



California Environmental Protection Agency  
Department of Pesticide Regulation

# DPR Update on VOC Emissions From Pesticides

*April 2007*

# DPR's VOC Program

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- Review
- Current Status
- Regulatory Activities and Issues
  - Adjustments for field conditions/application methods
- Summary

# Review

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- Volatile organic compounds (**VOCs**) + nitrogen oxides (NO<sub>x</sub>) + sunlight = ozone

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- Many pesticide active and inert ingredients are **VOCs**

# Review

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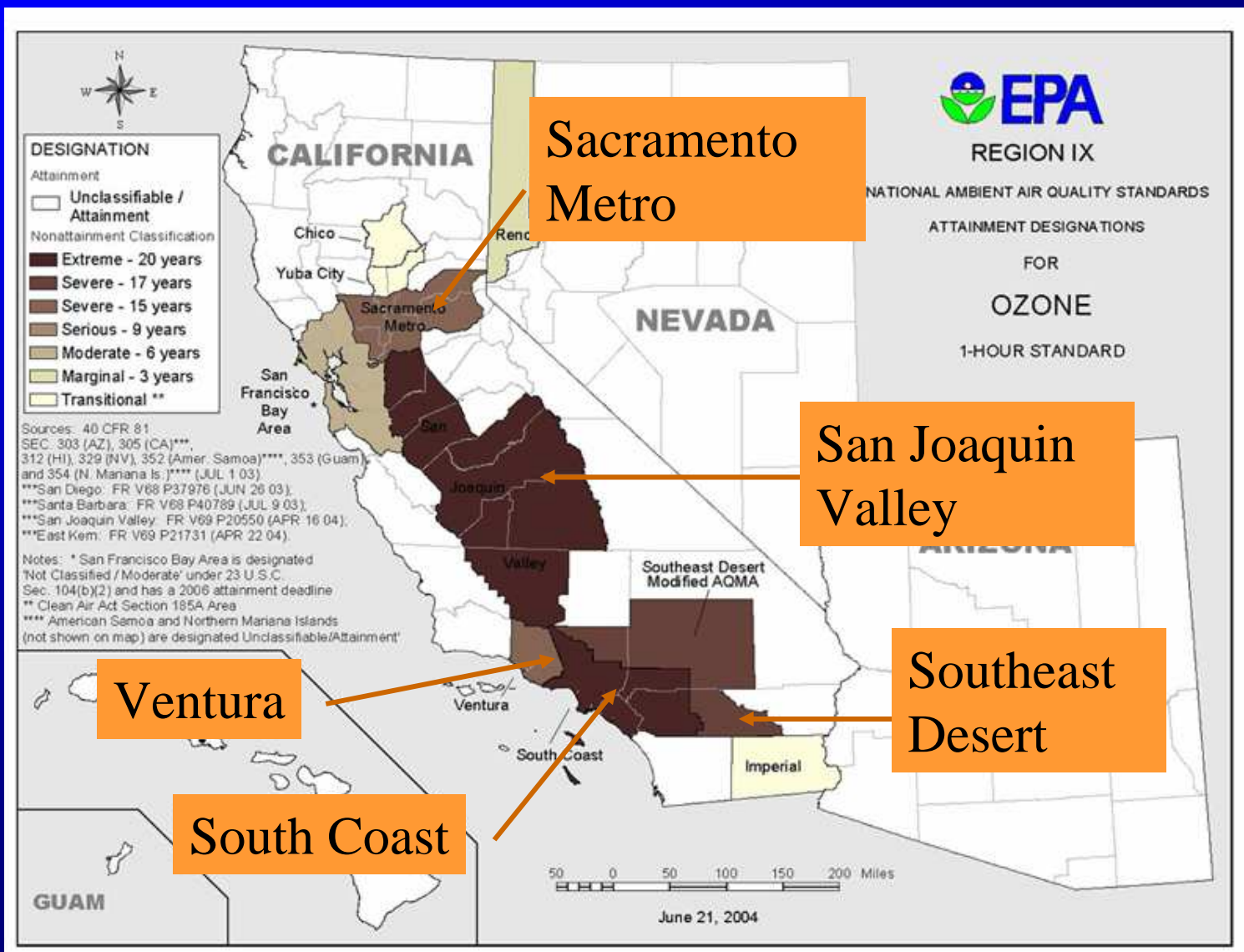
- Volatile organic compounds (VOCs) + nitrogen oxides (NOx) + sunlight = ozone
- Many pesticide active and inert ingredients are VOCs
- **Clean Air Act:**
  - ARB & APCD have lead for development of State Implementation Plans (SIP) to reduce VOCs and NOx
  - DPR responsible for preparation and implementation of SIP pesticide element.

