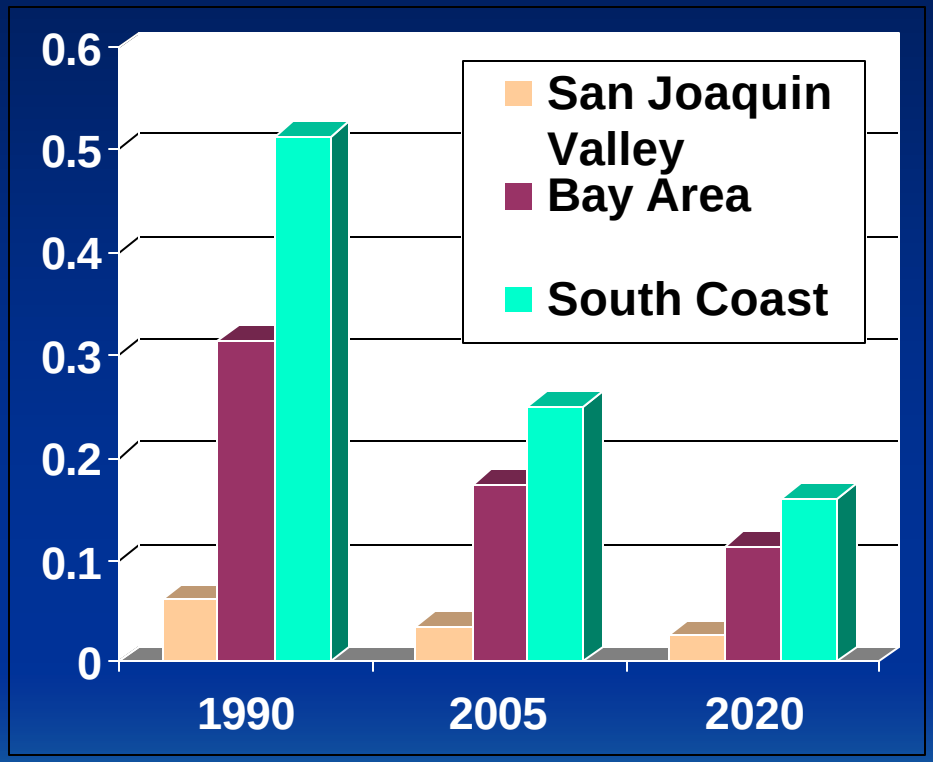
Ozone Spatial and Temporal Patterns



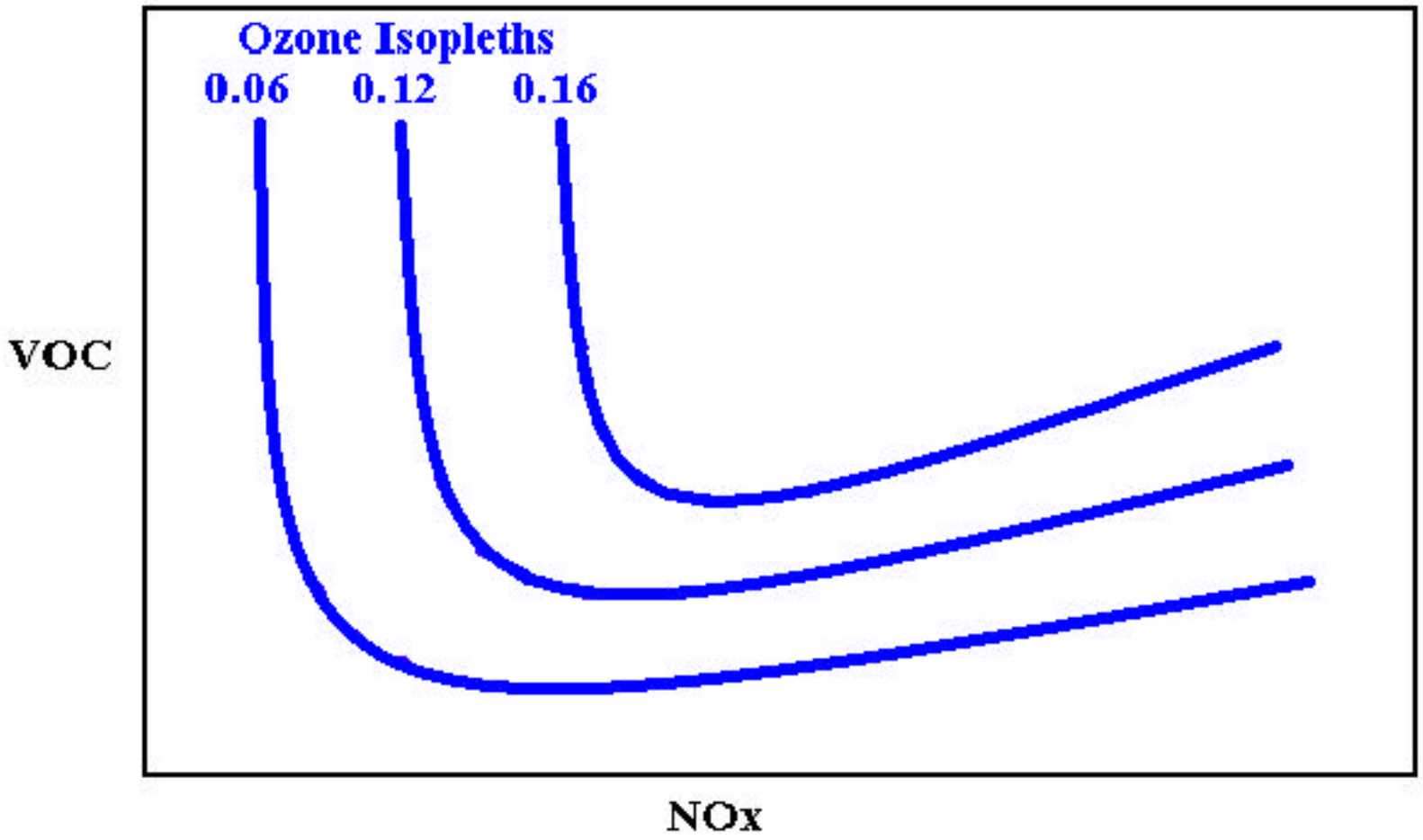


Air Basin Sensitive to Emissions

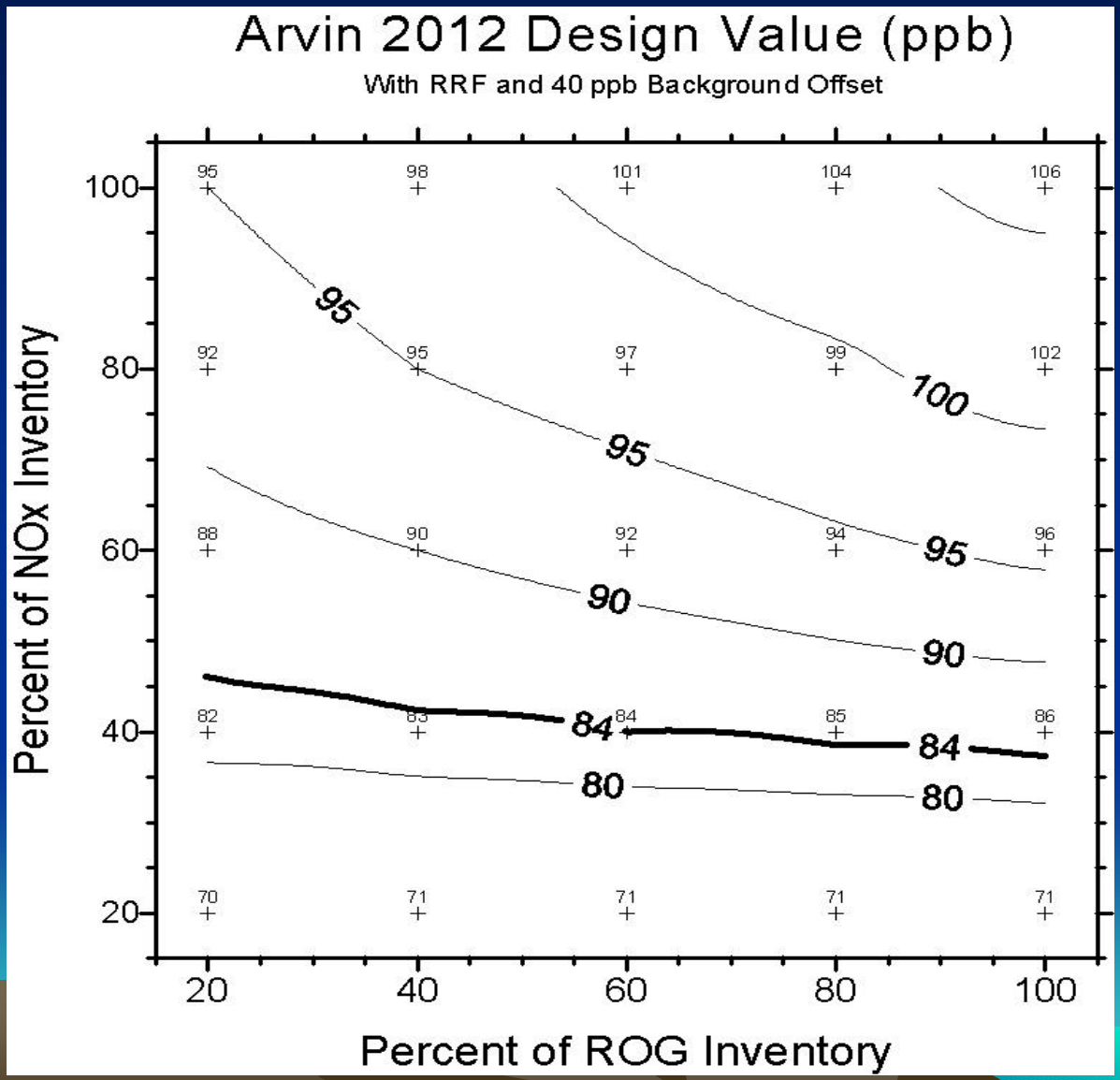
- Valley's ozone air quality problem worse than SF and about same as LA
- But SJV emissions per unit area (emissions density) much less than SF or LA
- Natural factors enhance ozone air pollution in SJV



