# Challenges in Measuring Emissions of VOCs from Agricultural Sources

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# Beltsville Agricultural Research Center

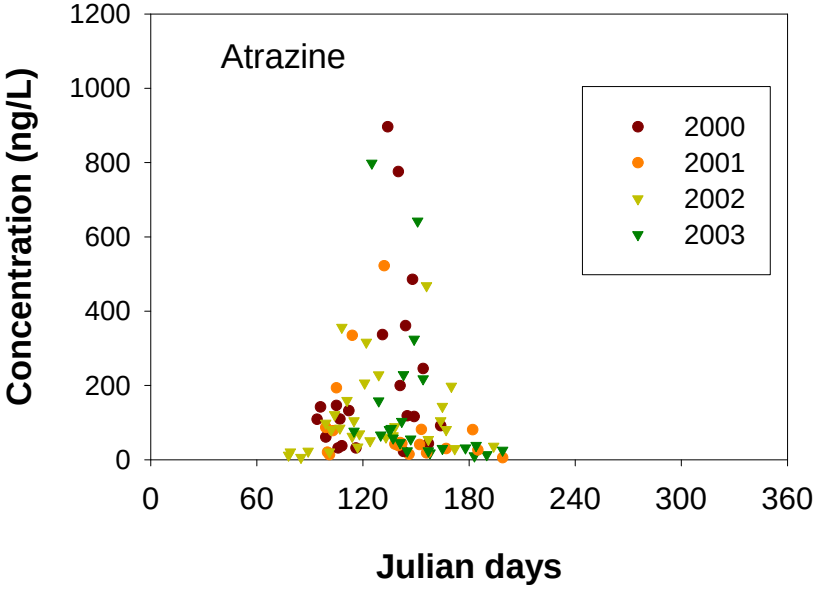
- Largest, most diversified agricultural research complex in the world
- Research laboratories focus on:
  - Plant Sciences
  - Animal Science and Health
  - Natural Resource Management and Protection
  - Human Nutrition
  - National Arboretum (Washington, DC)

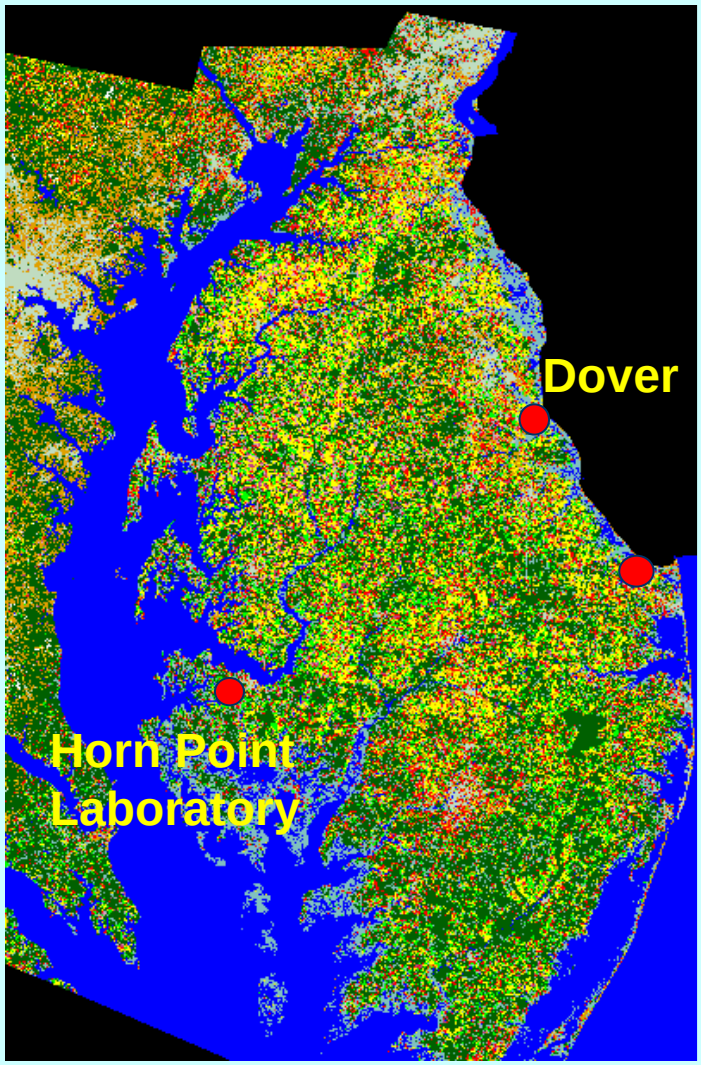
# Collaborators

- Cathleen Hapeman – USDA-ARS
- Walter Schmidt – USDA-ARS
- Mazyar Zenali – nEnvironmental
- John Prueger – USDA-ARS
- Steven Trabue – USDA-ARS
- Ronaldo Maghirang – Kansas State University

# Recent Research Efforts

- Transport processes controlling fate of pesticides in the atmosphere.

