

Refining Fumigant Emission Estimates



Susan Kegley, PhD, Pesticide Action Network
Anne Katten, MS, CA Rural Legal Assistance Foundation

Assumptions in Translating Field Monitoring Data to Percent Emissions

- Monitoring from a small number of field fumigations provides representative concentration and flux measurements that apply to all fumigations
 - Air/soil temperature doesn't affect percent emission
 - Variability between fumigations is negligible,
or
Variability between fumigations can be handled by averaging

Soil Temperature

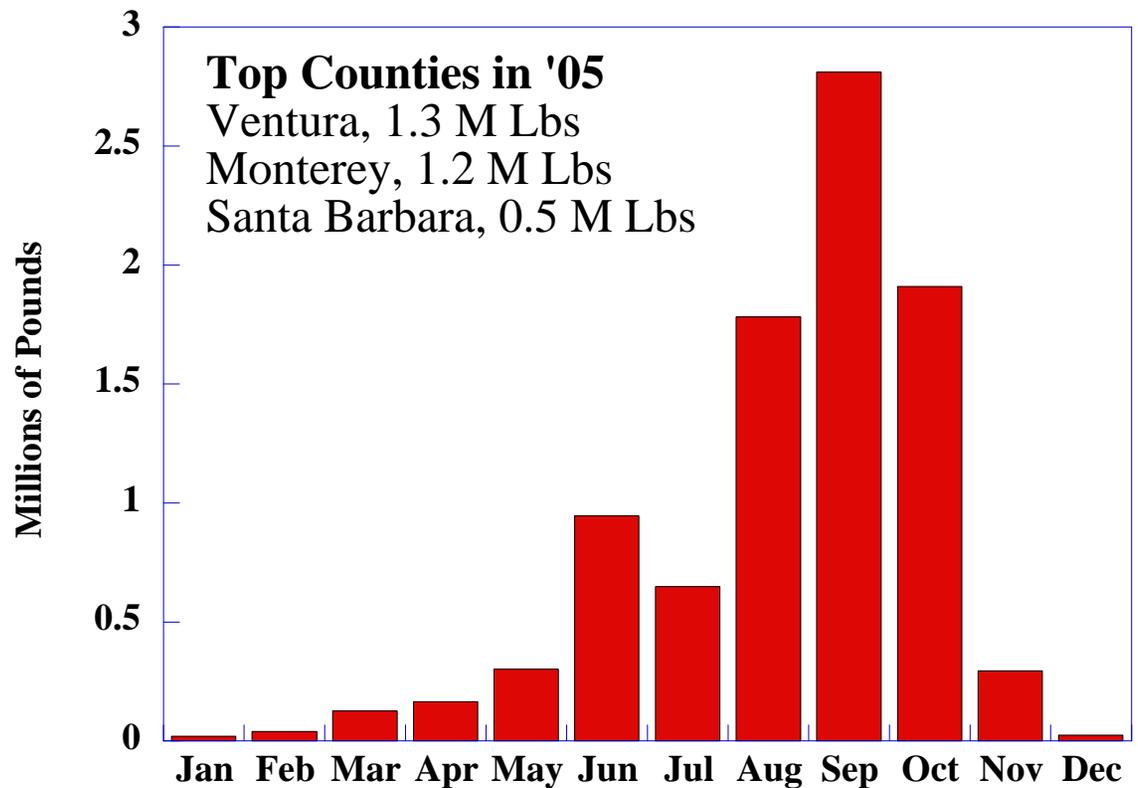
- Soil temperature is an important variable governing flux of fumigants from soil. Flux is directly proportional to observed concentrations.
- Fumigations conducted in the Central Valley, Imperial Valley, Coachella Valley will often be carried out in the hotter months of the year
- Emission estimates should account for these high-temperature applications

