



California Environmental Protection Agency
Department of Pesticide Regulation

Estimating Volatile Organic Compound Emissions from Pesticides using PUR data

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DPR's VOC Program

- Background
- Calculation overview
- Technical details
- Current status
- Regulatory and legal issues
- Current activities - research and regulatory
- Summary



Background

- Volatile organic compounds (**VOCs**) + nitrogen oxides (**NOx**) + sunlight = ozone



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- 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 NO_x
 - DPR responsible for preparation and implementation of SIP pesticide element.



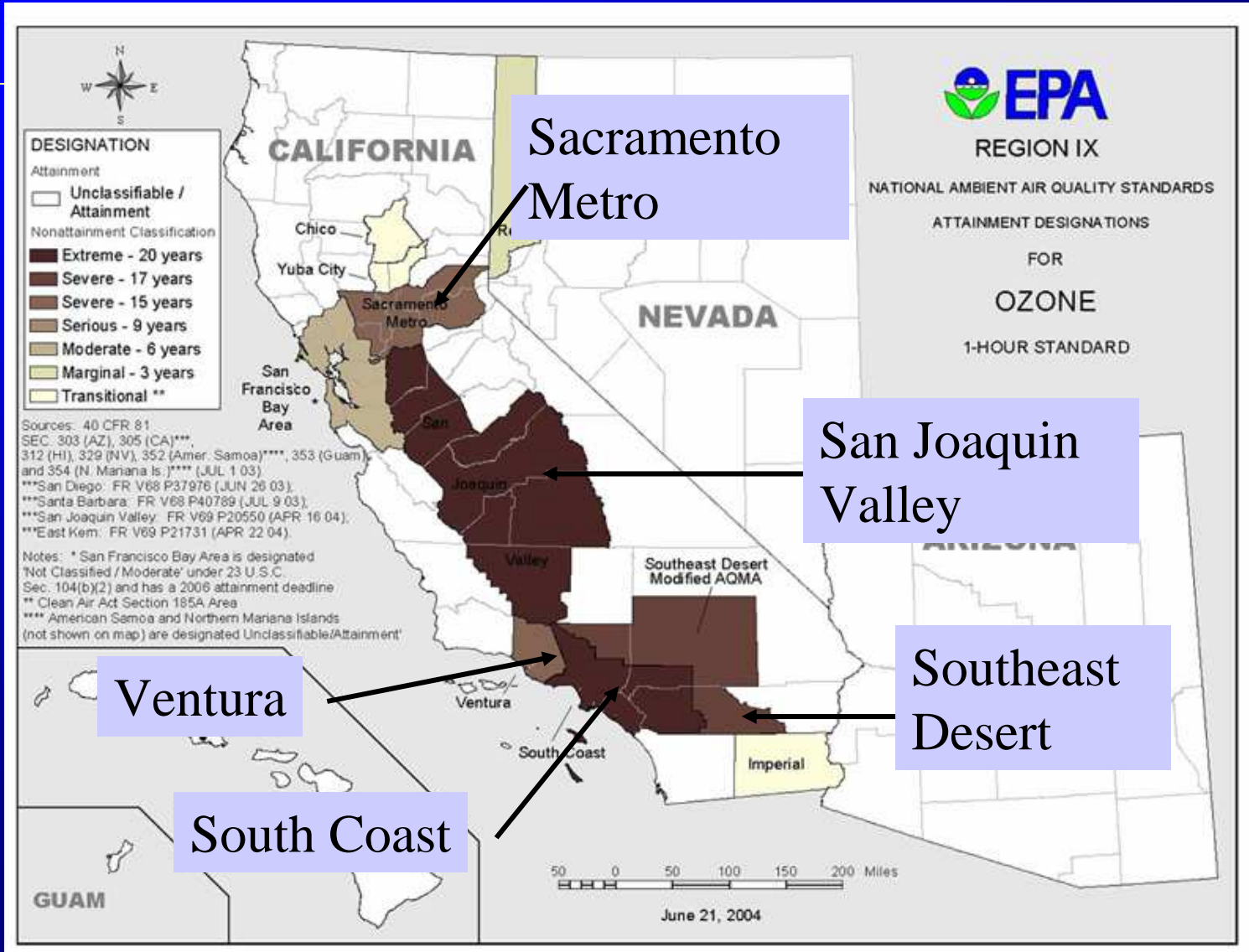
Background

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- 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.
- 1994 SIP: DPR to reduce pesticide emissions by specified amounts in five nonattainment areas (NAA)