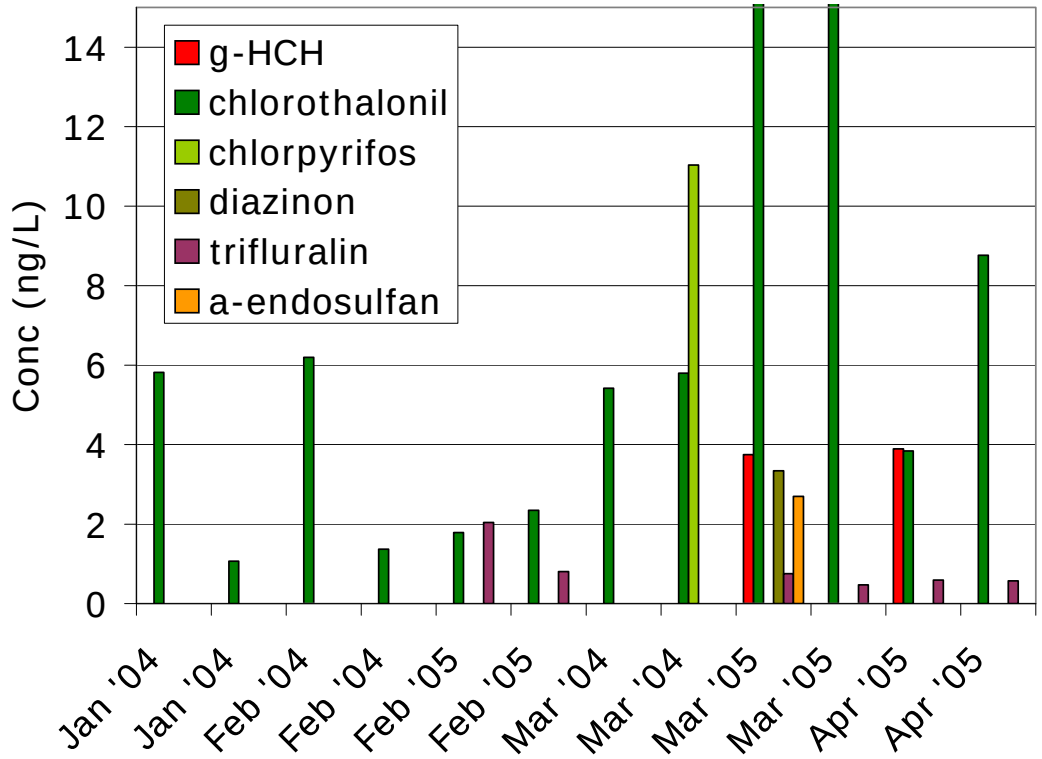


# Recent Research Efforts

- Investigating pesticide deposition to National Parks in Sierra Nevada Mountains.

**Yosemite National Park Snow**



# Current Research Efforts

- Investigating improved approaches to predicting VOC emissions from ag operations and their impact on air quality