Data Used for Emission Estimates May Underestimate Emissions

Chloropicrin

- April, 1995: Arizona
Broadcast/Untarped
43-86°F, Emiss = 62%
- April, 1995: Arizona
Bedded/Untarped
43-75°F, Emiss = 61%
- May, 1995: Arizona
Bedded/Tarped
54-88°F, Emiss = 69%
- October, 1995: Washington
Broadcast/Tarped
23-63°F, Emiss = 34%
- January, 1996: Florida
Broadcast/Tarp
55-73°F, Emiss = 36%
- August, 2003: Not reported
Drip
55-73°F, Emiss = 15%

Chloropicrin Use by Month, 2003-2005
in Counties with >0.5M Lbs Used

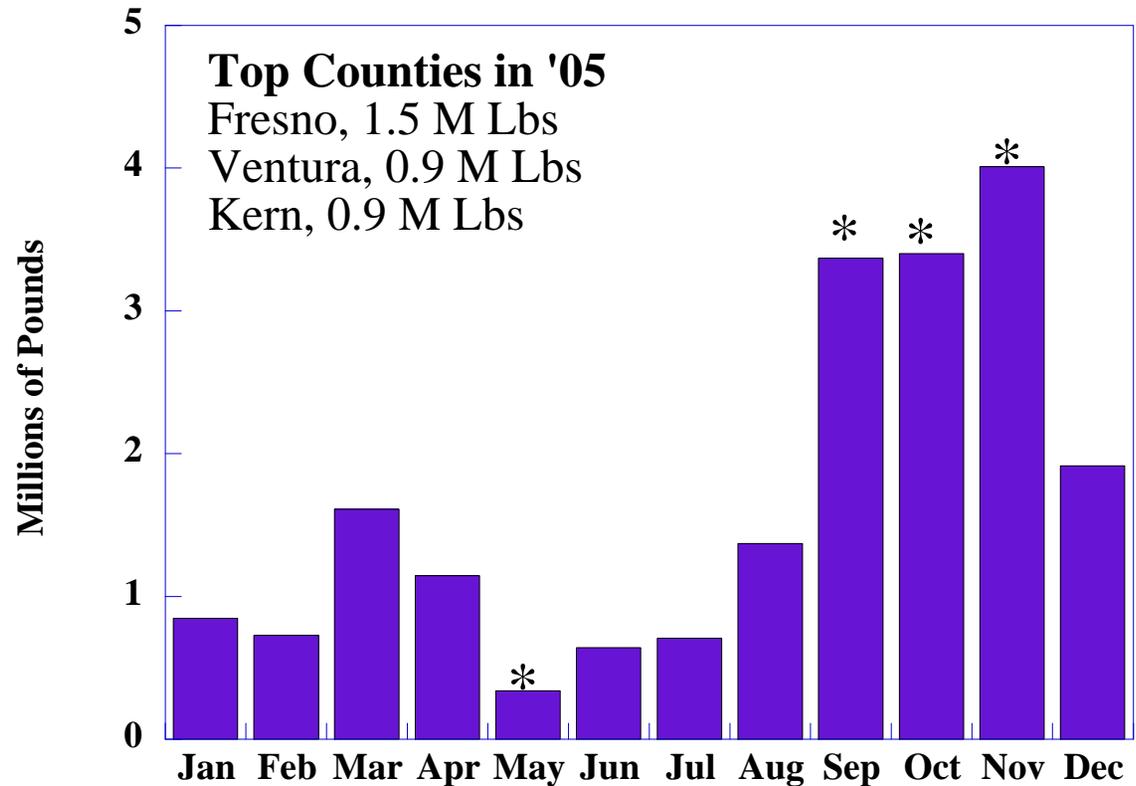


Data Used for Emission Estimates May Underestimate Emissions

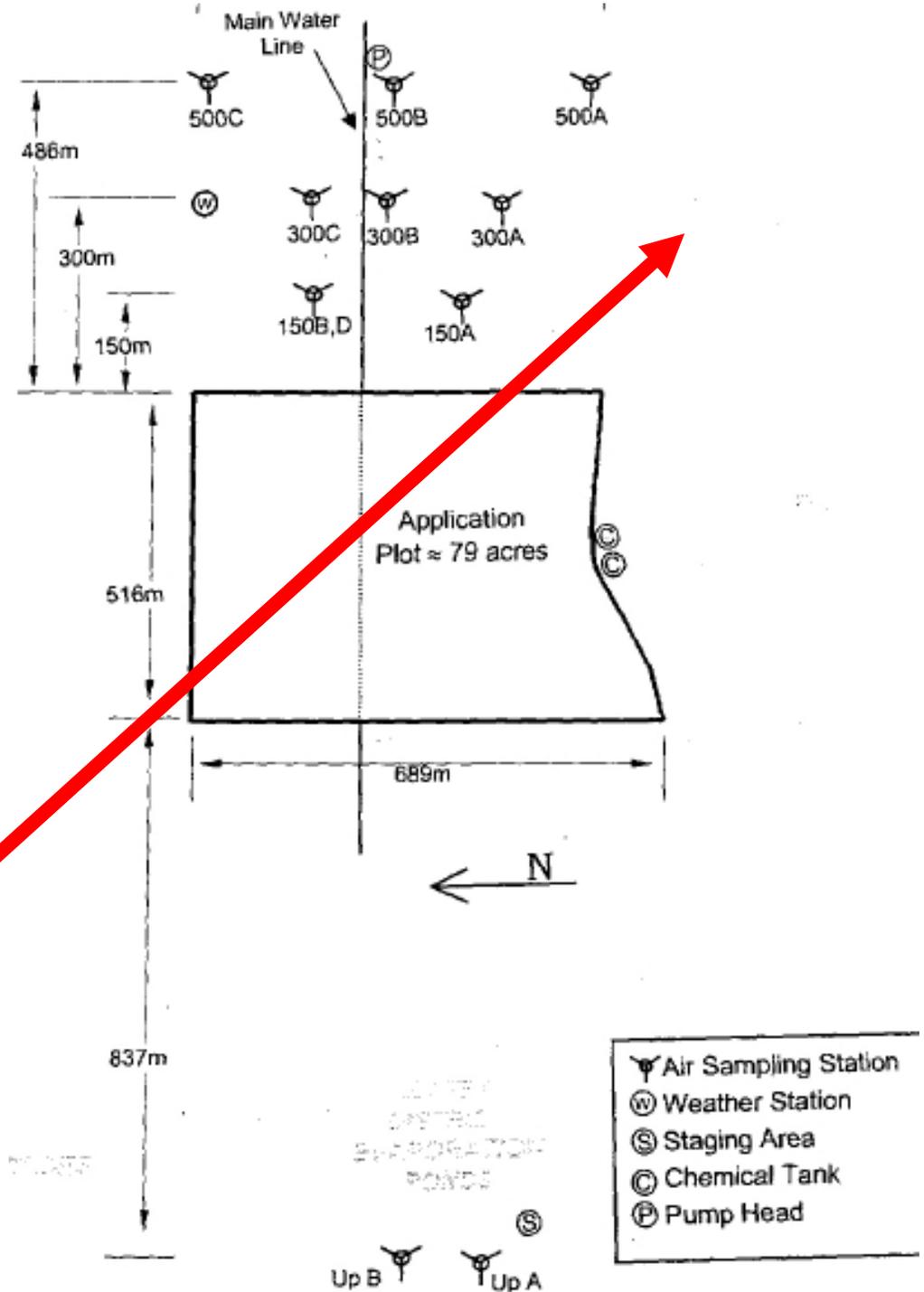
Telone

- December, 1999: Douglas Co, GA, 45-57°F
Shank/broadcast, 14”, 65%
- May, 1993: Madera Co, CA, 41-100°F
Shank/broadcast, 22”, 26%
- September, 1991: Monterey Co, CA, 51-84°F
Shank/broadcast, 18”, 25%
- October, 1998: Monterey County, CA, 45-79°F
Shank/broadcast, 14”, 65%
- November, 1995: Monterey County, CA, 42-83°F
Shank/bed-row, 12”, 65%