Ozone NAAs

Federal 1-hour Standard





Calculation Overview

- DPR estimates VOC emissions from **agricultural** and **commercial structural** pesticide applications
- ARB estimates emissions from ALL other sources, including consumer pesticide products



Calculation Overview

- DPR calculates agricultural and commercial structural VOC emissions for all years beginning with 1990
- DPR updates each year of inventory annually based on most recent PUR and emission potential data
- Inventory focuses on:
 - May – Oct (peak ozone period) for each year
 - 5 nonattainment areas



Method for Estimating VOCs

- DPR's VOC estimates

Estimated VOC emissions =

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

where **EP = product emission potential,**

i.e. fraction of product that contributes to VOCs



Method for Estimating VOCs

EP = product emission potential,

estimated via

- * lab test: thermogravimetric analysis (TGA)
- * confidential statement of formula
(inorganic and/or water subtraction)
- * “special” default EPs from product chemistry
- * formulation class median TGA defaults



Technical Details

- Definition of “agricultural use” (FAC 11408)
by reported application site - (vs label database)



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- Outliers
generally follow procedure of Wilhoit (2002)



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- EPs -
 - registered AI vs “environmental” AI, e.g. metam-sodium vs. MITC



Technical Details

- Definition of “agricultural use”
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- Outliers
- EPs

- PUR data w/o spatial attributes (monthly summary data)
 - => VOC allocation to administrative areas
(air districts, air basins, non-attainment areas)



Allocating emissions to administrative areas i.e. air districts, air basins, NAAs

PUR data

“spatial data”
mtrs coordinates

nonspatial data
“county only”

3 general categories:

- * commercial structural/landscape maintenance
- * rights of way
- * commodity fumigation



Allocating emissions to administrative areas i.e. air districts, air basins, NAAs

nonspatial data

“county only spatial attribute”

Approach: *use surrogate geographic distributions*

- * commercial structural/landscape maintenance
population - from census
- * rights of way
distribution of roadway and ditch miles
- * commodity fumigation
anecdotal “expert” opinion of County
Agricultural Commissioner staff



Current Status: Pesticide Emission Characteristics

- temporal emission patterns parallel pesticide use
- More than 90% of emissions from ag sources, except South Coast
- Fumigants are high contributors in all areas
- Emulsifiable concentrates are high contributors



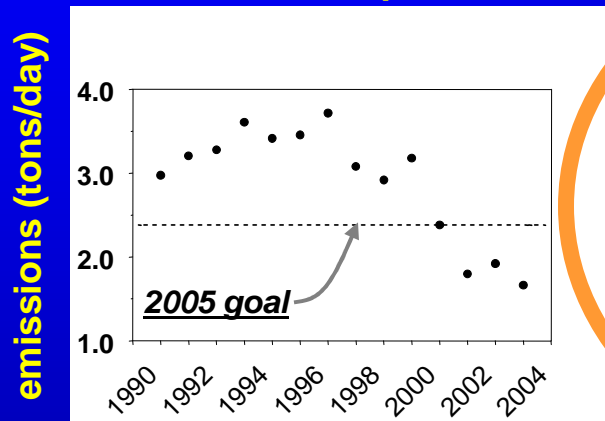
Current Status: 1994 SIP Requirements

- Pesticide VOC emissions must be reduced by the following amounts of the 1990 base year:
 - South Coast: 20% by 2010
 - Southeast Desert: 20% by 2007
 - Ventura: 20% by 2005
 - Sacramento Metro: 20% by 2005
 - **San Joaquin Valley: 12% by 1999**
- If SIP requirements are not met by deadlines:
 - Federal Implementation Plan (FIP) imposed
 - Loss of federal highway funds