# Review

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- Volatile organic compounds (VOCs) + nitrogen oxides (NOx) + sunlight = ozone
- Many pesticide active and inert ingredients are VOCs
- Clean Air Act:
- 1994 SIP: DPR to reduce pesticide emissions by specified amounts in five nonattainment areas (**NAA**)

# Non-attainment areas (NAA) Federal 1-hour O<sub>3</sub> Standard



# Current Calculation Procedure

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- DPR's VOC estimates

**Potential VOC emissions =**

$$\sum_{\text{all products}} (\text{PUR use} * \text{EP})$$

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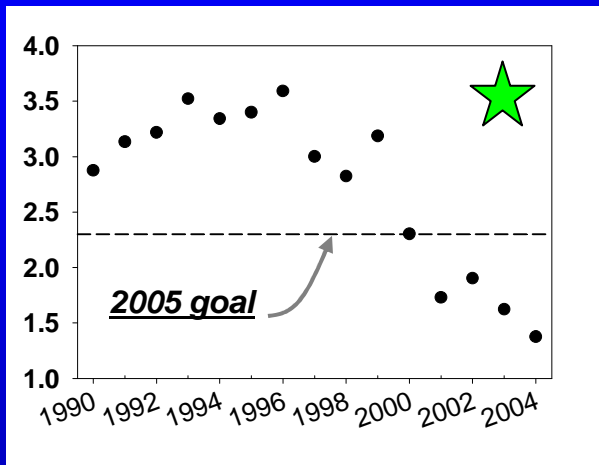
where **EP** = **product emission potential**

thermogravimetric analysis (TGA),  
inorganic subtraction,  
water subtraction,  
default values .....

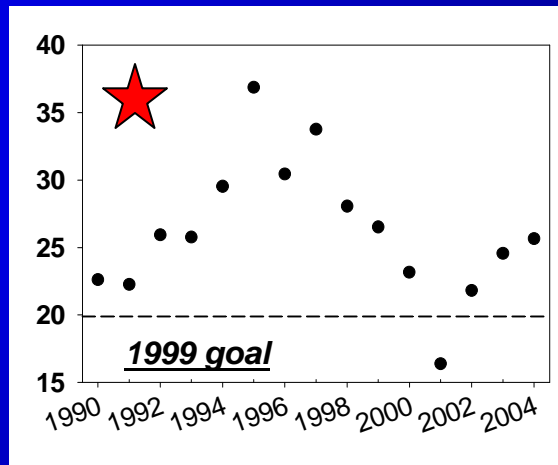
# Current Status: 1990-2004 May-Oct Pesticide Inventory

emissions (tons/day)

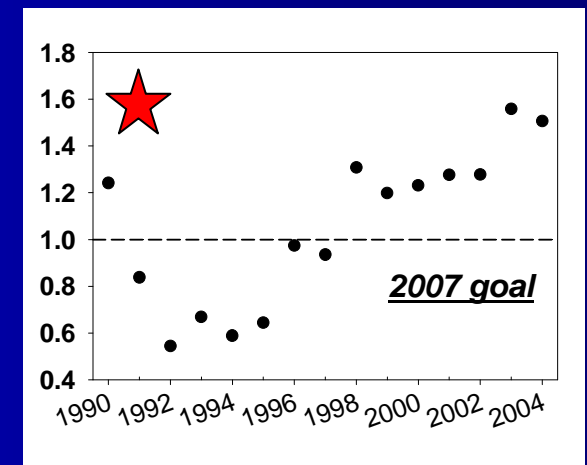
**NAA 1**  
Sacramento Metropolitan Area



