

Air Monitoring of Pesticides in California

ARB Primary Quality Assurance Organization Training
Cal Poly Pomona

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Overview

- Background
- Pesticides in air
- ARB approach to air monitoring of pesticides
- Pesticides monitored to date
- How ARB monitoring data are used
- Findings of interest
- Monitoring plans for 2017
- Challenges and lessons learned
- Questions



Background

- Toxic Air Contaminant (TAC) program
 - Started in mid-1980s
 - California Department of Pesticide Regulation (DPR) identifies pesticides as TACs based on:
 - atmospheric persistence
 - use of the pesticide
 - toxicity
 - public exposure
 - ARB required to conduct air monitoring of pesticides in support of DPR TAC program
 - DPR uses data to evaluate need for mitigation of TACs



Pesticides in Air

- Routes of offsite movement of pesticides in air
 - Drift
 - Post-application volatilization
 - Adsorbed on wind blown dust
- Agricultural pesticide application methods
 - Aerial
 - Ground rig
 - Soil injection (untarped and tarped fields)
 - Through irrigation systems



Aerial Application



08/21/2009



Ground Rig Application



Orchard Sprayer



Soil Injection of Fumigant



Tarped Soil Injection of Fumigant



Irrigation System Application



ARB Approach to Air Monitoring of Pesticides

- DPR annual request to ARB for monitoring of target pesticide(s)
 - Selection of pesticides prioritized based on:
 - toxicity
 - physicochemical characteristics
 - potential public exposure
- Objectives
 - Assess seasonal exposure – monitoring in agricultural area of high historical use during season of high expected use for the target pesticide(s)
 - Assess short-term exposure – monitoring adjacent to application of target pesticide



Monitoring Approach (continued)

- Summary of monitoring approach
 - Develop sampling and analysis methods
 - developing new methods can be complex
 - requires studies to verify sampling and analysis methods are appropriate for target pesticides
 - achieve desired limits of detection
 - collection efficiency (breakthrough) studies
 - sampling methods
 - adsorbents (XAD or charcoal)
 - filters
 - stainless steel canisters



XAD and Charcoal Sampling Media



Filter Sampler



Stainless Steel Canister



Monitoring Approach (continued)

- analysis methods - chemical-specific methods for pesticides and, in some cases, toxic atmospheric breakdown products
 - gas chromatography with mass selective, electron capture, and fluorescence detectors
- Quality assurance/quality control
 - storage stability studies
 - blank and spiked samples in lab and field
 - collocated samples



Monitoring Approach (continued)

- ARB conducts two types of monitoring in coordination with DPR and county agricultural commissioners
 - Ambient air monitoring to assess sub-chronic (seasonal) public exposure
 - follow U.S. EPA siting criteria for locating ambient samplers
 - 4-5 monitoring sites plus urban background site
 - sites are temporary
 - 4 sampling periods per week, each 24 hours in duration
 - studies 6-12 weeks in duration



Example of Ambient Monitoring Site



Example of Ambient Monitoring Site



Monitoring Approach (continued)

- Application monitoring to assess acute public exposure
 - attempt to target worst-case conditions with regard to application rate, crop, and weather
 - ring perimeter of target field or orchard with 8 sites
 - sites located 10-20 meters from field edge to approximate public exposure to adjacent resident or school
 - samples of a few to several hours in duration prior to, during, and following target application
 - collect on-site meteorological data
 - studies 3-5 days in duration



Example of Application Monitoring Site



Meteorological Equipment



Pesticides Monitored to Date

- Ambient and/or application monitoring for approx. 50 pesticides
- Monitoring often includes atmospheric breakdown products
 - near application of metam-sodium, monitored for MITC, MIC, CS₂, and H₂S
- Multiple seasonal monitoring studies in different regions for several pesticides



Regions Where Pesticide Monitoring Studies Have Been Conducted



Monitoring Associated with Pesticides Used on Following Crops

- Alfalfa
- Almonds
- Beans
- Broccoli
- Carrots
- Cauliflower
- Celery
- Corn
- Cotton
- Dormant orchards
- Grapes
- Lettuce
- Oranges
- Potatoes
- Rice
- Strawberries
- Sugar beets
- Sweet potatoes
- Tomatoes
- Walnuts



Types of Pesticides Monitored

- Defoliants
- Fungicides
- Herbicides
- Insecticides
- Soil fumigants
- Structural fumigants



Pesticides Monitored

- Acephate
- Acrolein
- Alachlor
- Aldicarb
- Amitraz
- Atrazine
- Azinphos-methyl
- Benomyl
- Bifenthrin
- Bromoxynil
- Captan
- Carbaryl
- Carbofuran
- Chloropicrin
- Chlorothalonil
- Chlorpyrifos
- Cycloate
- DEF
- Diazinon
- Dichloropropene
- Dicofol
- Endosulfan
- EPTC
- Ethoprop
- Ethyl parathion
- Fenamiphos
- Linuron
- Malathion
- Mancozeb
- Metam-sodium / MITC
- Methamidophos
- Methidathion
- Methomyl
- Methyl bromide
- Methyl parathion
- Molinate
- Monocrotophos
- Naled / dichlorvos
- Oxydemeton-methyl
- Paraquat
- Permethrin
- Phorate
- Phosphine
- Propanil
- Propargite
- Simazine
- Sodium arsenite
- Sodium tetrathiocarbonate
- Sulfuryl fluoride
- Ziram