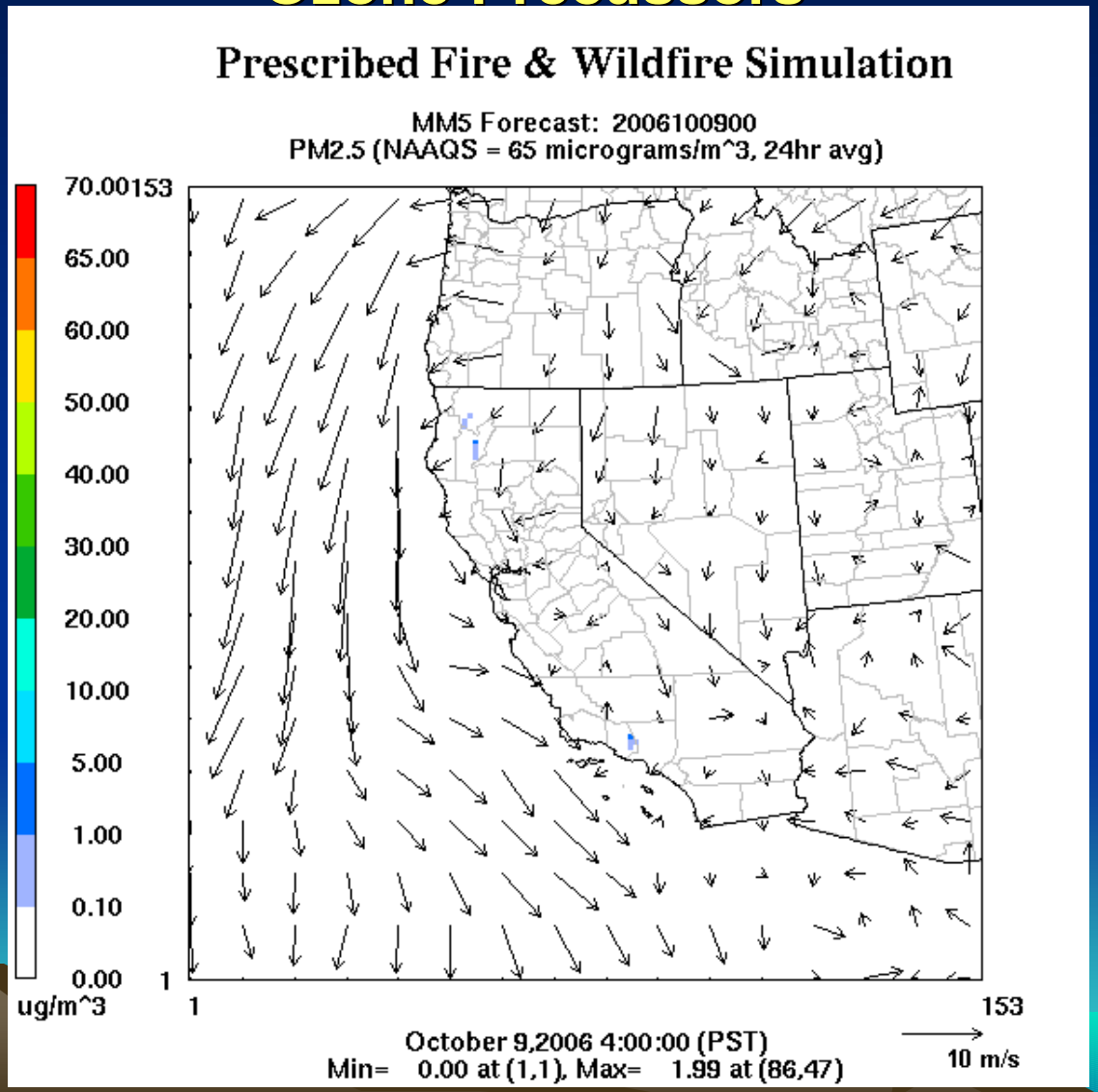
Idealized Ozone Response to VOC and NOx



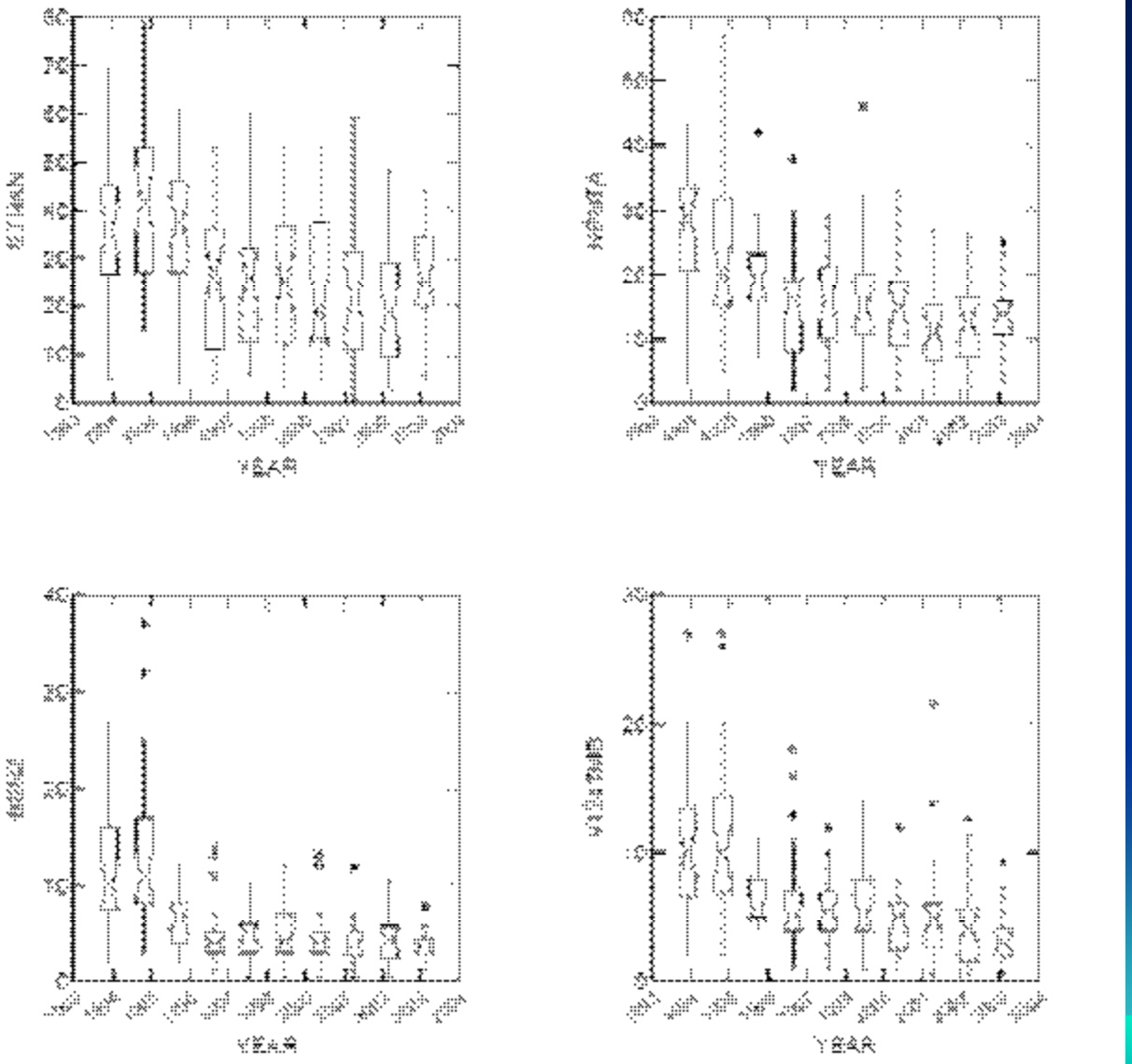
Ozone Model Response At Arvin to Reductions in VOC and NOx



Fire Impacts Ozone
CANSAC Prediction of PM2.5 That Are Associated with Ozone Precussors



Trends in VOC at Bakersfield



Summary

- Meteorology in the SJV produces ozone readily
- Trends of VOC ozone precursors in the atmosphere appear to be declining
- Models show that significant emissions reductions are needed to demonstrate attainment

Regulatory and Jurisdictional Challenges

Donald B. Hunsaker, Jr., D. Env.