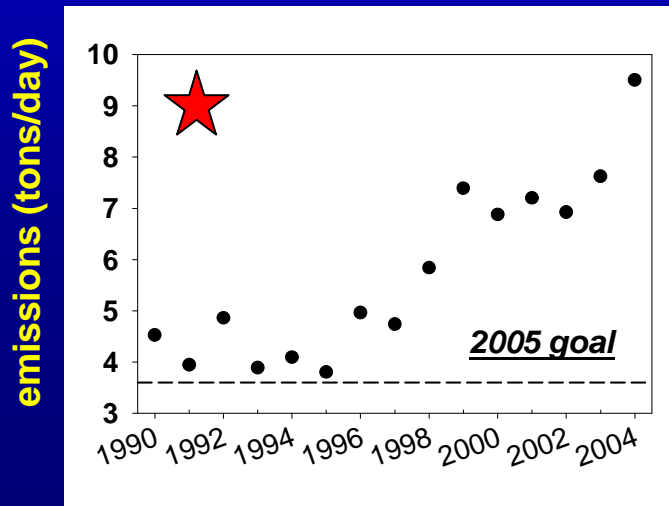
**NAA 2**  
San Joaquin Valley



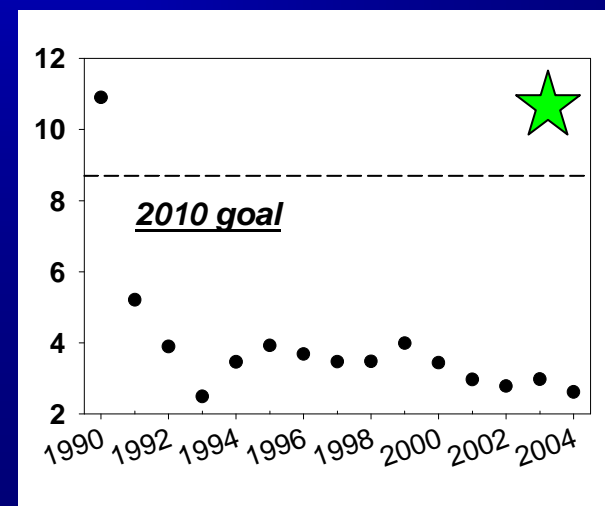
**NAA 3**  
Southeast Desert



**NAA 4**  
Ventura



**NAA 5**  
South Coast



# Principal Contributors (May-Oct 2004)

Nonattainment Area	Pesticide VOCs from Fumigants (%)	Pesticide VOCs from Emulsifiable Concentrates (%)
San Joaquin Valley	52	34
Southeast Desert	84	10
Ventura	93	3

# Key Regulatory and Legal Issues

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- SIP
  - Out of compliance in SJV; soon in SE Desert, Ventura
  - Need new SIP for more stringent 8 hr ozone standard
  - Out for public comment in May
  - 2023 targets

# Key Regulatory and Legal Issues

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- SIP
- U.S. District Court decision
  - DPR must implement regulations by 1/1/2008 to achieve 20% reduction of 1991 emissions in 5 NAAs

# Key Regulatory and Legal Issues

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- SIP
- Court decision
- DPR's "Clean Air Initiative"
  - New fumigant regulations: out for comment in May

# Key Regulatory and Legal Issues

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- SIP
- Court decision
- Clean Air Initiative
  - New fumigant regulations
  - improve accuracy of inventory
    - **Accounting for application method or management practices**