How ARB Monitoring Data Are Used

- ARB provides results to DPR
- DPR risk assessment
 - Evaluate exposure data (monitoring and modeling data)
 - Evaluate toxicology data
 - Characterize risk
- External review of risk assessment
 - Public comment and other agencies
 - Scientific Review Panel
- TAC listing
- DPR risk mitigation (e.g., tarps for soil fumigation; buffer zones around applications)



Findings of Interest

- Soil fumigants
 - 1,3-dichloropropene
 - ambient results led DPR to suspend use statewide, and led to changes in application methods and mitigation measures
 - Methyl bromide, chloropicrin, and metam sodium
 - application monitoring results led DPR to develop mitigation measures



Findings (continued)

- Public concerned about exposure to airborne pesticides - ARB assisted DPR, OEHHA, state health department, and counties with community exposure studies
 - Lompoc
 - Parlier
 - Kettleman City



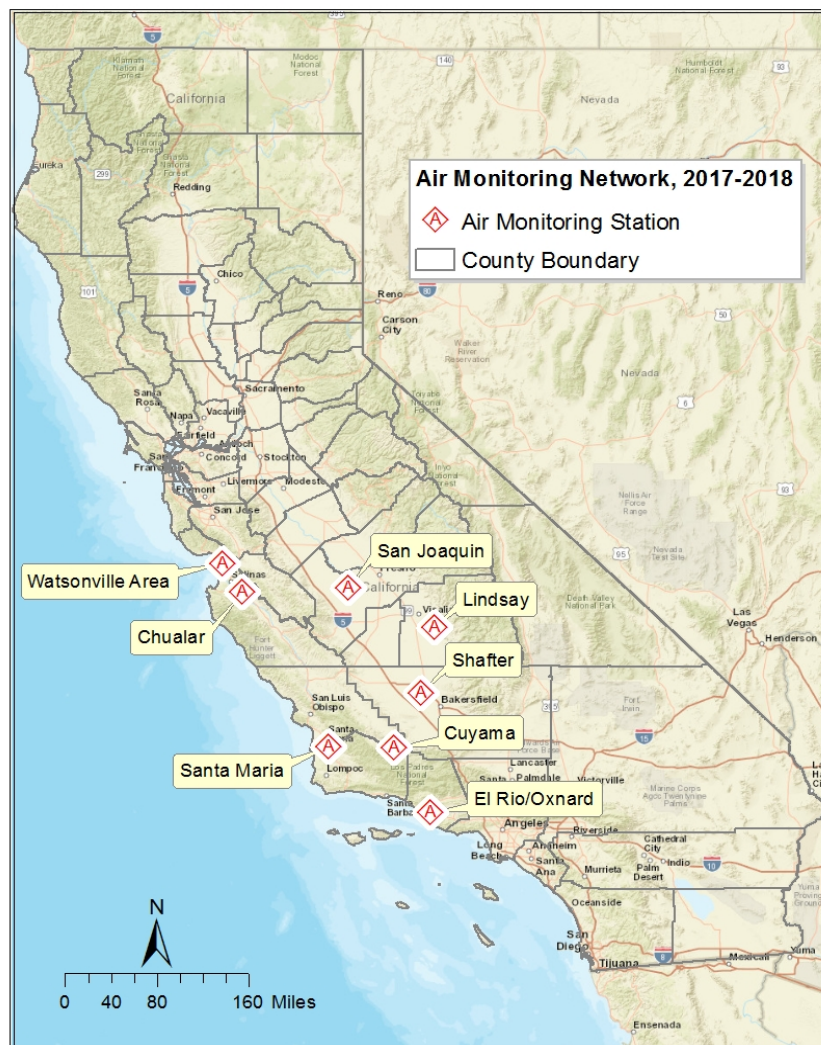
Monitoring Plans for 2017

DPR and ARB

- Network of 8 ambient air monitoring sites for 2-year monitoring effort
 - Initiated by Governor's Office
 - Communities selected based on historical use of fumigant or organophosphate pesticides
 - Weekly 24-hour samples (random day each week)
 - Monitoring for 4 soil fumigants & 27 additional pesticides



DPR/ARB Monitoring Network



Plans for 2017 (continued)

- Seasonal monitoring studies to be conducted by ARB in additional regions for specific pesticides during season of expected high use
 - 4-6 monitoring sites per region
 - 3-4 sampling periods per week, each 24 hours in duration
 - 8-12 weeks in duration



Regions for Seasonal Studies



Challenges

■ Challenges

- Obtaining permission from property owners
- Timing monitoring with season of high use of target pesticide
- Procurement of equipment and supplies
- Weather and pesticide use patterns change annually, complicating planning and interpretation of results
- Potential for employee exposure during sample collection



Lessons Learned

- Lessons learned
 - Advance planning is key
 - Siting is critical to obtaining representative results
 - Quality assurance evaluation may be needed to allow comparability of results from different labs



Questions?

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