Planning Department

Federal Standards

- The current federal 8-hour ozone standard is 0.08 ppm
- Standard is attained at a given monitor when the three-year average of the annual 4th highest daily maximum 8-hr ozone concentration is equal to or less than 0.084 ppm
- One monitor in an air basin showing ozone levels over the standard triggers nonattainment
- EPA science advisors recommend lowering federal ozone standards to 0.060 to 0.070 ppm; final decision by February 2008

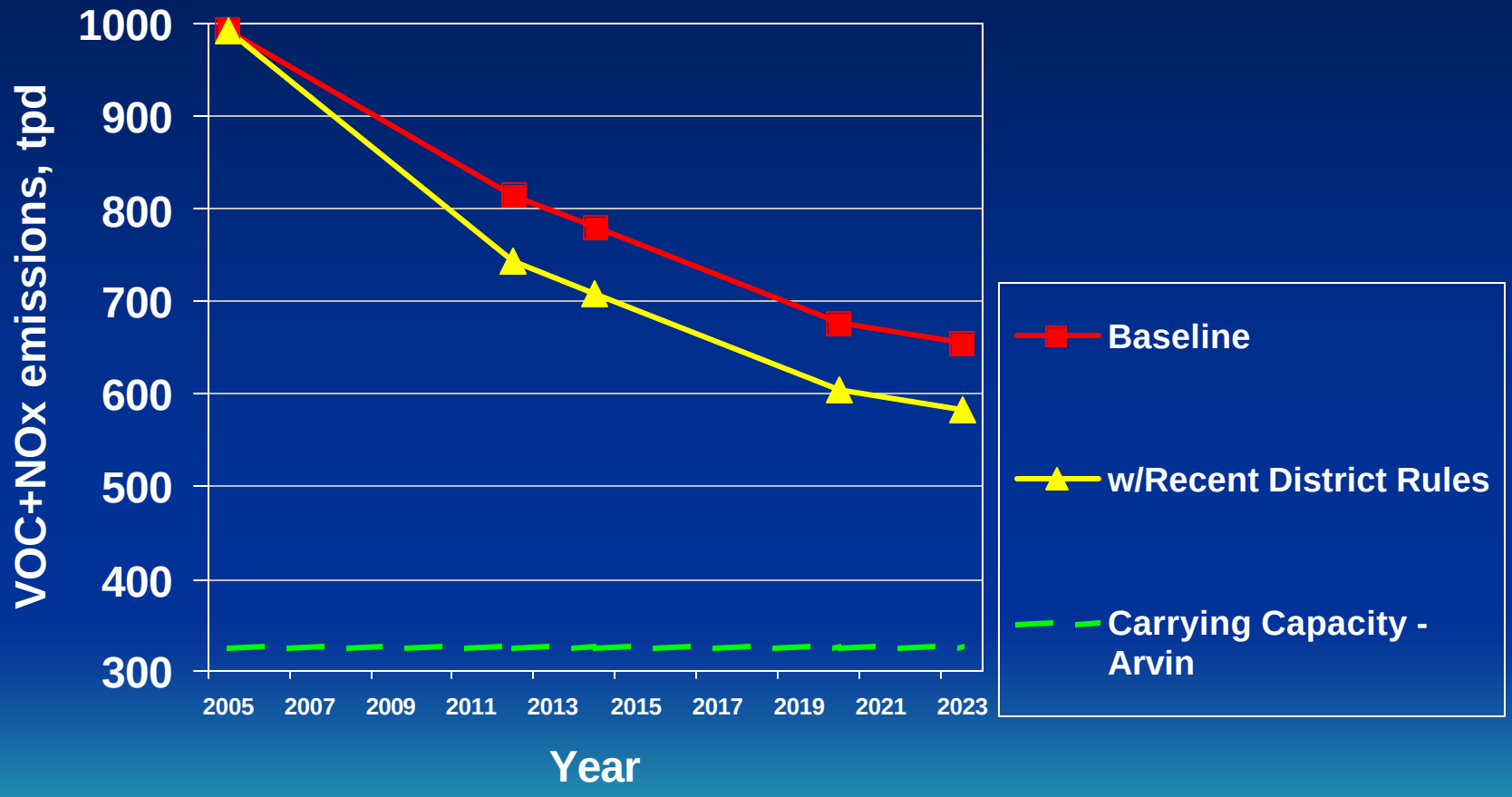
Federal Planning Requirements

- Air basins with air quality not meeting federal 8-hr ozone standards must prepare plans
- Plans must show how standards will be met by required deadlines
- SJ Valley must attain by June 15, 2013
- Plan due to EPA June 15, 2007

What is Needed for SJV to Attain the Federal Standards?

- Computer models are used to establish a "carrying capacity," the emissions level the atmosphere can "carry" and attain
- The SJV's carrying capacity indicates that 2012 NOx and VOC emissions each need to be reduced by about 60%
- The combined NOx+VOC inventory for 2012 is 815 tpd, so about 480 tpd need to be removed, leaving a total of about 325 tpd as carrying capacity

Emission Reductions, SJV Carrying Capacity

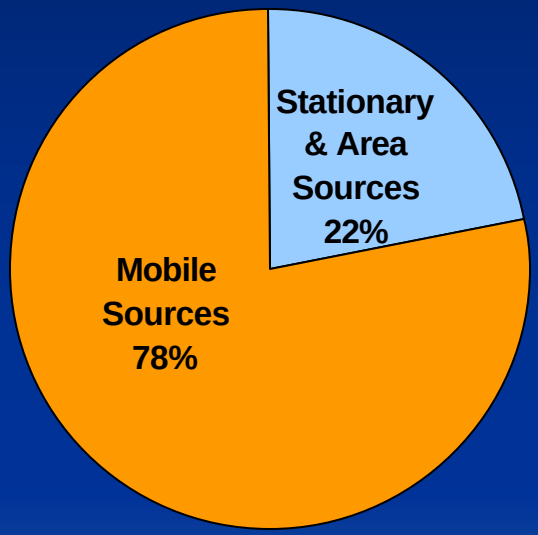


Carrying Capacities derived from ARB photochemical modeling

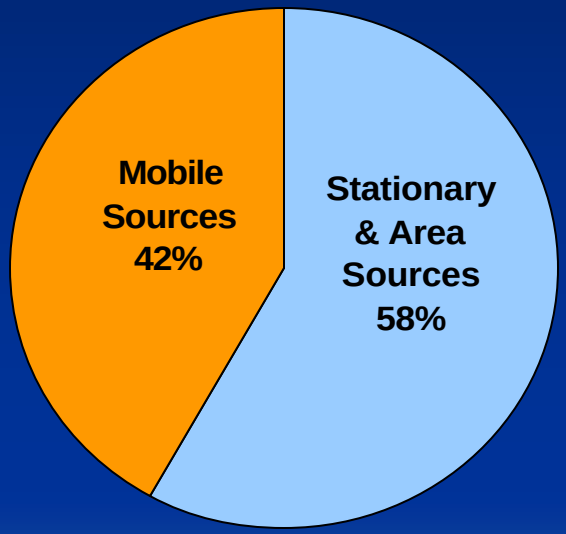
Ozone Precursors by Major Category

(Based on Summer Emissions Inventories, O3 SIP (v1.04_RF976))

Oxides of Nitrogen (NOx)



Volatile Organic Compounds (VOC)



Summary: Regulatory and Jurisdictional Challenges

- Substantial reductions needed to show attainment of standard
- Relatively short time frame in which to achieve reductions due to Clean Air Act requirements
- Many emissions outside District authority to control with rules and regulations

Our Guiding Principles

1. With public health as our number one priority, meet federal ambient standards as expeditiously as practicable.
2. Recognize that Valley's economic vitality and prosperity are essential to achieve public health goals.
3. Recognize that no "silver bullet" exists – every sector, from the public through all levels of government, business, and industry, must reduce emissions.
4. Achieve emissions reductions in the most cost-effective way possible to get the "biggest bang for the buck."