# Current Calculation Procedure

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- DPR's VOC estimates

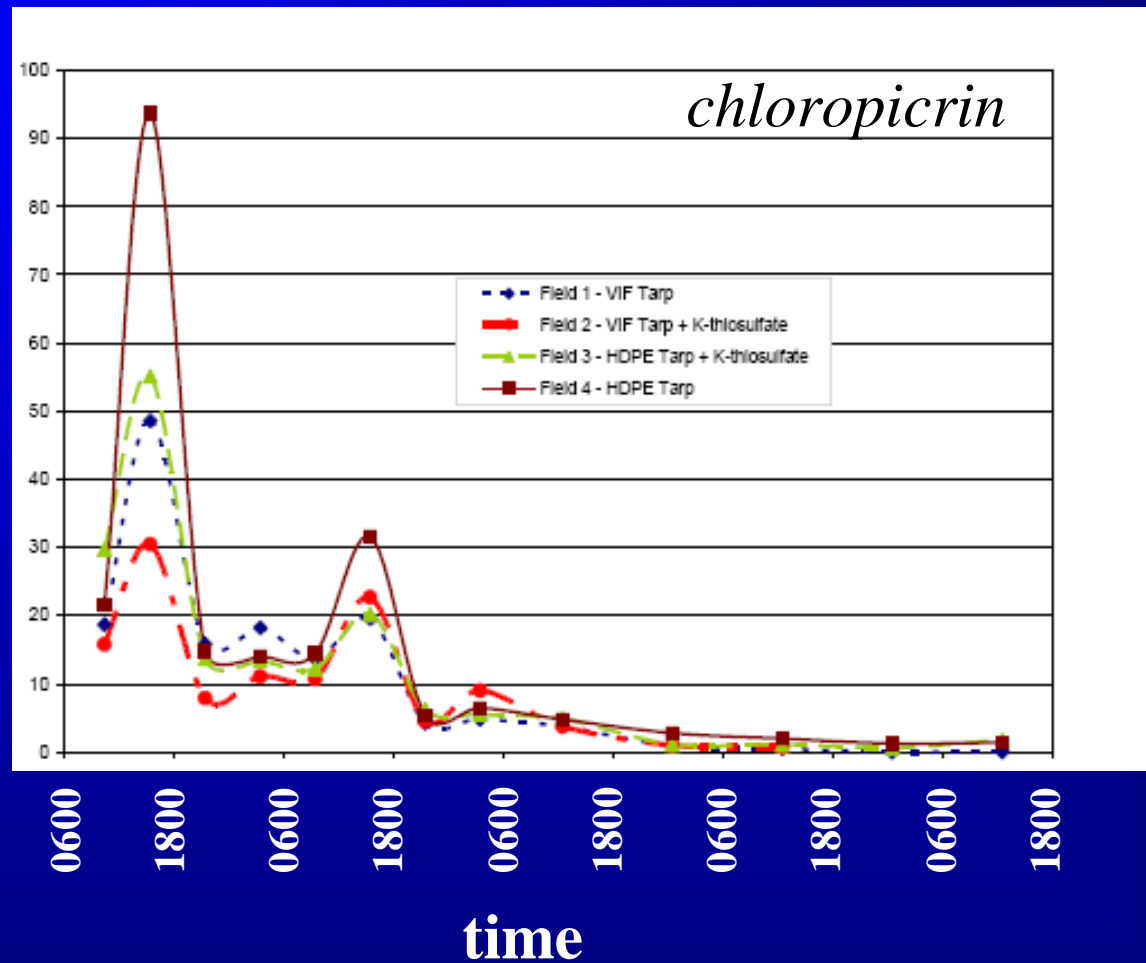
**Potential VOC emissions =**

$$\sum_{\text{all products}} (\text{PUR use} * \text{EP})$$

**..... no provision for effects of application method  
or management practices**

# Emission vary under different application methods

emission rate  
 $\text{ug m}^{-2} \text{sec}^{-1}$



“Methods to Reduce Fumigant Volatilization Losses from Agricultural Fields”  
Husein Ajwa et al., *Proceedings 2007 California Plant and Soil Conference*