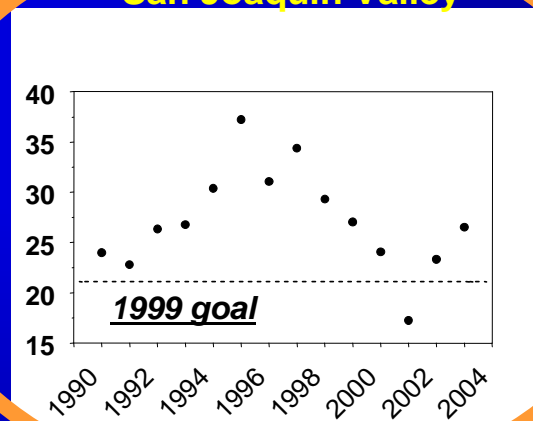
Current Status:

1990 - 2003 May - October Pesticide VOC Emissions

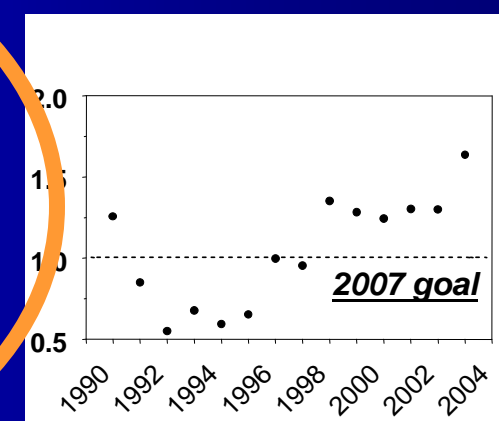
NAA 1
Sacramento Metropolitan Area



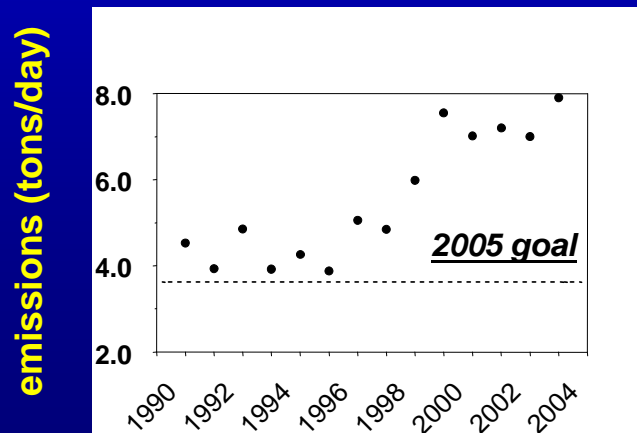
NAA 2
San Joaquin Valley



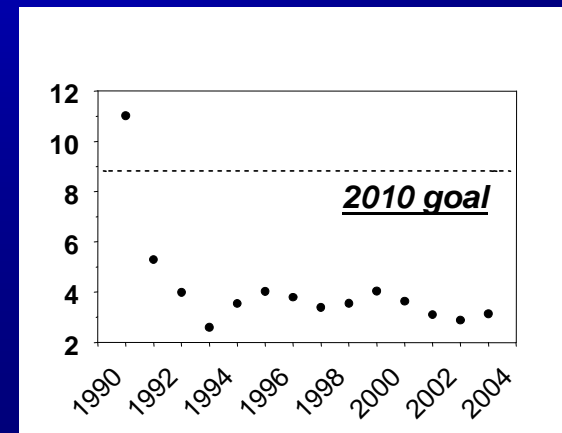
NAA 3
Southeast Desert



NAA 4
Ventura



NAA 5
South Coast





Key Regulatory and Legal Issues

- Environmental groups are suing DPR and ARB about 1994 SIP
- DPR is no longer in compliance with pesticide SIP for San Joaquin Valley
- Even if in compliance, San Joaquin Valley needs approx 30% additional VOC reduction from all sources to achieve **1-hr** ozone standard
- In April 2004, U.S. EPA issued a more stringent **8-hr** standard for ozone