Our Guiding Principles (cont.)

5. When scheduling regulatory actions such as rules and strategies, allow adequate time for public participation.
6. Consider total impact on businesses; allow reasonable time for implementation of current and future rules.
7. Give precedence to NOx emissions reductions to assist with attainment of the federal standard for PM. NOx emissions contribute to both ozone and PM formation.

Our Guiding Principles (cont.)

8. Take advantage of imminent new technologies & allow more time to get more reductions if needed.
9. Don't let "one-size-fits-all" governmental policies and bureaucracy stand in the way of timely, innovative, and cost-effective emissions reductions.
10. Use sound science in assessing public health impacts, the magnitude of emissions from various source categories, and availability, effectiveness, and feasibility of emissions control measures.

Our Guiding Principles (cont.)

11. Do not rely exclusively on the state and federal government to reduce mobile source emissions. Consistent with state and federal laws, find effective and innovative regulatory and incentive measures at the local level to address mobile source emissions.
12. Consider seasonal, episodic, and regional measures to more strategically target limited resources for optimum air quality benefits throughout the Valley.

Strategies for Attainment

Scott Nester
Planning Department

4-Faceted Control Strategy

- Regulatory component (District rules)
- Incentive-based strategies
- Alternative compliance
- Local, state, and federal sources/partnerships

Current District Control Measures

- **41 Stationary & area source measures**

  Current rulemaking projects (10) – affecting 20 current rules, Proposed CMs (17), Further Study CMs (14)

- **7 Mobile & Indirect Measures:**

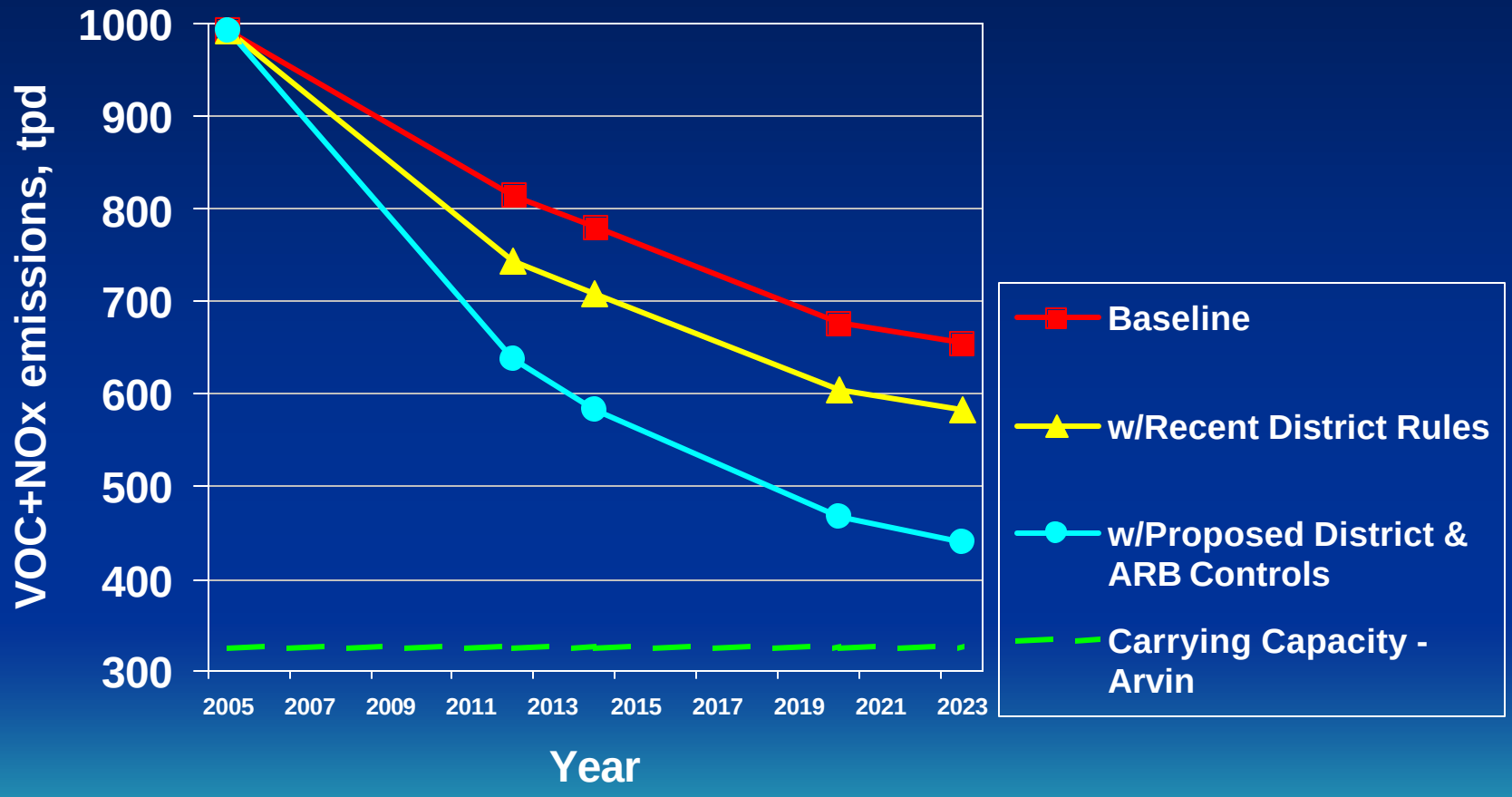
  Trip Reduction, Accelerated Fleet Rule, ISR Enhancement, Green Contracting, Expanded Spare the Air, Heat Island Mitigation, Alternative Energy & Energy Conservation

- **Incentive Programs- for faster fleet turnover of diesel trucks, off-road equipment, farm equipment, light/medium duty vehicles)**

Reductions from Control Measures

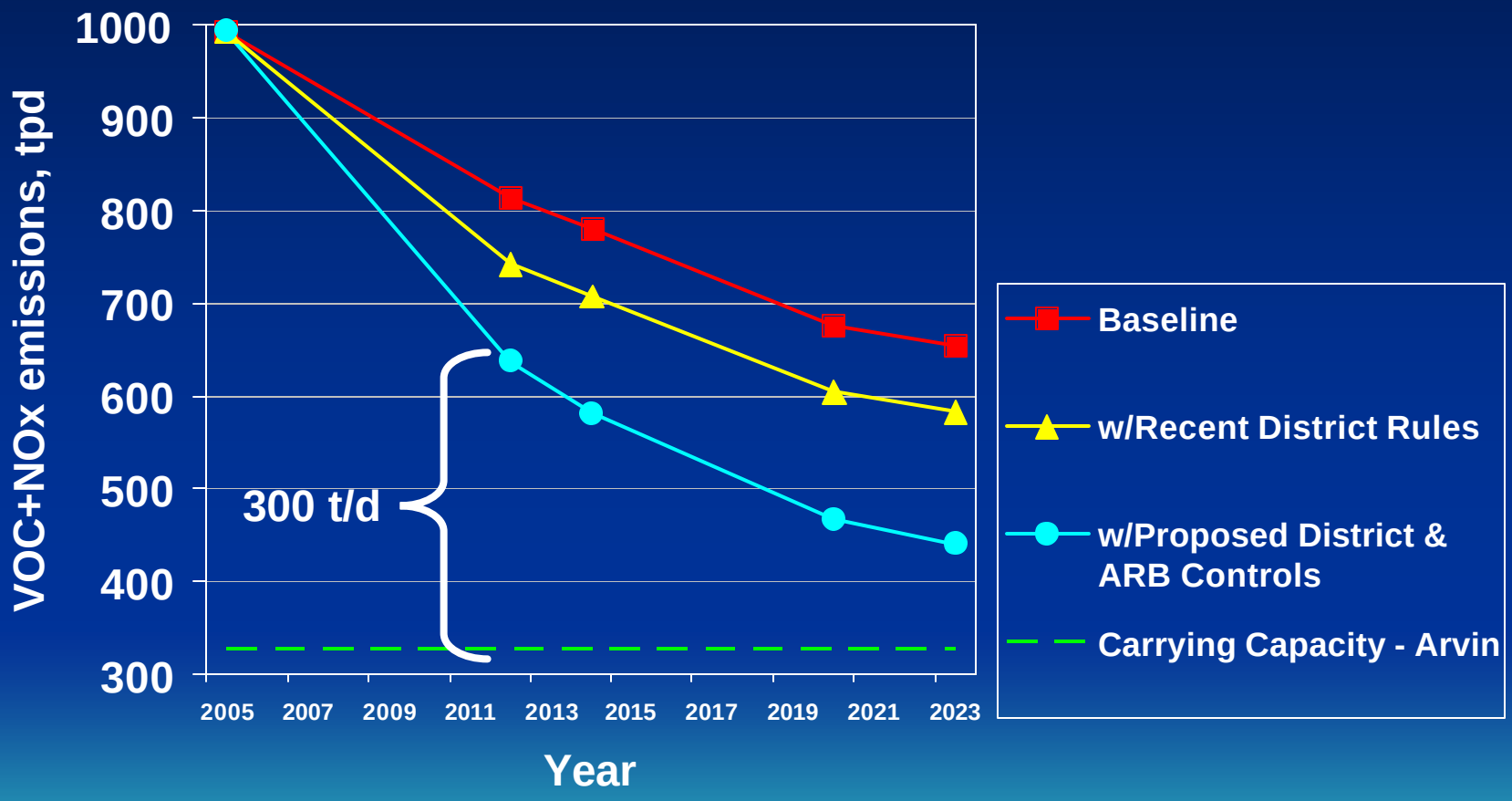
- New reductions from recent District rules (not yet in inventory) = 72 tons/day by 2012
- Reductions from new District rules & programs = 46 tons/day by 2012
- Reductions from state & federal mobile source emissions = 80 tons/day by 2014
- Reductions from known District incentive funding = 12 tons/day by 2012