# Proposed calculation of field adjusted emissions

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## I. A single fumigant application:

$$\text{field VOC emission (pounds)} = \text{pounds applied} \times \text{EP} \times \text{AMAF}$$

where **AMAF** = application method adjustment factor  
= fraction of fumigant actually emitted to the atmosphere

**AMAF is:**

- 1. fumigant- and application method-specific,**
- 2. derived based on field studies**

## Metam-sodium emissions for different application methods (MITC equivalents)

Reference	Application Method	Emissions (%)	Average Emissions (%)
Merricks (1999)	Standard Sprinkler	81	77
Merricks (1999)	Standard Shank	73	
Merricks (2001)	Sprinkler w/ 3 Water Treatments	23	21
Merricks (2001)	Shank w/ 3 Water Treatments	19	
Levine, et al. (2005)	Nontarp drip	4.4	9.1
Levine, et al. (2005)	Nontarp/intermittent drip	2.4	
Li, et al. (2006)	Tarp drip	20.5	
Wofford (2005)	Rototill	14	14

**AMAF = Application Method Adjustment Factor**



# Proposed calculation of field adjusted emissions

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## I. A single fumigant application:

field VOC emission (pounds) = pounds applied x EP x AMAF

### *Problem:*

Application methods are not reported in the PUR.....

# Proposed calculation of field adjusted emissions

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Annual emissions of a single fumigant in a NAA

*i* application methods:

annual field-adjusted VOC emissions

$$= \sum_i \text{pounds applied} \times EP \times AMAF_i \times MUF_i$$

where

$AMAF_i$  = adjustment factor for  $i^{\text{th}}$  application method

$MUF_i$  = method use fraction for  $i^{\text{th}}$  application method

# Proposed calculation of field adjusted emissions

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**MUF** = *method use fractions*:

- fumigant- and NAA-specific
- may change over time
- estimated from various sources:

**1,3-d** : registrant

**metam-Na** : grower/applicator surveys

**MeBr/Cpic** : regulatory history/"expert" opinion

**dazomet/Na tetrathiocarbonate**: not required

## Example: 2004 May – Oct 1,3-d adjusted emissions in Ventura County (NAA 4)

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<u>1,3-d application method</u>	<u>MUF</u>	<u>AMAF</u>
Shallow injection w/ high permeability tarp or no tarp-broadcast.....	2	61
Deep injection w/ high permeability tarp or no tarp-broadcast.....	4	41
Drip w/ high permeability tarp or no tarp.....	94	29

