PPDC Meeting

Field Volatilization of Agricultural Pesticides

U.S. EPA

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Volatilization

- What is it?
  - Vapors of a pesticide leaving an application site after sprays settle (from both plant surfaces and soils)
- What it isn't
  - Spray drift, overspray, wind blown soil
- Why should we be concerned?
  - Possible risks to humans

Framework for Assessing

- What do we know about the potential for exposure/risk from pesticides that volatilize?
- What are the criteria for determining when to conduct a quantitative assessment for potential exposure/risk for a pesticide that volatilizes?
- What are the methods that are used in assessing exposure/risk from pesticides that volatilize?

Field Volatilization: Current Work

- Screen to determine which pesticides are possible volatilization concerns
  - Factors affecting volatilization
- Toxicity Issues
  - RfC methodology and HECs
  - Inhalation vs. oral studies
- Exposure Issues
  - Monitoring data: PANNA, CARB
  - Air Dispersion Modeling (One field vs. airshed)
- Example assessments

Factors Affecting Field Volatilization

- Most significant physical property regarding volatilization is vapor pressure (Farmer et al., 1972; Glotfelty et al., 1984; Woodrow et al., 1997; Smit et al., 1998; and Wolters et al, 2003)
  - True for both soils and plants
- Other factors impact to varying degrees:
  - Pesticide properties
  - Ag practices
  - Meteorological conditions
  - Persistence on the plant surface
  - Soil physical properties

Factors Affecting Field Volatilization Uncertainties

- Volitilization may be product specific
  - Inert ingredients could have impact
- Hard to pinpoint magnitude that each factor has on volatilization after vapor pressure

Evaluating Risk

- Hazard
  - Preferable to have an inhalation toxicity study of the duration matching exposure to assess risks
  - If not available, oral studies are relied upon
  - If inhalation study is available, EPA uses the RfC Methodology
    - Used to assess non-cancer risks from inhalation
    - Peer reviewed and Agency policy since 1992
    - Treats vapors/gases differently than aerosols/droplets
    - Used to extrapolate from animals to humans
      - Uses known physiological and anatomical differences between animals and humans

http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=71993

Field Volatilization: Toxicity

- Currently used RfC to calculate HECs for chlorpyrifos, diazinon, and endosulfan
  - Pesticides for which PANNA has provided valid monitoring data
- Working on developing a database that compares HECs derived from inhalation toxicity studies and NOAELS from oral toxicity studies

Field Volatilization: Toxicity Uncertainties

- Vapors vs. Aerosols
  - Typically get inhalation toxicity studies for aerosols but volatilization is vapors
  - Fumigants showed vapors can be different
- Oral vs. Inhalation kinetics
  - Assumes how the pesticide gets in the body via the different routes is the same
  - Inhalation studies can show portal of entry effects

Field Volatilization: Exposure Data

- **PANNA Drift Catcher Data**
  - Air monitoring data on 4 pesticides (chlorpyrifos, diazinon, endosulfan, trifluralin)
    - Chlorothalonil data collected but not available yet
  - 24-hour samples
  - Samples taken over 1 to 3 week periods depending on study
  - Samples taken at various places: field edges, homes, schools
  - Rarely known when specific applications occurred during the studies

Field Volatilization: Exposure Data

- **California Air Resource Board (CARB) Data**
  - Two types of data
    - Application site monitoring
    - Seasonal ambient air monitoring
  - Air samples collected over a 24-hour period
  - Samples taken over season of high use (2 – 3 months), in areas of high use
  - Samples taken at various places: field edges, homes, schools
  - Over 40 chemicals sampled over the past 20 years
    - Mainly focused on ambient monitoring
  - Generically know historical amount of pesticide applied in the sampled area

Field Volatilization: Exposure Data Uncertainties

- Typically unknown when applications occurred
  - If known, typically don't know what product was applied
- Most samples are 24 hours in length
  - May be capturing both drift and volatilization after applications
    - Respirable particles (< 10 um) vs. inhalable particles (< 100 um)
  - Cannot focus on possible differences between daytime and nighttime volatilization rates
    - Calm nighttime conditions may lead to higher volatilization rates than daytime conditions
- PANNA data does not include continuous weather monitoring

Field Volatilization: Exposure Modeling

- Modeling of field volatilization is possible
  - Number of models and approaches
  - Very detailed and complicated
    - Number of assumptions need to be made

PANNA – EPA Assessments

PANNA	EPA
Start with the same toxicological endpoint	
Utilize REL approach	Utilize RfC Methodology
Use full uncertainty factors	Reduce intra species factor
Risk based on exceedances	Risk based on MOE approach
Use 24 hour max exposures	Use average exposures
Assume 24 hr exposure	Assume 24 hr exposure

Going Forward

- Reconsider the criteria for triggering an assessment of exposure from volatilized pesticides
- Further mine CARB data, PANNA data, and any other data sources to help us better understand field volatilization
- Determine the best way to evaluate these exposures considering magnitude of exposures, duration and timing of exposures and what hazard data are available
- Determine if aggregation of semi-volatile pesticide exposures is necessary

Going Forward

- Encourage stakeholders and states to produce data looking at pesticides that volatilize
- Encourage stakeholders and states to initiate programs to encourage better coordination/ cooperation between growers and the public