

# Decadal Changes in Ozone and Emissions in Central California and Current Issues

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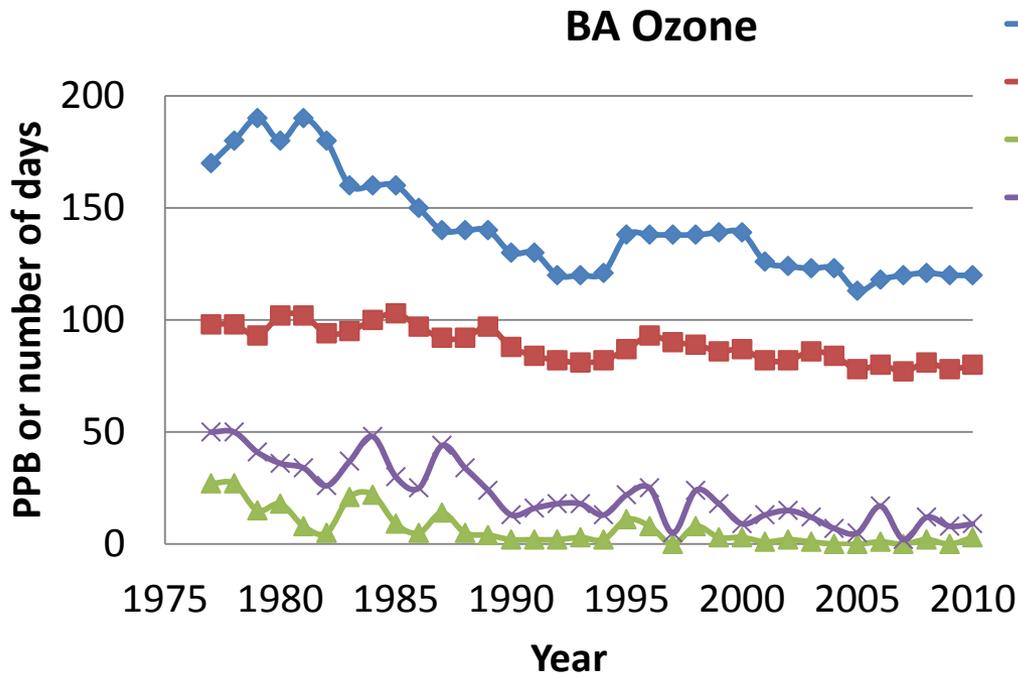
*Ahmet Palazoglu, UC Davis*