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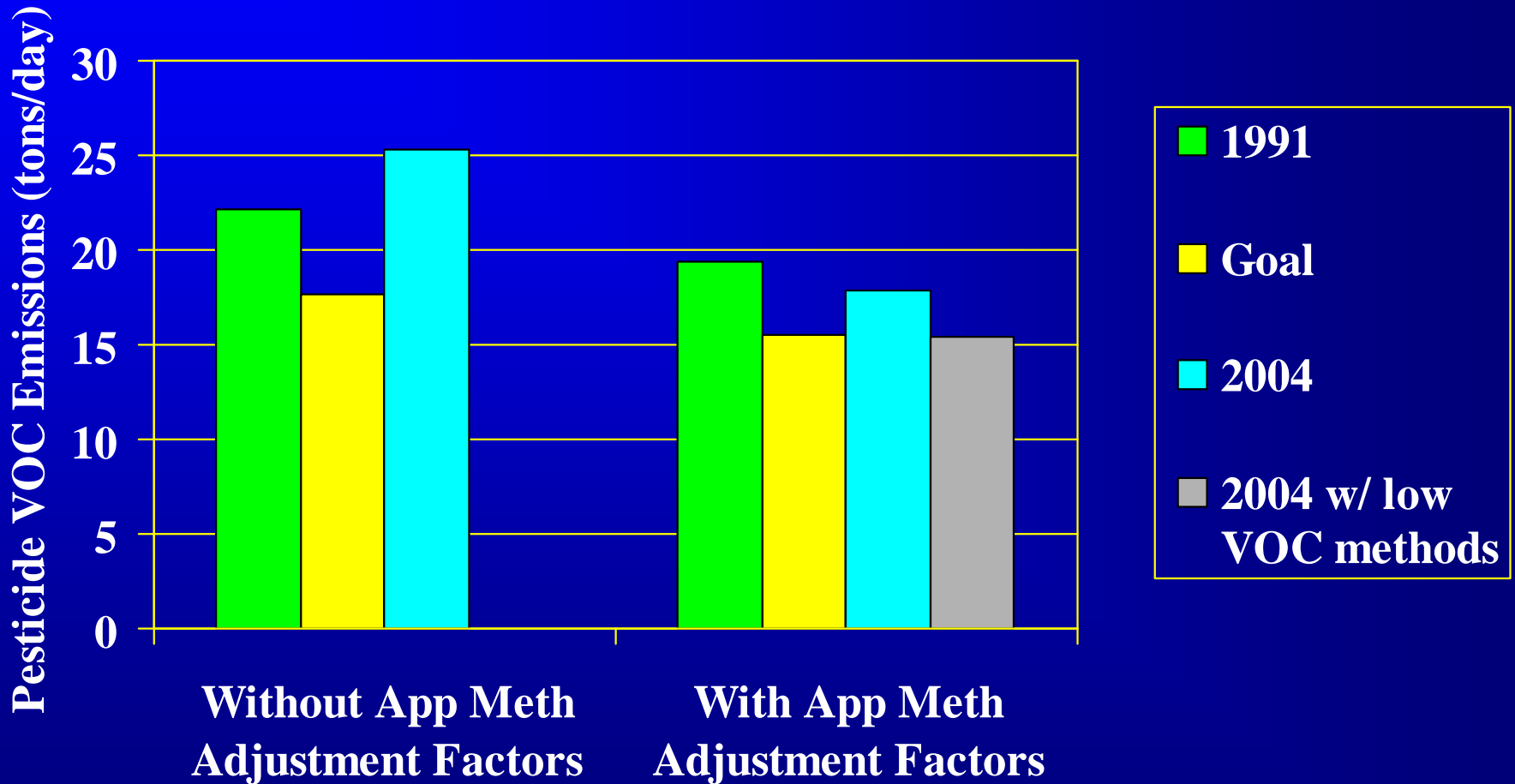
\* **weighted mean adjustment factor** for 1,3-d in Ventura  
 $= (0.02 \times 0.61) + (0.04 \times 0.41) + (0.94 \times 0.29) = \mathbf{0.3012}$