Emission Reductions, SJV Carrying Capacity



Carrying Capacities derived from ARB photochemical modeling

2012 Attainment "Gap"

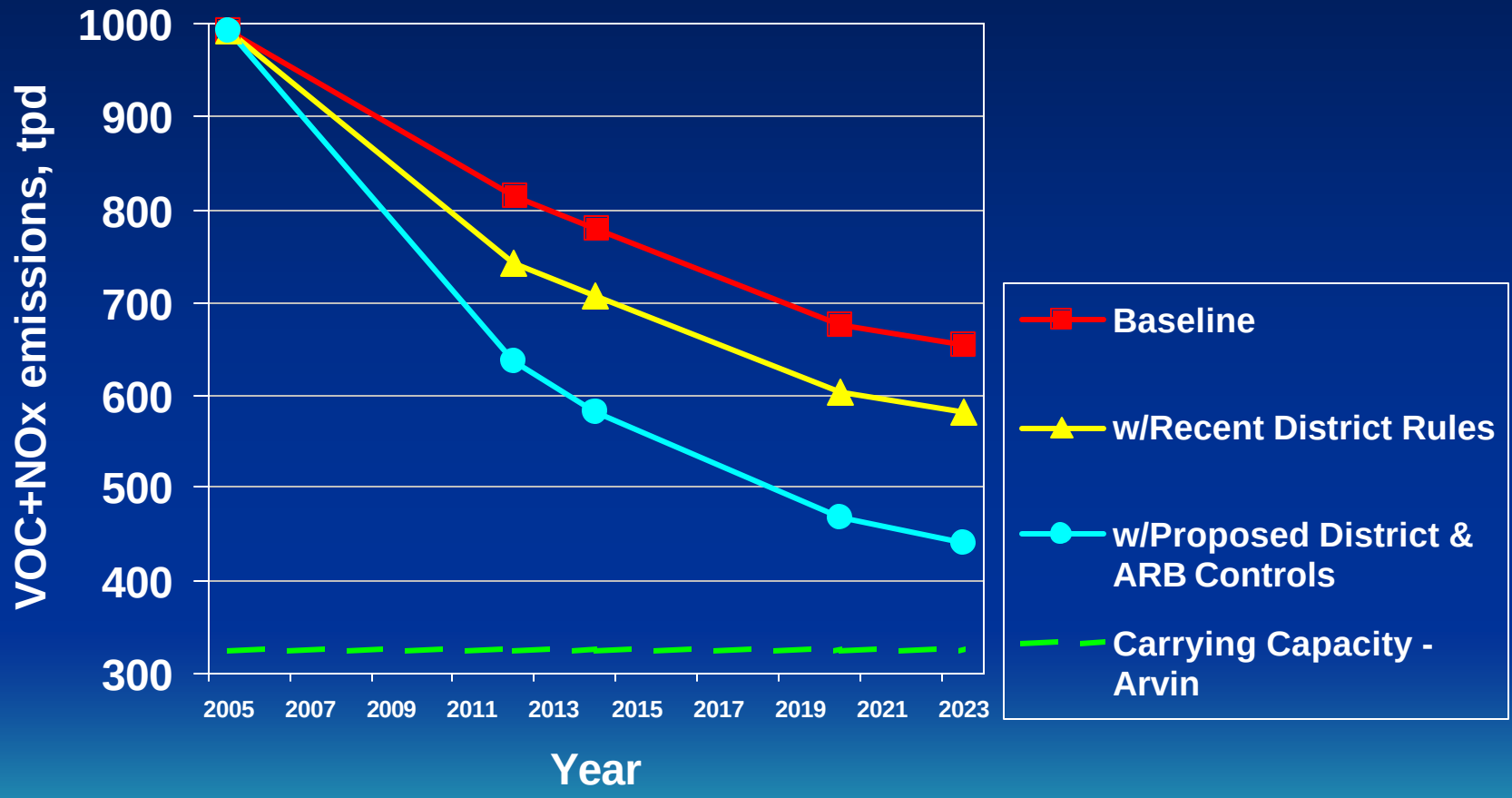


Carrying Capacities derived from ARB photochemical modeling

When Will the Valley Attain?

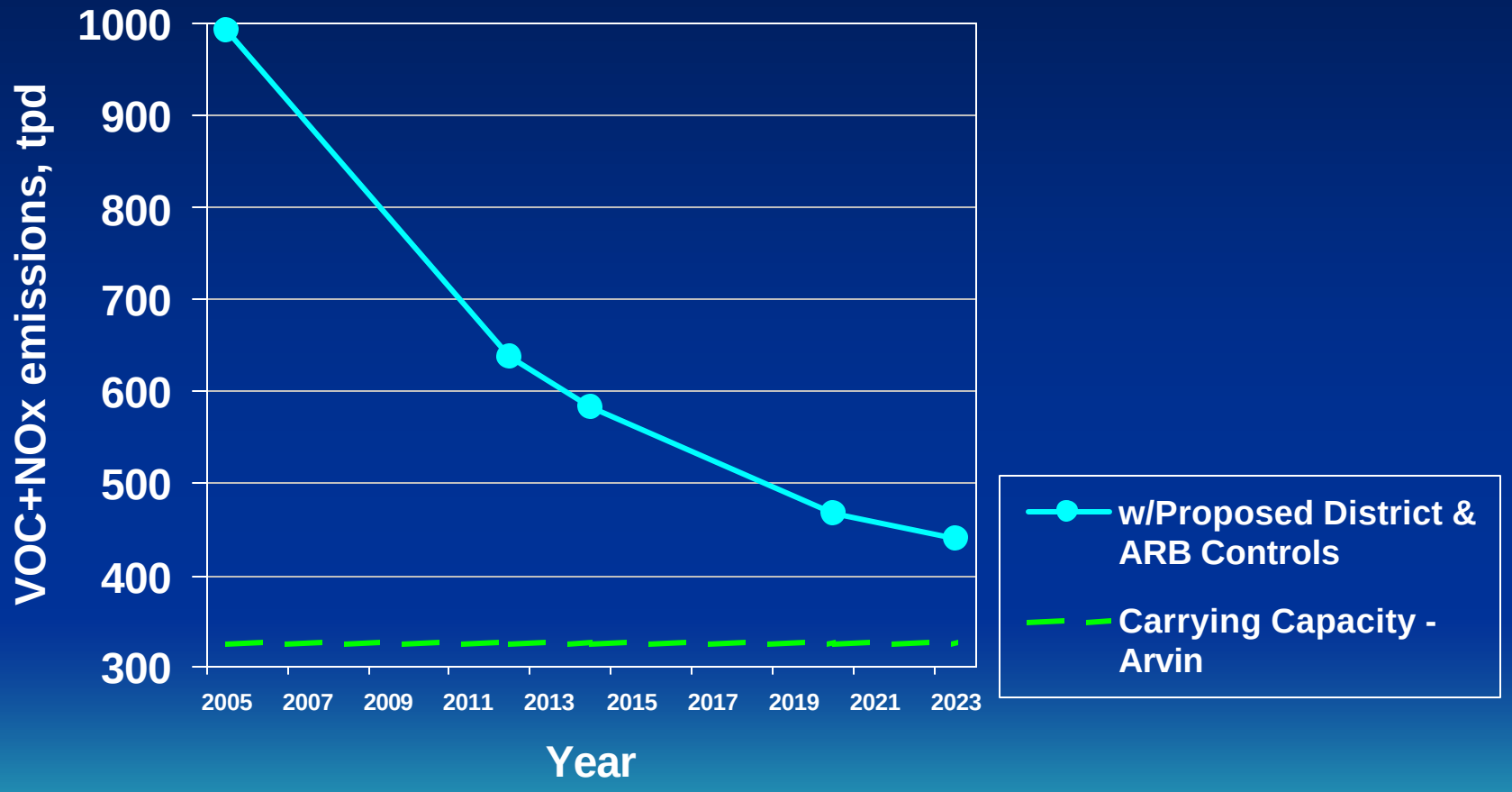
- Attainment is possible with this Plan
- Attainment will "phase in" over time
  - Some areas are currently in attainment
  - Others will attain as emissions are reduced
- Attainment in Parlier/Edison…
  - Requires 35%-40% reduction from 2012 baseline
  - Means attainment for all SJV metro areas
  - Will be achieved by 2019 with proposed controls
- Over 90% of the Valley population will be in attainment by 2019
- Arvin's low carrying capacity defines the strategy