*AGU Fall Meeting, San Francisco, CA*

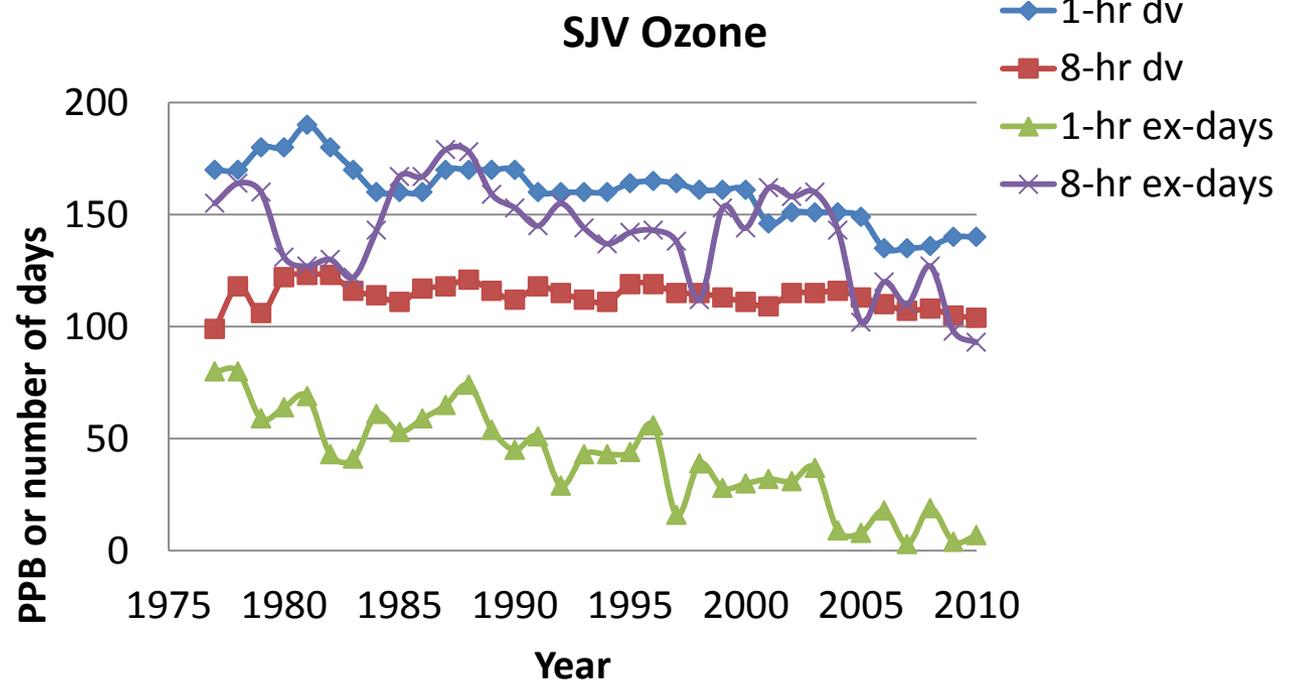
*December 5-9, 2011*

# Question

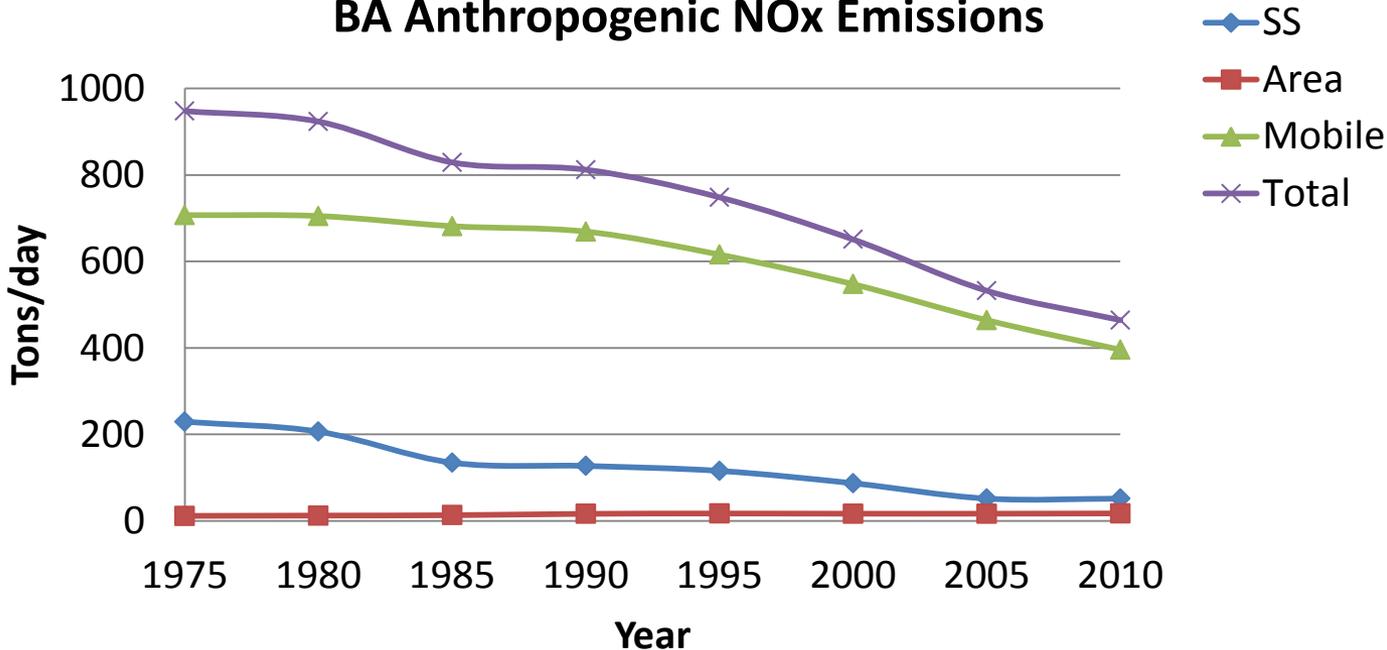
Why is ozone not declining in the San Joaquin Valley as fast as other areas of California, despite significant progress in reducing emissions?