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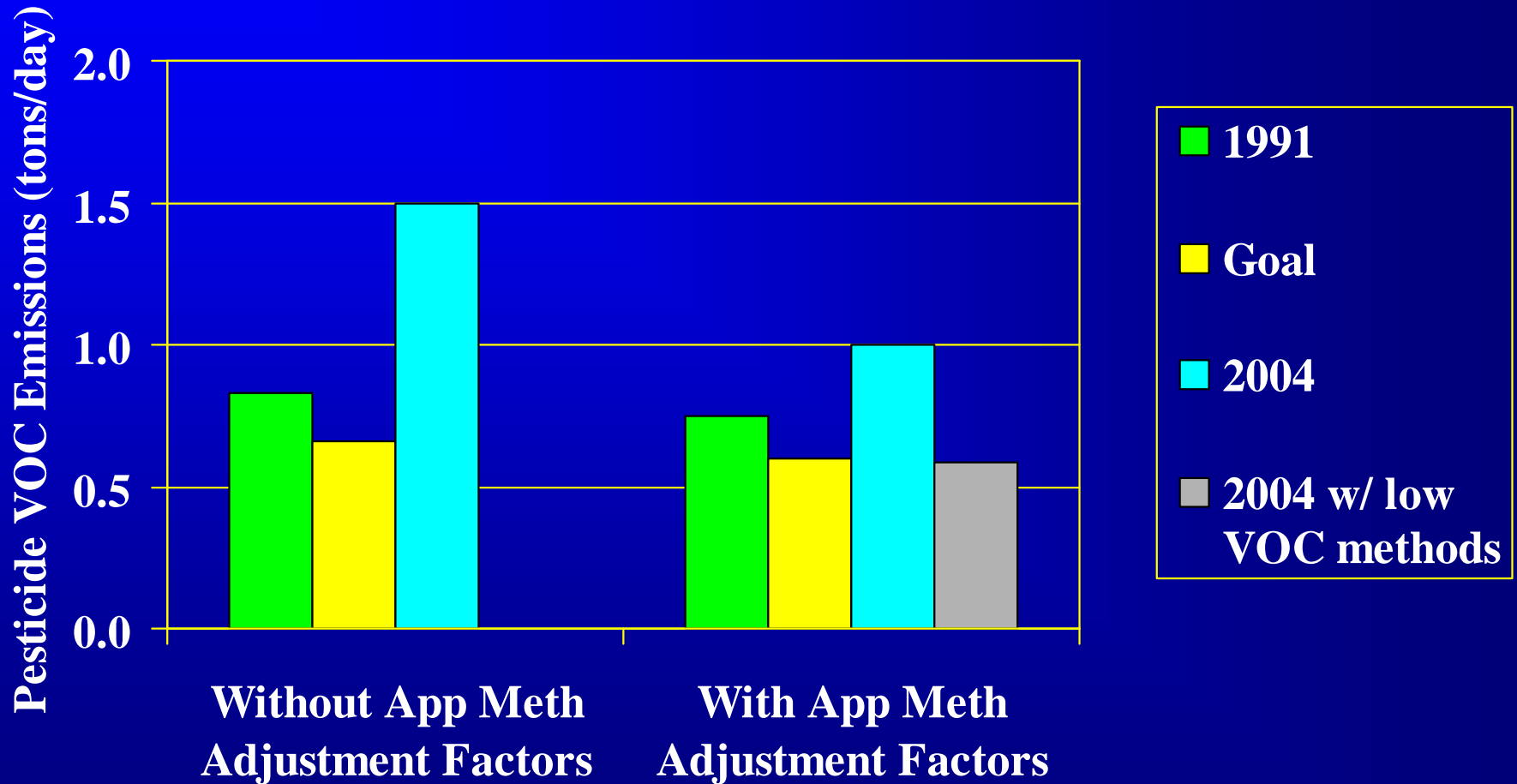
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- \* **weighted mean adjustment factor** for 1,3-d in Ventura  
 $= (0.02 \times 0.61) + (0.04 \times 0.41) + (0.94 \times 0.29) = \mathbf{0.3012}$
- \* 1,3-d 2004 use in Ventura Co. = **568,000 lbs**
- \* 1,3-d field adjusted emissions =  $0.3012 * 568,000$   
 $= \mathbf{171,000 lbs}$