**Ozone Precursors**

**Odors**

# Ag Air Quality Issues

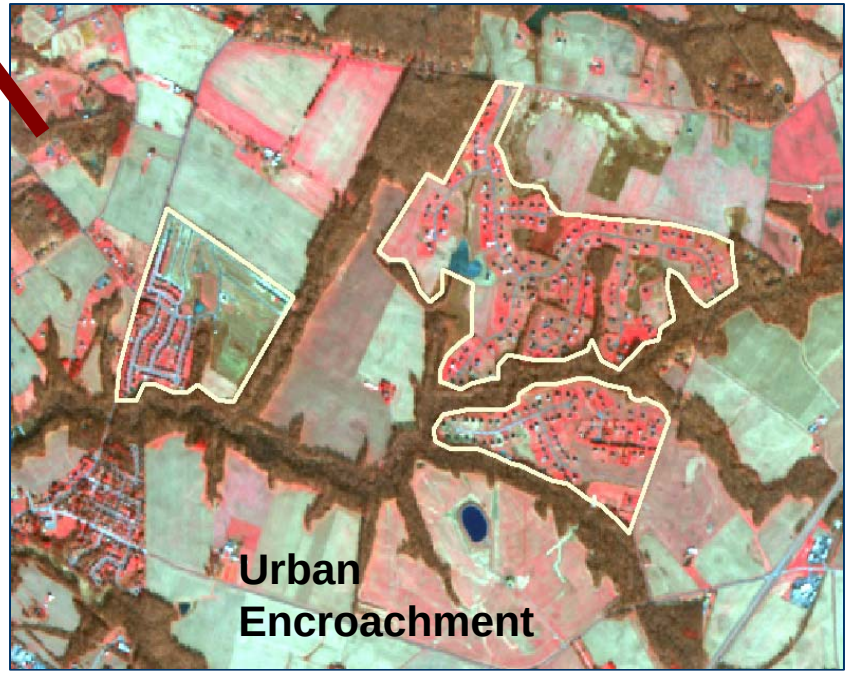
- Urban Encroachment
- Consolidation of Ag Operations
- Development of new regulatory systems for atmospheric emissions of odorants, PM, $NH_3$, and VOCs
- Air pollution issues are now as important as water and soil resource protection.