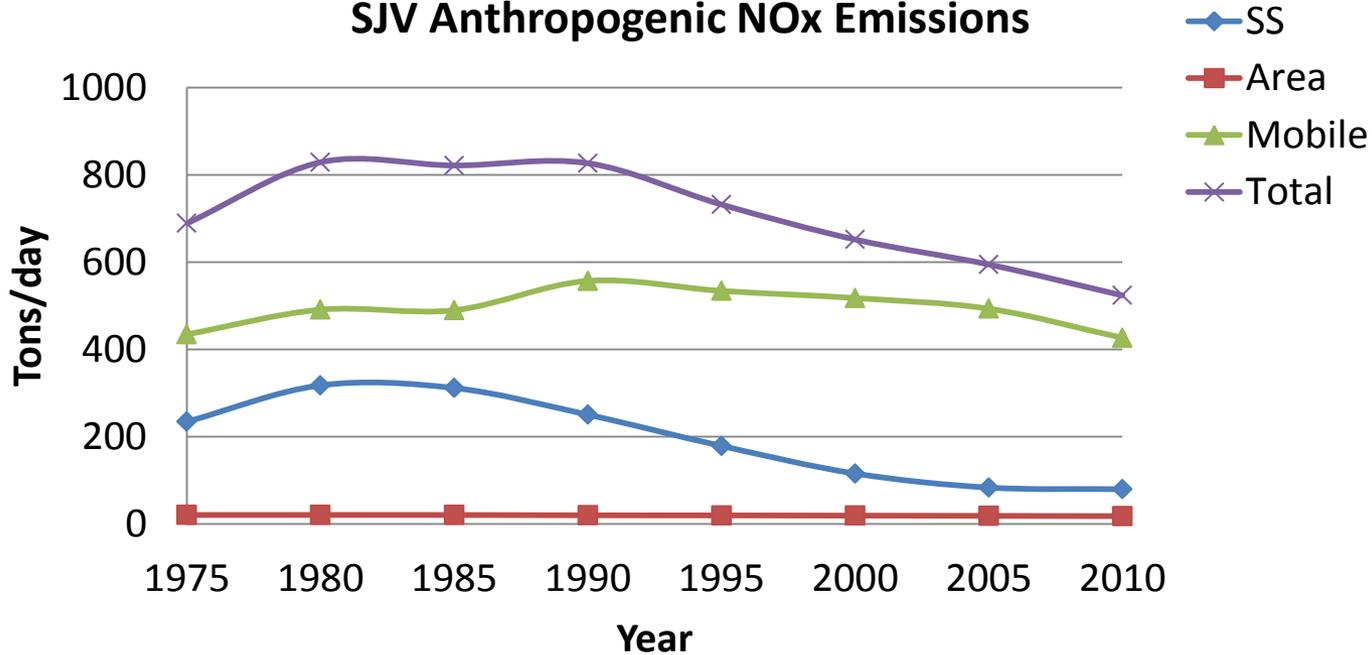
dv=design value  
 ex-days=exceedance days  
 BA=Bay Area  
 SJV=San Joaquin Valley