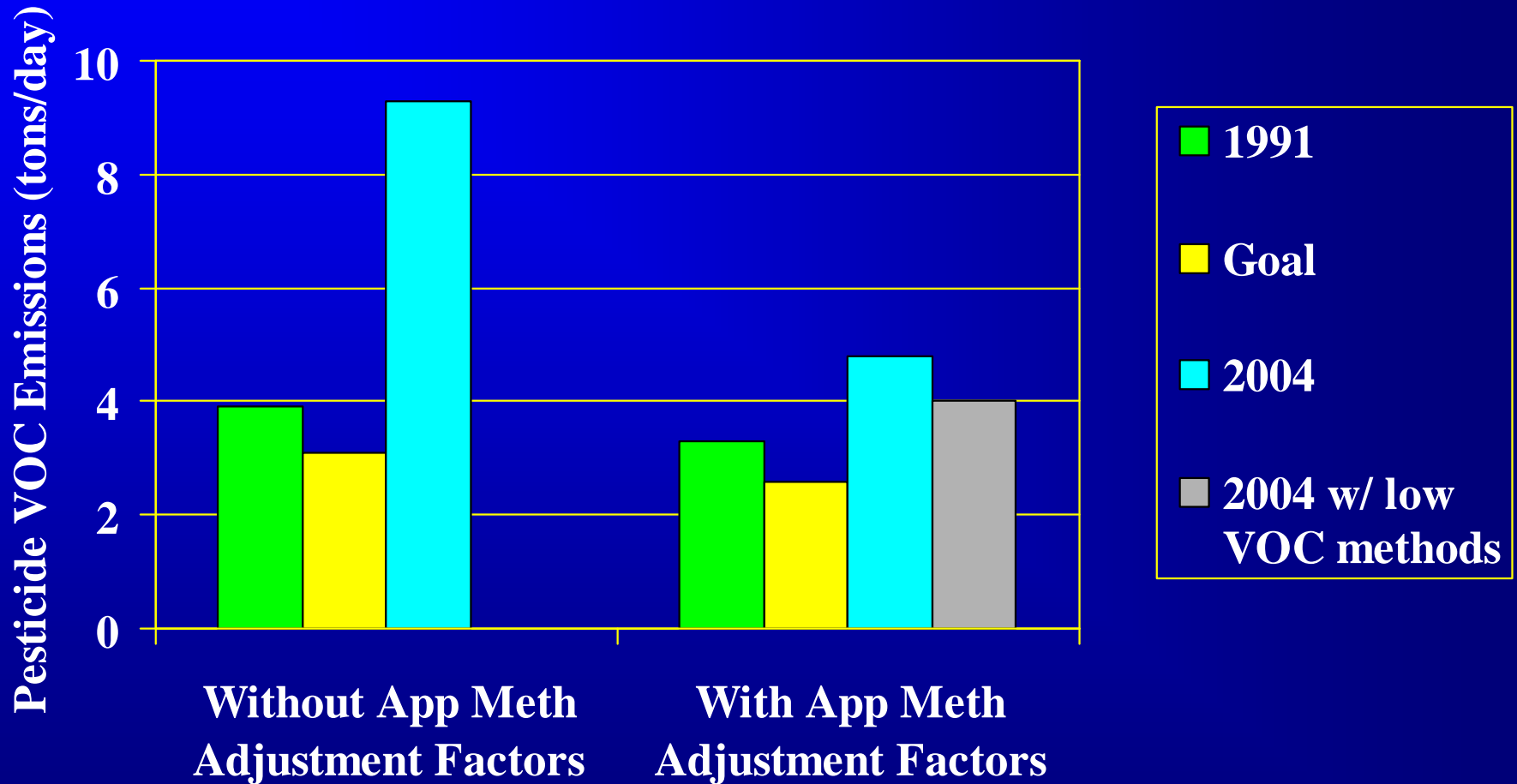
# Effect of field adjustments on the inventory – San Joaquin Valley



# Effect of field adjustments on the inventory – Southeast Desert



# Effect of field adjustments on the inventory – Ventura



# Summary

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- SJV out of compliance with 1994 SIP; Ventura and SE Desert will be out of compliance soon.
- Additional VOC reductions needed to meet 8-hr ozone standard in new SIP.
- DPR is committed to meeting court order in 2008; Fumigants will be short-term focus.
- Proposed adjustment procedures should yield better fumigant emission estimates.

# Additional Information

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2-day symposium, May 22-23, Sacramento Red Lion Hotel: “Current Research and Research Needs”

- VOC inventory research
- VOC reduction research
- Pest management/VOC reductions
- Innovative technologies/VOC reductions
- Economics of VOC reductions

Web Page: [www.cdpr.ca.gov](http://www.cdpr.ca.gov)

=> Programs and Services

=> Volatile Organic Compounds Emissions Project