# Increasingly Complex Emissions/Reaction Scenarios

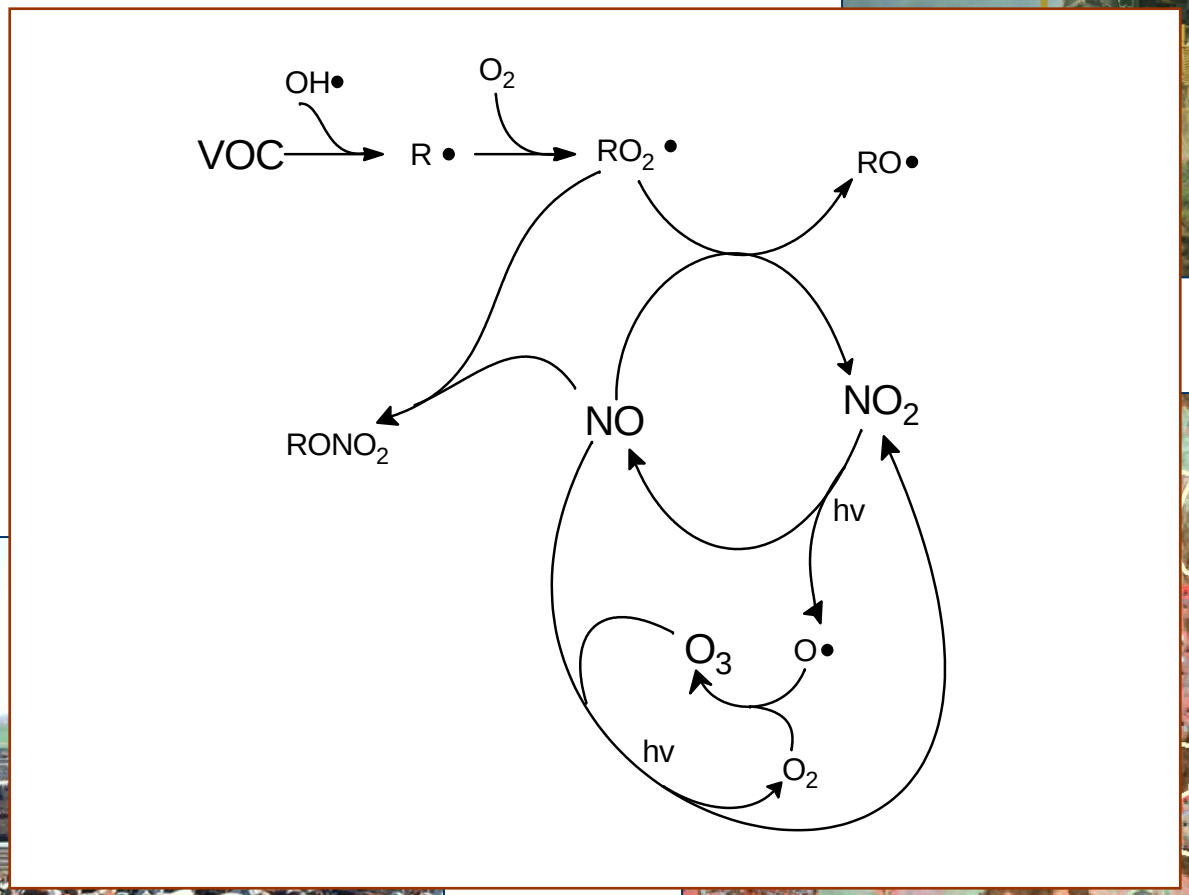
VOCs

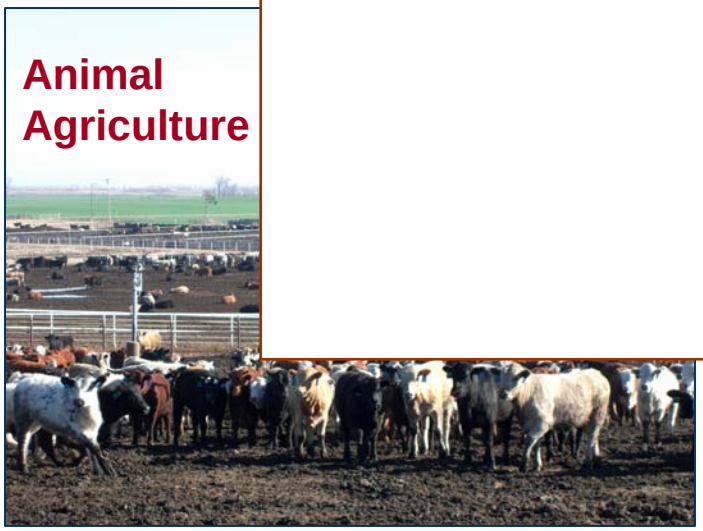
$NH_3$, VOCs, $PM_{10}$, $PM_{2.5}$

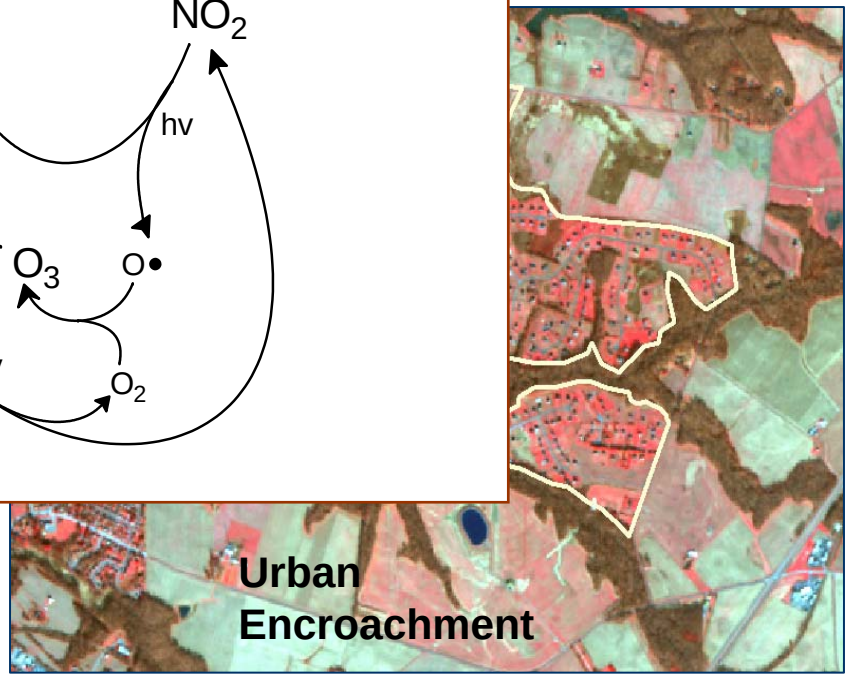
NOx



# Increasingly Complex Emissions/Reaction Scenarios



## Challenges in Accurately Measuring Emissions and Environmental Fate of VOCs:

- Farm operations and farm practices vary widely across the U.S.
- Constantly change meteorological conditions.
- Farms often represent a collection of sources varying in space and time.
- New tools designed to characterize VOC and PM emissions across an large area are still experimental in nature.