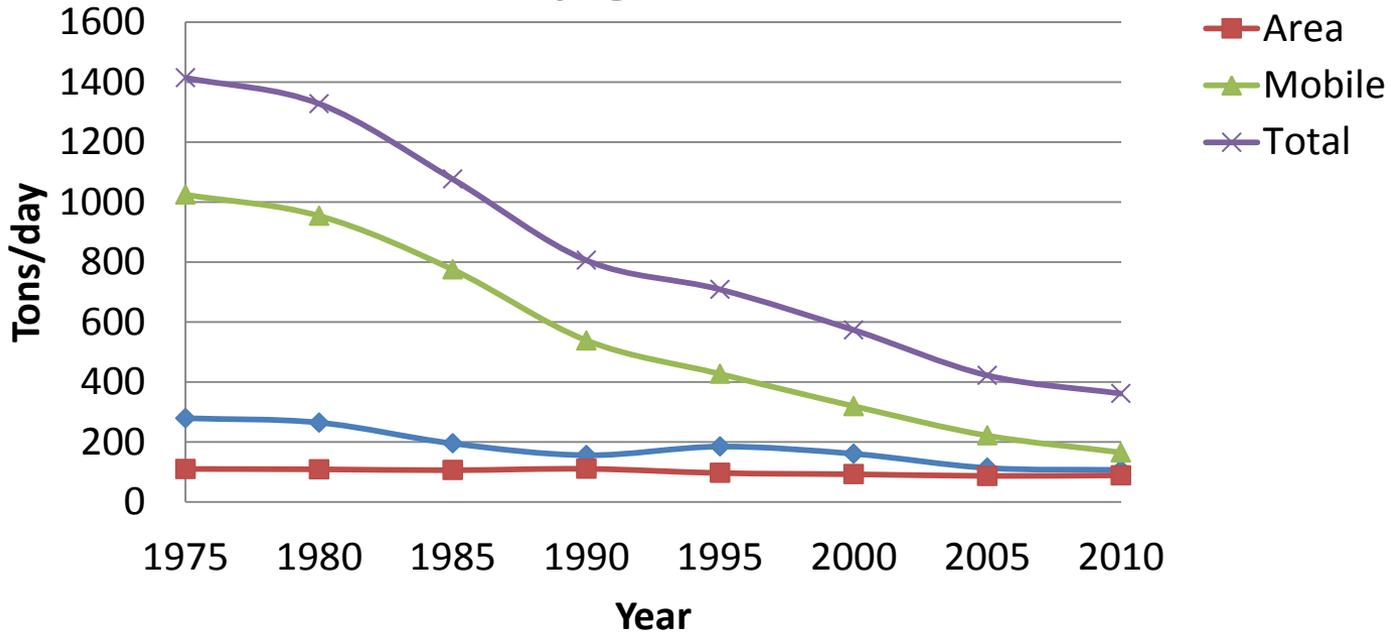
### BA Anthropogenic NOx Emissions



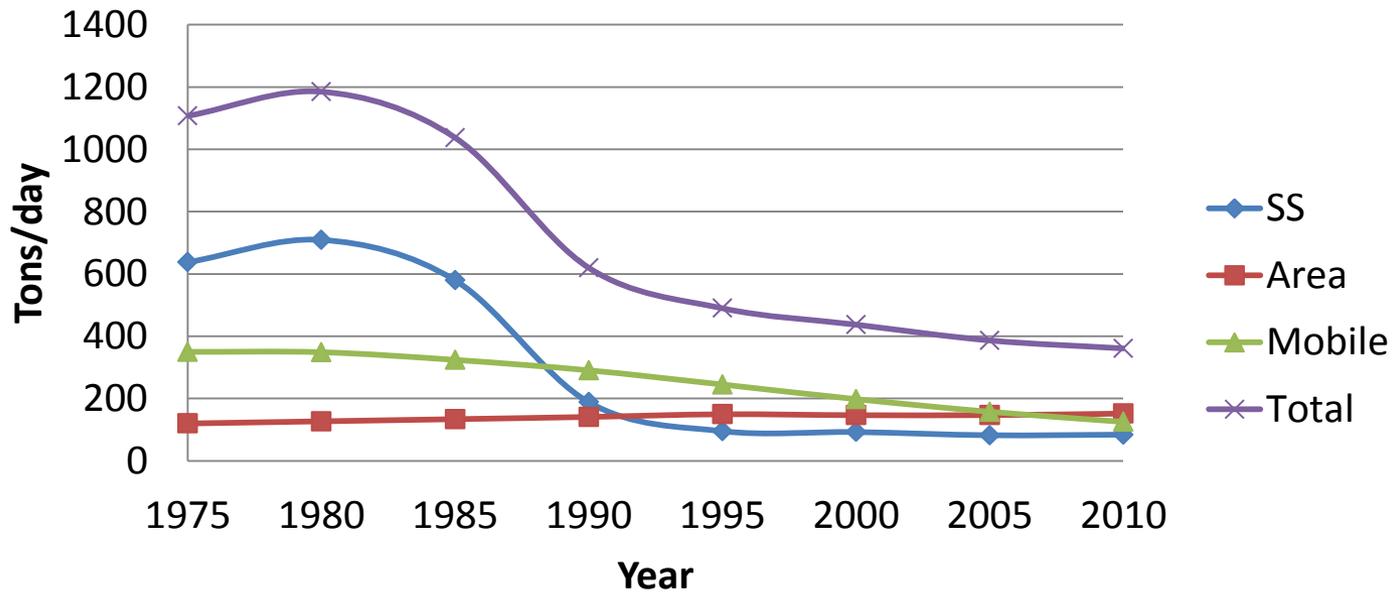
### SJV Anthropogenic NOx Emissions



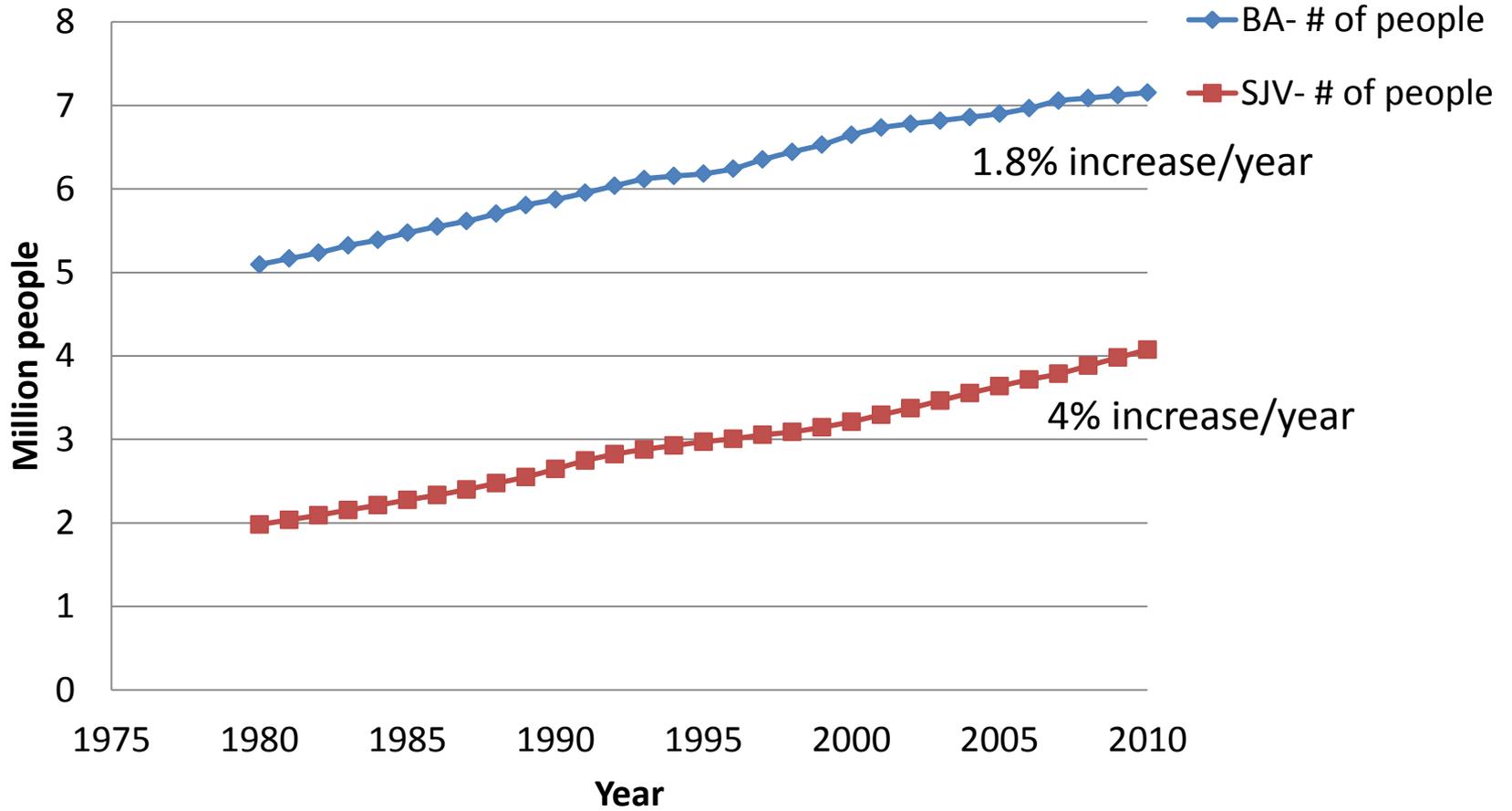
### BA Anthropogenic VOC Emissions



### SJV Anthropogenic VOC Emissions



