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
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
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, CS$_2$, and H$_2$S

- 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

- 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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