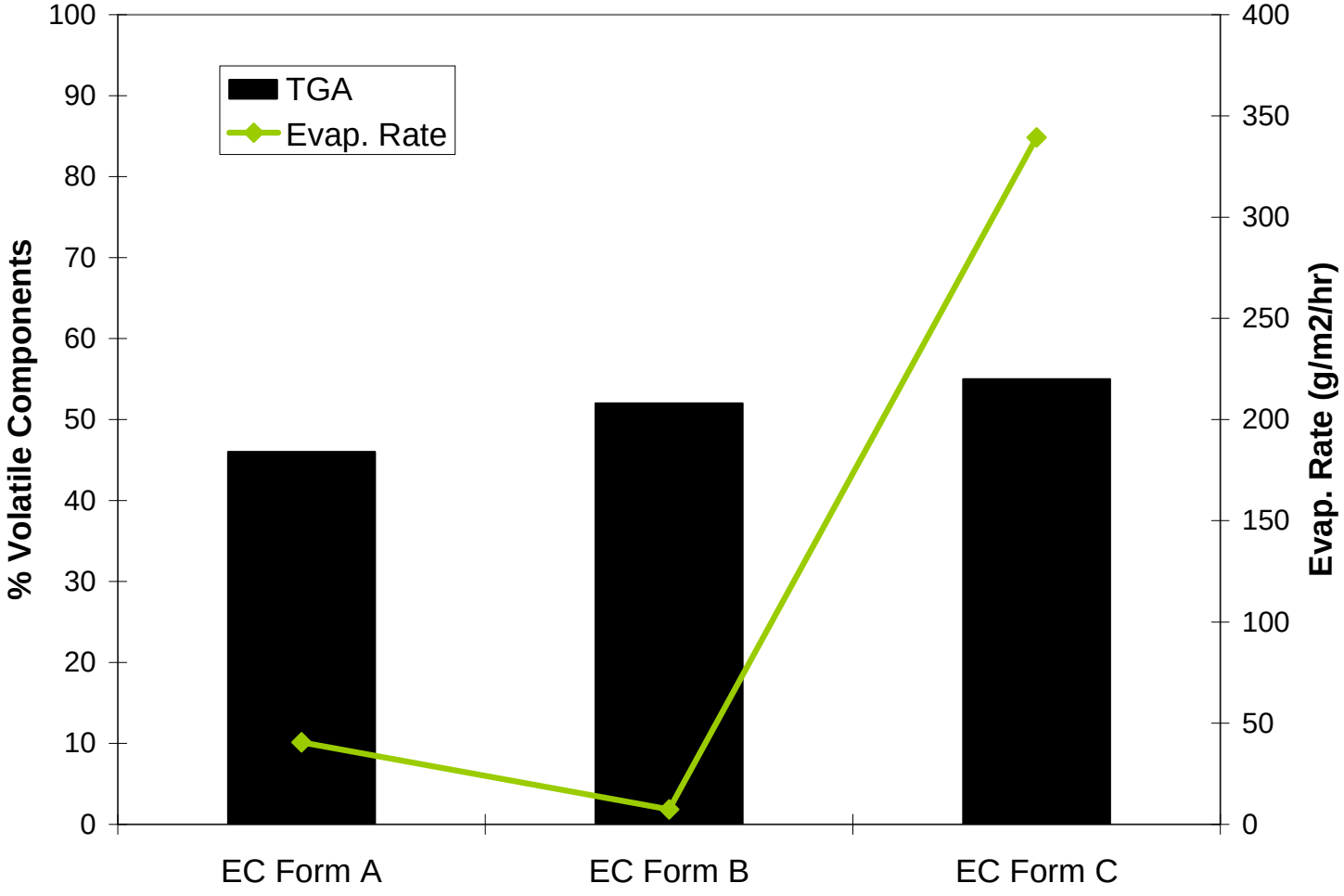
# Current Research Efforts

- Odorous VOC emissions from Feedlots under different dust management practices.
- Kansas State/USDA-ARS Air Quality NRI Grant 2006-2009