# Population

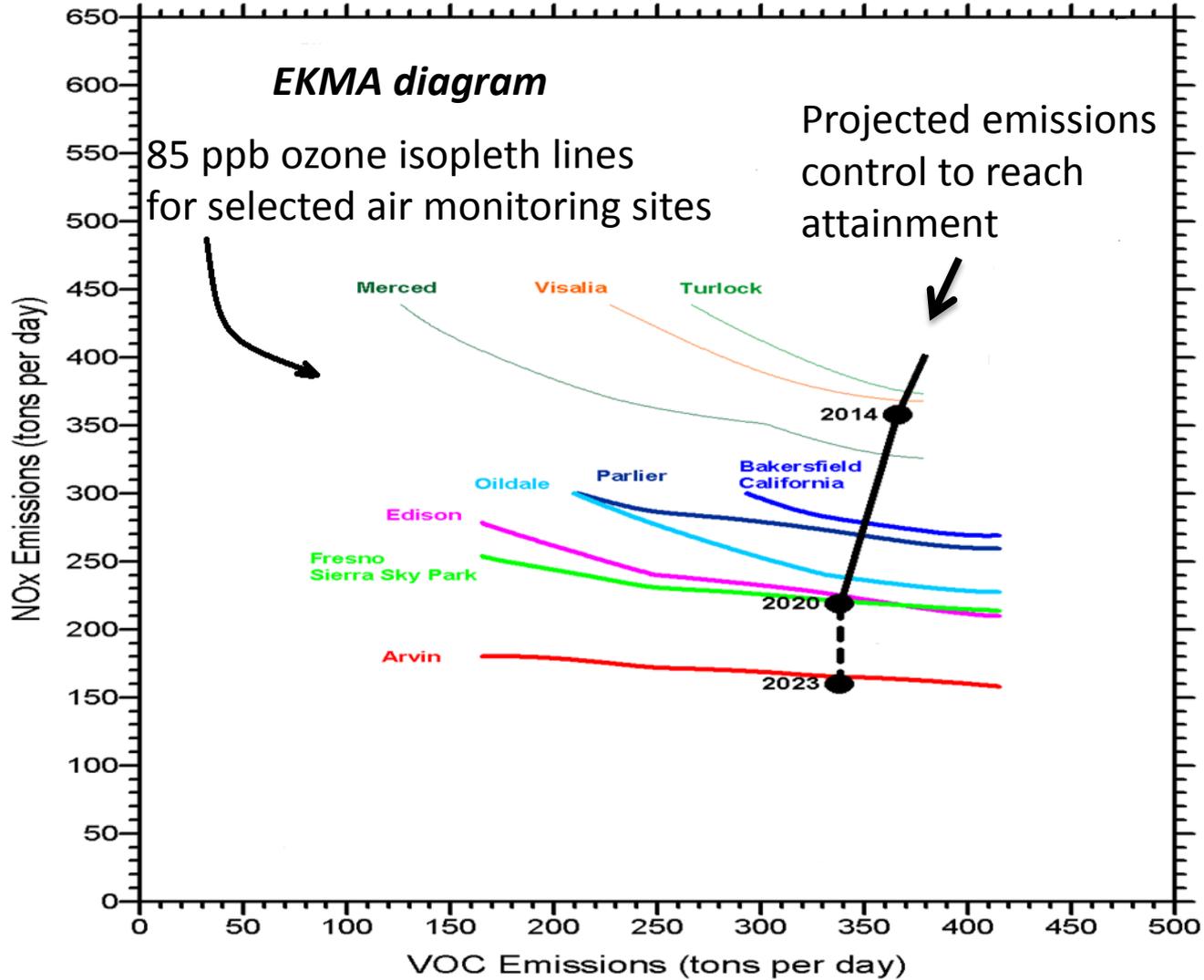


## 1-hr Ozone SIPs

### Carrying capacity for anthropogenic emissions

- SJV
  - 1994 (360 tons/day NO<sub>x</sub> and 350 tons/day VOC)
  - 2004 (344 tons/day NO<sub>x</sub> and 314 tons/day VOC)
- BA
  - 2001 (520 tons/day NO<sub>x</sub> and 440 tons/day VOC)

# SJV 2007 8-hr Ozone SIP



## ***ISSUE 1 – Uncertainty in biogenic emission estimates***

<b>BIOGENIC VOC EMISSIONS (Tons/day)</b>				
	<b>BA</b>		<b>SJV</b>	
<b>SPECIES</b>	<b>ARB BEIGIS</b>	<b>BEIS3</b>	<b>ARB BEIGIS</b>	<b>BEIS3</b>
ALK1		2.2		12.5
ALK2	8.8	1.3	30	7.1
ETHENE		8.9		50.3
HCHO		8.5		47.9
ISOPRENE	94.9	586	182.4	1231.7
MEOH		47.4		279.8
OLE1		52.9		298.1
OLE2	2.1	51.5	7.2	276.5
RCHO		2.7		15.4
SESQ		12.6		83.2
TRP1	39.3	33.9	103.3	352
MBUT	43.6		162.5	
TOTAL	188.7	807.9	485.4	2654.5
INCREASE (factor)		4.3		5.5