Emission Forecast, Attainment Projection



Carrying Capacities derived from ARB photochemical modeling

Emission Forecast, Attainment Projection



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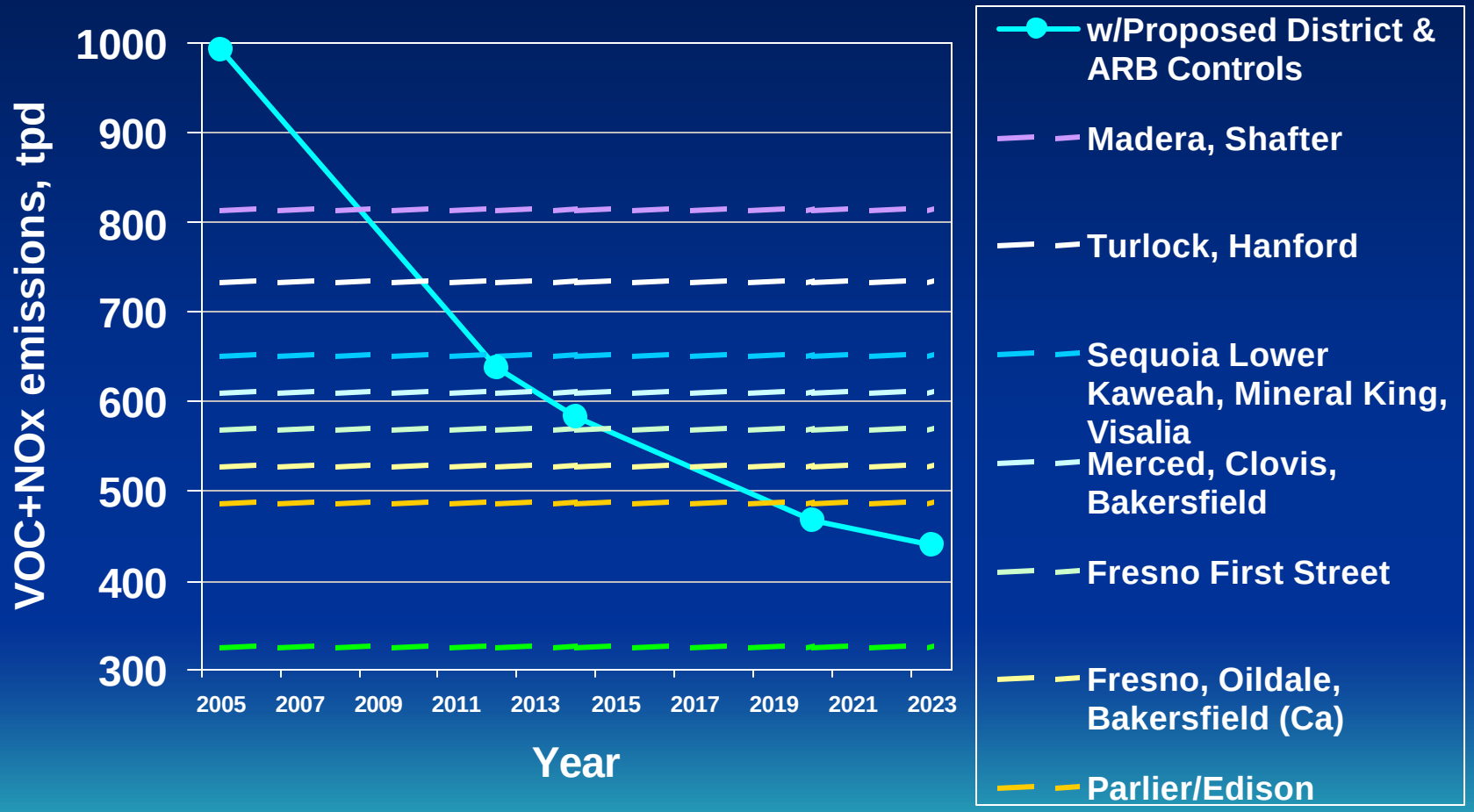
Emission Forecast, Attainment Projection