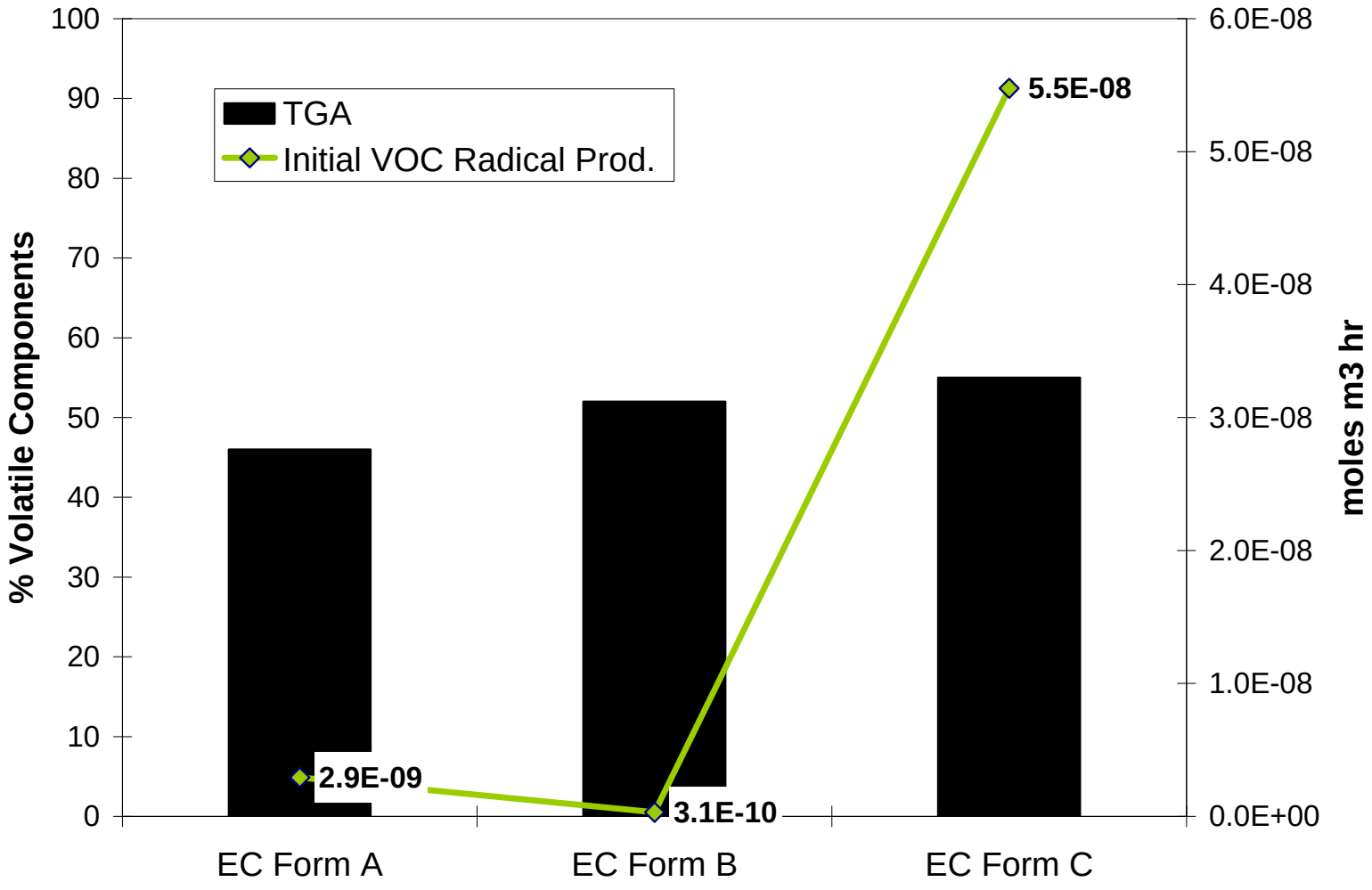
# Current Research Efforts

- Improved approaches to estimating pesticide emission potentials.
- More accurate determination of air quality risks from specific co-formulants.
- Focus on EC formulations