***Projected reductions in anthropogenic VOC emissions may be insignificant***

## ***ISSUE 2 – Uncertainty in soil NO emission estimates***

Estimates in mid 90s during an ozone episode using EMS95

- BA: 40-60 tons/day
- SJV: 200-400 tons/day

1996 measurements

- SJV: 60-90 tons/day

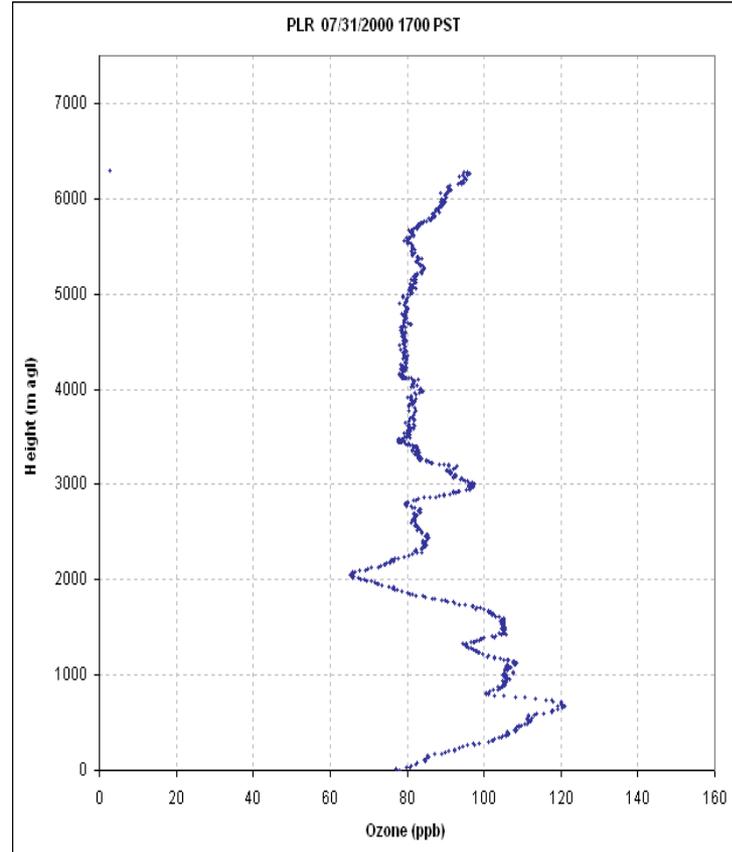
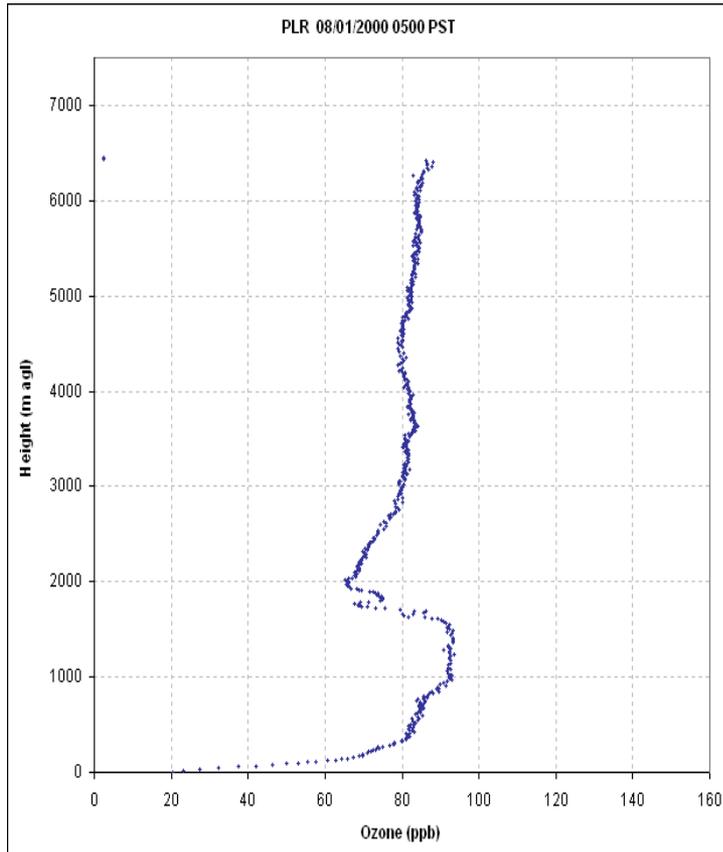
Estimates using BEIS3

- BA: 12 tons/day
- SJV: 68 tons/day

***Soil NO is missing in planning/modeling inventories***

# ***ISSUE 3 – Formation of ozone in aloft layers and its impact on surface ozone are unknown***

Parlier ozone sonde at 0500 and 1700 PST during CCOS



***Models underestimate aloft ozone concentrations***

***Model sensitivity to emission reductions may be impacted***

## ***ISSUE 4 – Air quality models underestimate ozone during peak days***

- Both MM5 and WRF fail to reproduce meteorology, especially winds, under high pressure conditions (Beaver, et al., 2010; JAMC)
  - As a result, air quality models underestimate ozone and its precursors
  - SIPs are prepared based on modeling of exceedance days (peak days)
- Problem is inherent in both MM5 and WRF
- Only air quality meteorologists simulate high pressure conditions; they are mostly end users, not developers

***This problem requires nationwide/statewide attention***

## Other issues

- Role of irrigation on meteorology and air chemistry is unknown
- Emissions control technology may not be following the most efficient ozone reduction chemistry across the board

# Conclusions

## Past SJV progress

- Emission reductions in SJV started late compared to BA and levels are still high for attainment

## Future SJV progress

- Problems identified need to be resolved to better understand true impacts of emission reductions in SJV
- Solutions to these problems require major national/state efforts
  - On-going research and development efforts may not be aimed at resolving these problems
  - Focused efforts in solving these air quality-specific issues are needed
- Progress for each region needs to be evaluated separately
  - Progress for BA is not transferable to SJV; BA is VOC limited, SJV is NO<sub>x</sub> limited