Difficulty in Achieving Ozone Standard

≈ 30% VOC reduction of all sources needed to achieve 1-hour ozone standard in San Joaquin Valley

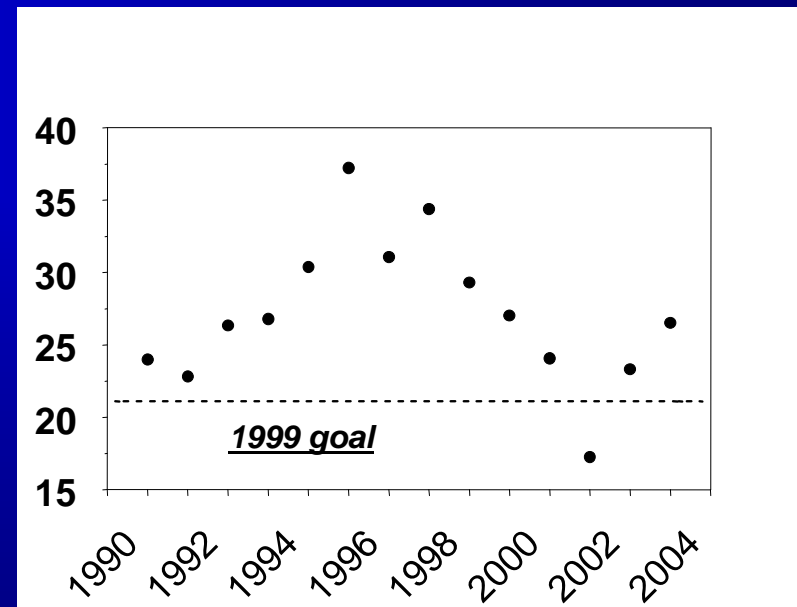
Category	% of 2004 Emissions
LIVESTOCK WASTE (DAIRY CATTLE)	9.6
LIGHT AND MEDIUM DUTY TRUCKS	9.1
LIGHT DUTY PASSENGER CARS	8.3
PRESCRIBED BURNING	7.5
OIL AND GAS PRODUCTION	7.4
PESTICIDES	6.3
CONSUMER PRODUCTS	6.2

$\Sigma < 30\%$



2003 Pesticide VOC Emissions in San Joaquin Valley NAA

- Top “Primary” Active Ingredients (% of emissions)
 - Metam-sodium (22%)
 - 1,3-dichloropropene (15%)
 - Methyl bromide (11%)
 - Chlorpyrifos (9%)
- Top Application Sites
 - Carrots (18%)
 - Cotton (13%)
 - Almonds (12%)
 - Nursery-outdoor (5%)





Current and Future Activities – Research Needs

- Emission Inventory Research
 - Field emissions of VOCs
 - Speciation and reactivity
- Emission Reduction Research
 - IPM
 - Formulation changes and new pesticides
 - Application method changes, particularly fumigants
 - Application rate reductions
 - Temporal changes
- Current Research funded or conducted by:
 - ARB, USDA, UC, CDFA, CA Strawberry Commission



Current Regulatory Actions

- 1994 SIP requirements => DPR cannot wait until research completed to implement regulatory measures
- DPR requiring emission potential (TGA) data
 - Reevaluation for ~800 current products
 - Registration requirement for new products
- DPR initiated a second product reevaluation to require reformulation of certain liquid products
 - Establish a VOC limit of 20%
 - Primarily impacts emulsifiable concentrates



Summary

- DPR estimates VOC emissions based on VOC content and use of pesticide products
- DPR no longer in compliance with 1994 pesticide SIP for San Joaquin Valley
- Additional VOC reductions likely needed to meet new 8-hr ozone standard
- ARB and others are conducting research
- DPR initiated regulatory actions to increase accuracy of emission estimates and reduce VOC emissions



Additional Information

Web Page: www.cdpr.ca.gov

=> Programs and Services

=> Volatile Organic Compounds Emissions Project