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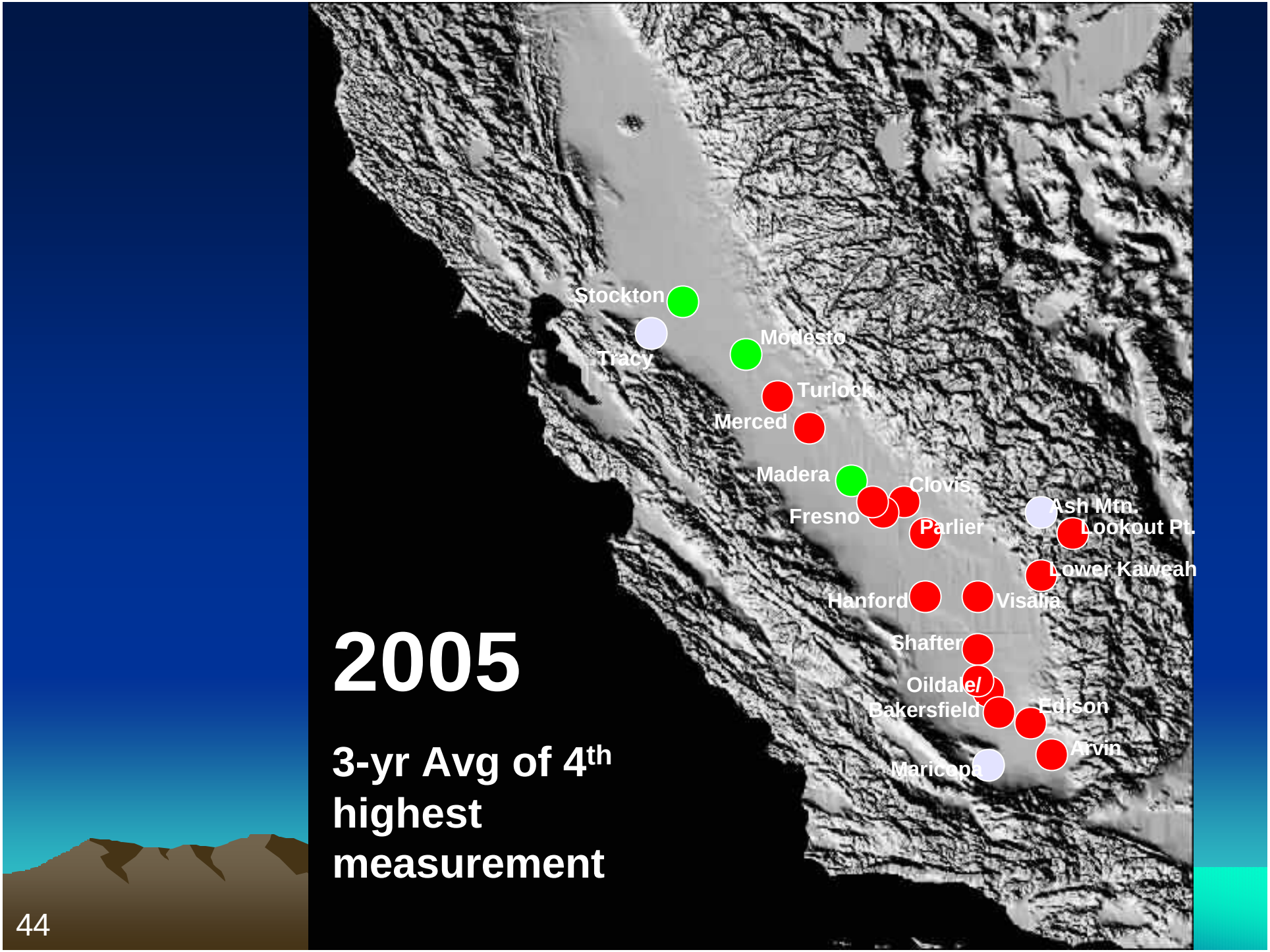
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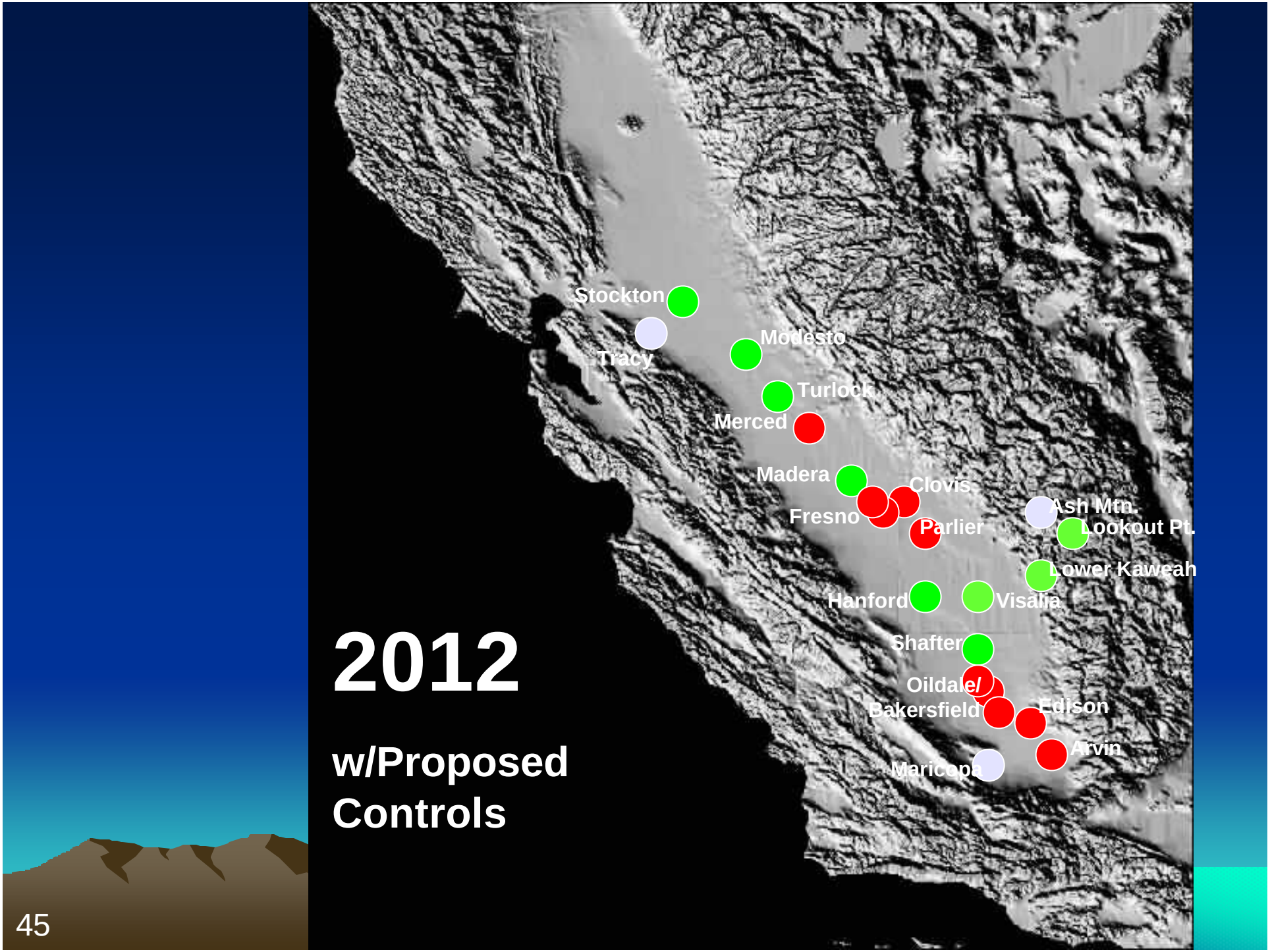
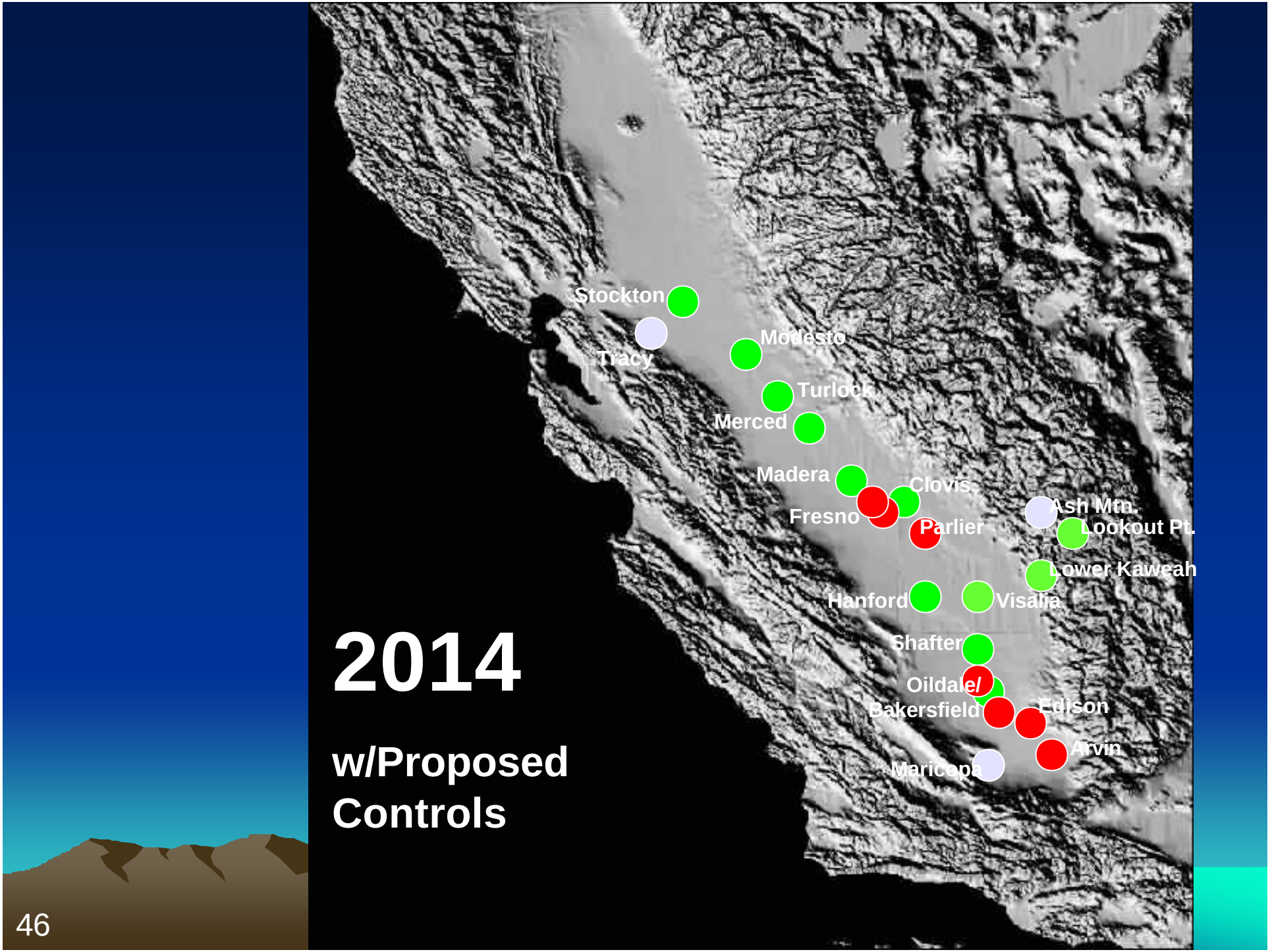
Arvin
Maricopa
2005
3-yr Avg of 4th highest measurement