Telone Use by Month, 2003-2005
in Counties with >0.5M Lbs Used



Models Based on Flux Values Determined with Misplaced Samplers May Underestimate Emissions



Prevailing winds from NW

Averaging Underestimates Toxicity

- Using a 24-hour average misses the exposure peaks, which are toxicologically important in both ozone formation and the native toxicity of the fumigant

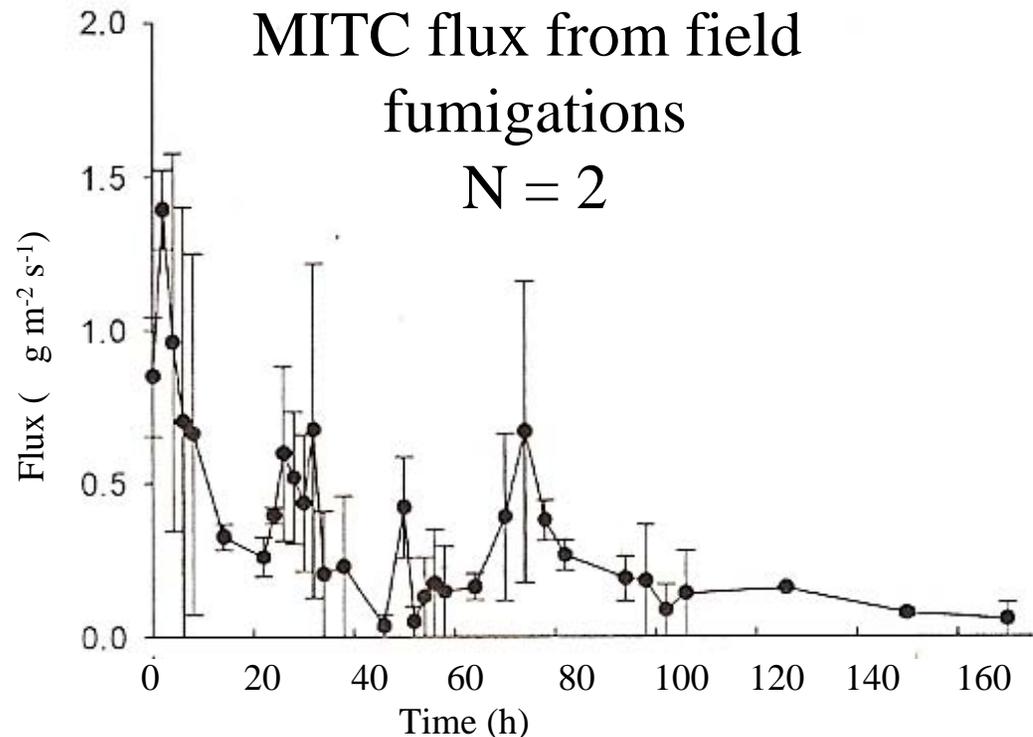
$$\text{weighted avg} = \frac{11h \times 251 \mu\text{g}/\text{m}^2\text{s} + 12h \times 57 \mu\text{g}/\text{m}^2\text{s}}{23h} = 150 \mu\text{g}/\text{m}^2\text{s}$$

Johnson, Barry, Wofford, 1999, DPR

- 4-hour and 8-hour peak values should be calculated as well

Averaging Concentrations from Multiple Studies Underestimates Emissions

- Variability is high between studies conducted under nearly identical conditions
- Emission estimates should be re-done using highest values, not averages



Yates, Papiernik, Dungan, *et. al*, *Envi. Sci.Tech.*,
2004, 38, 5489-5496.

Other Concerns & Research Needs

- Groundwater contamination
 - Monitoring needed
- Effects of plastic tarp disposal on landfills
- Why aren't ARB studies being used to estimate flux?
- How do fumigant exposure models account for temperature effects on flux?