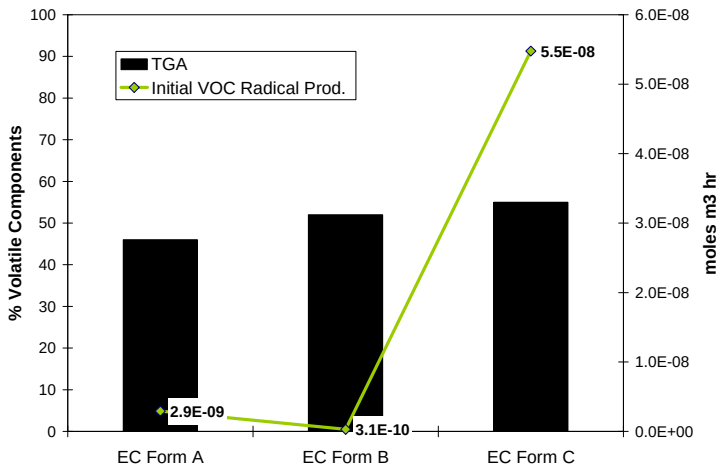
# TGA and Evaporation Potential of 3 EC Formulations

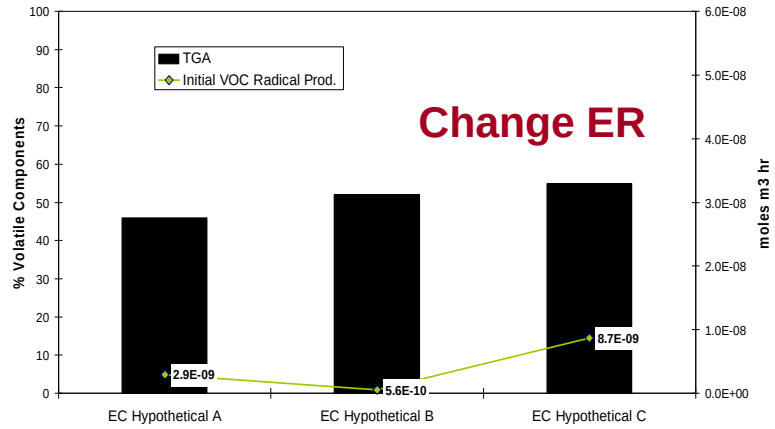


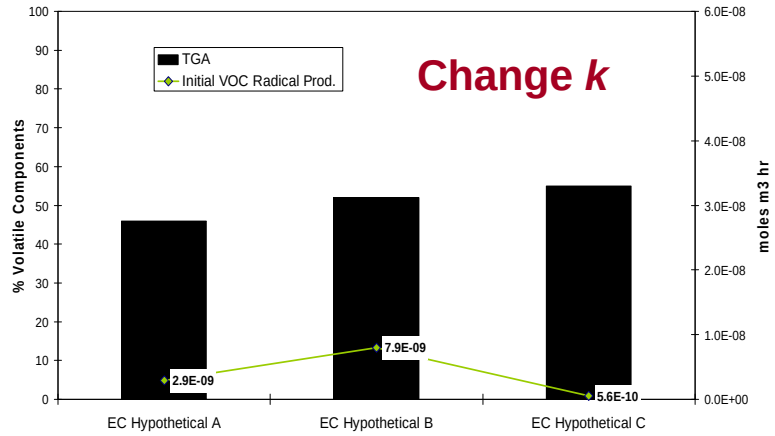
# TGA and Potential Reactivity of 3 EC Formulations



# TGA and Potential Reactivity of Hypothetical Formulations



# Initial Conclusions:

- TGA data does not provide an accurate estimate of realistic evaporation rates for EC formulations.
- The both evaporation potential and reactivity of the active ingredients and co-formulants must be taken into account to appropriately describe the potential risks from a particular product.

# Approach for the Future:

- Laboratory and field experiments are required to provide improved estimates of emissions rates of co-formulants under different meteorological/soil/crop conditions and agronomic practices.
- Results from these experiments will be used in emissions/transport/deposition and reactivity models to evaluate the effectiveness of air quality protection practices.

# Expected Outcomes:

- New tools to effectively mitigate negative air quality impacts from agricultural operations.
  - Improved methods for assessing air quality risks from specific agronomic practices.
  - Critical evaluation of existing and experimental air quality conservation practices.
  - Effective transfer of information to extension and USDA action agencies.,

# Reality Check:

- State of CA must address $O_3$ reduction goals through a combination of reductions in $NO_x$ and VOC emissions.
- Pesticides are currently part of conventional ag production .
  - Certain minor yet important crops have a limited number of products which are registered for use to control pests.
- Most effective approach to conservation is cooperative and incentive-based programs.