2012

w/Proposed Controls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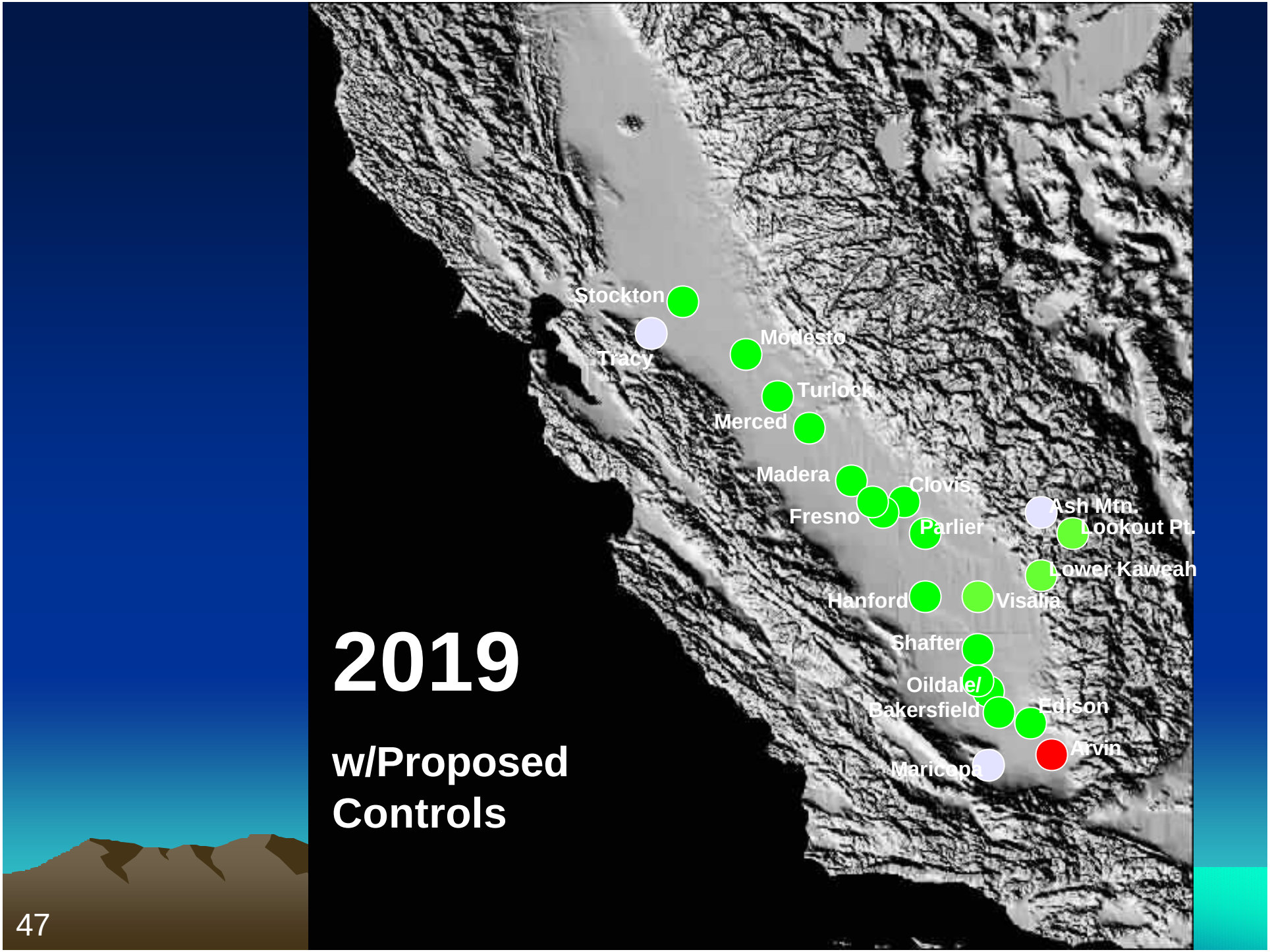
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Oildale/
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Edison
Arvin
Maricopa
2019
w/Proposed
Controls

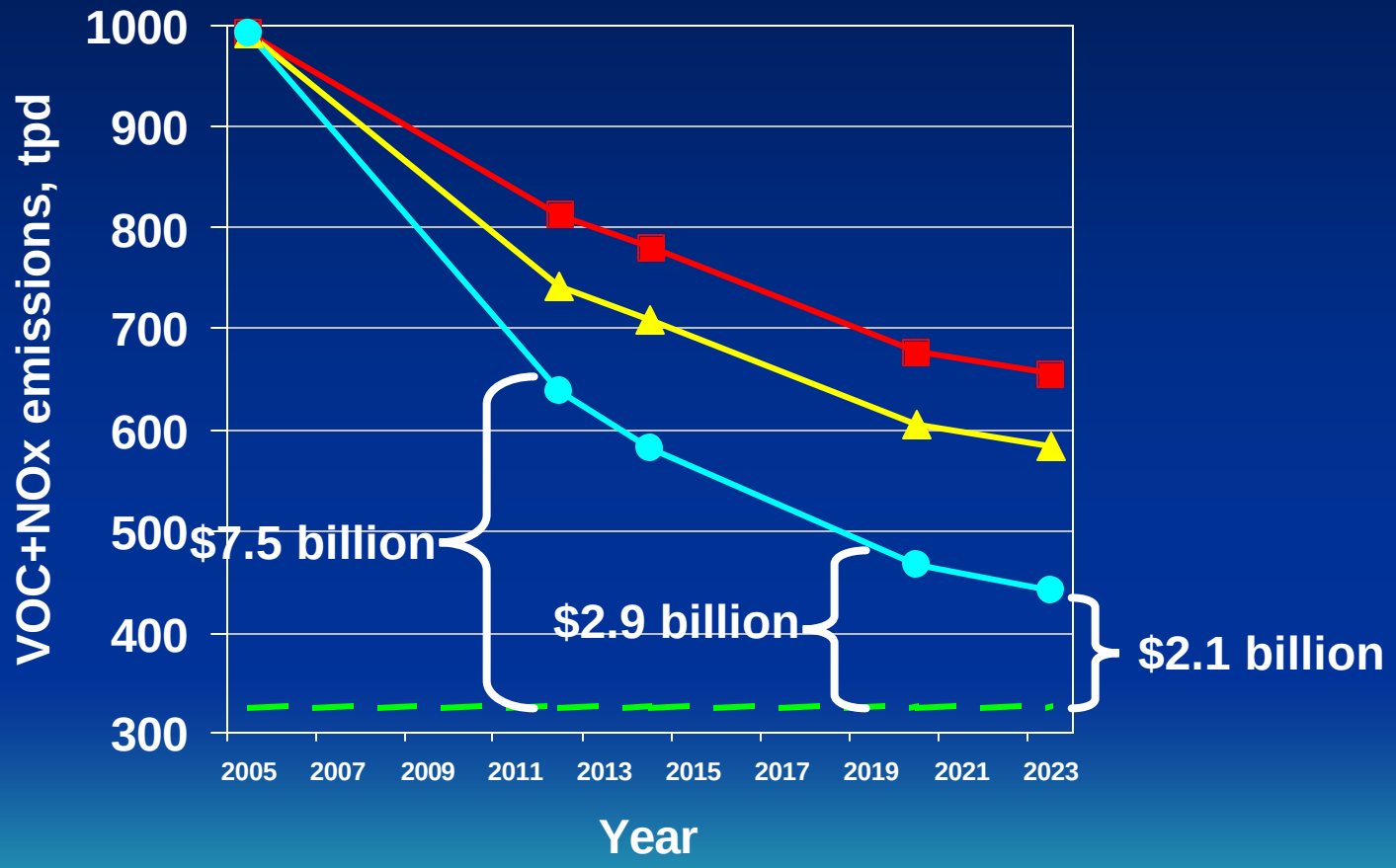
Expediting Attainment

- Additional funding for incentives can…
  - Bring all of the Valley into attainment
  - Expedite attainment in all areas
- NOx emission inventory is dominated by mobile sources – 78% in 2005
- Natural turnover of vehicle fleet is too slow for expeditious attainment

How much funding is needed to "bridge the gap"?

- Emissions reductions cost ~$7,000/ton
- For a permanent reduction (>10 years), cost is $25 million per ton/day
  - ($7,000/ton*365 days/yr*10 years) @ $25.6 million/ton/day
- 2012 "gap" is ~300 t/d
- 300 t/d * $25 million per ton/day = $7.5 billion
- Costs to "bridge the attainment gap"
  - $7.5 billion for attainment in 2012
  - $2.9 billion for attainment in 2020
  - $2.1 billion for attainment in 2023

Bridging the Gap



Summary

- >90% of the Valley population will be in attainment by 2019
- How soon we attain depends on how quickly we can turn over the on-road and off-road fleets
- Public funding is needed to accelerate turnover
- Assuming sufficient technology can be purchased and deployed between now and 2012, $7.5 billion is needed
- All Valley stakeholders must be in consensus on need before seeking state and federal funding

Ozone Plan, Next Steps

- Next (final) workshop – January/February 2007
  - Address public comments
  - Prioritize regulatory control measures
  - Cost & reductions of incentive measures
  - Emission reduction profiles
  - Identify attainment year
- District Governing Board – April 2007
- Air Resources Board – June 2007
- EPA – June 2007