Toxicology Update/Exposure Insights: Long Beach, CA

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Why do we keep *updating pesticide toxicology* if our regulations are based on “no effect” levels of exposure?

Personal Chemical Exposure Program

Manufacturers, regulators, universities, users, and others who should know better have done a very poor job of public education.

Toxicology

Scientific study of adverse effects of chemicals

- **Effects** are determined by dose
- Principle codified by a physician, alchemist, philosopher: *Paracelsus*, 1450
- *If dose determines a poison, there must be a safe level of everything!*

Bob.Krieger@ucr.edu, Personal Chemical Exposure Program, 2009

Pesticides

Very special chemicals!

Preserve safe uses!

You make a difference–
know your stuff!

We live in a chemical world!

More than 32,000,000 known

- Origin

Natural and Synthetic

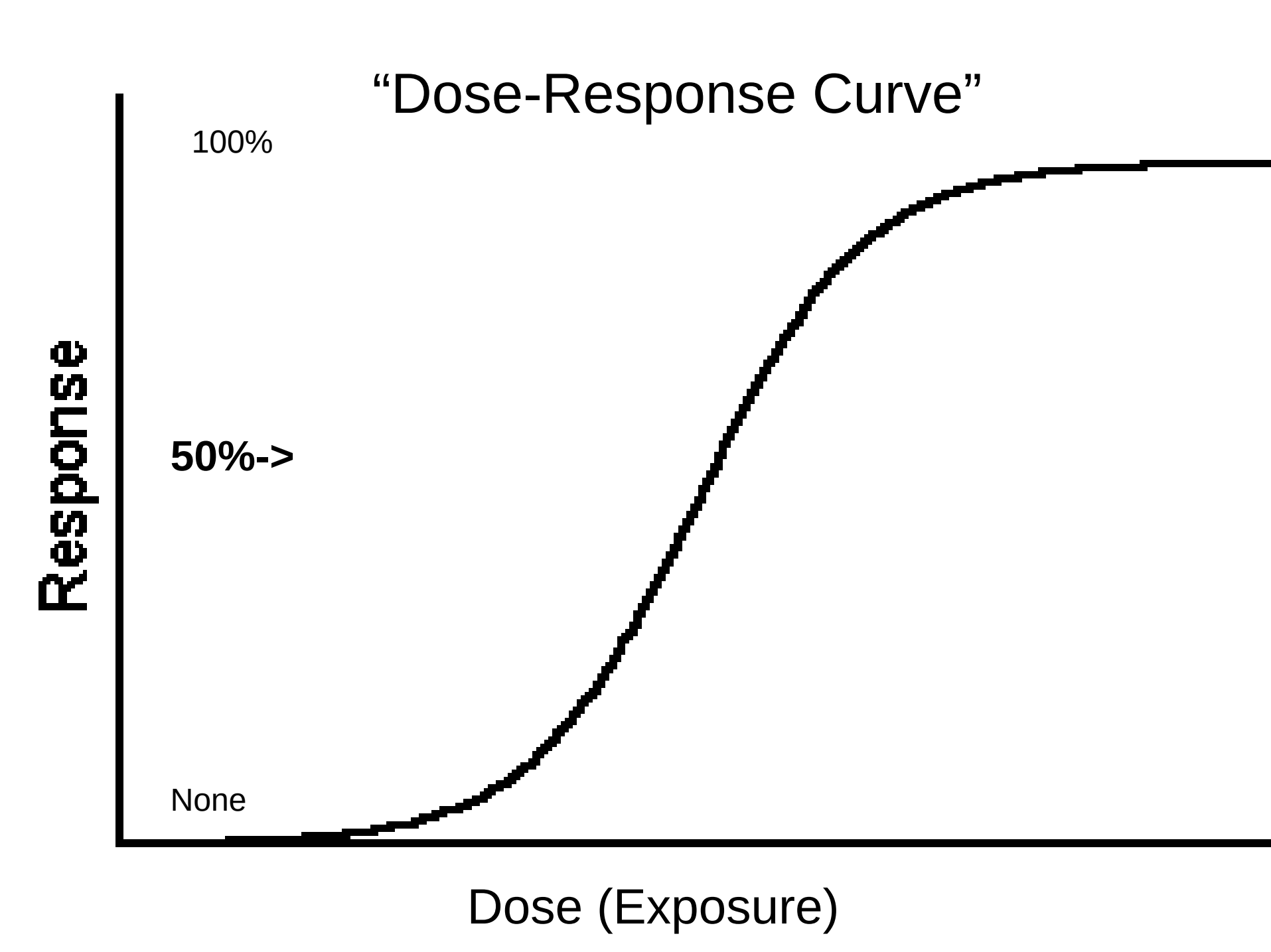
- Class

Organic and Inorganic

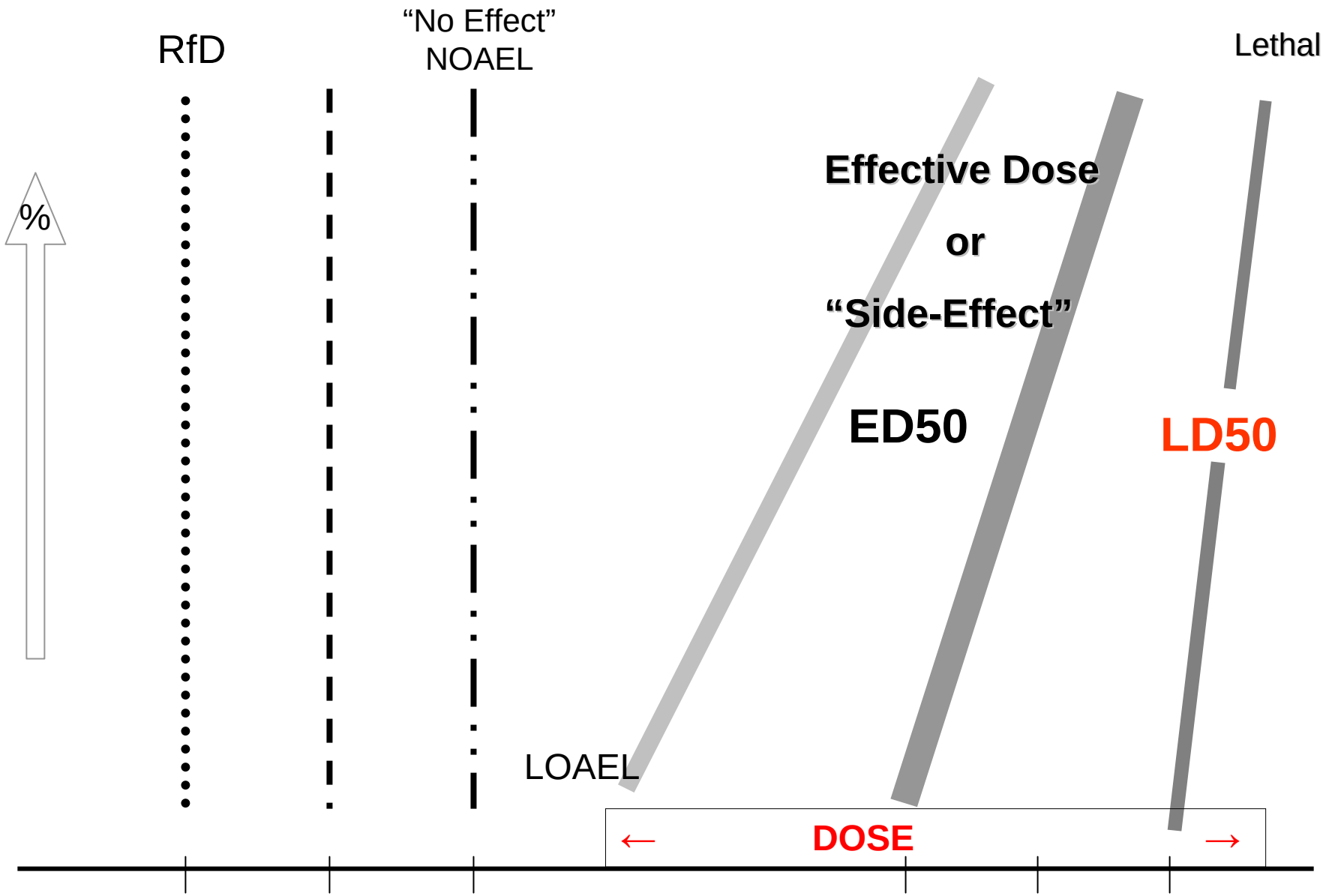
- Sustainable Use

Process •• ***Commercial Products*** •• Pollutants

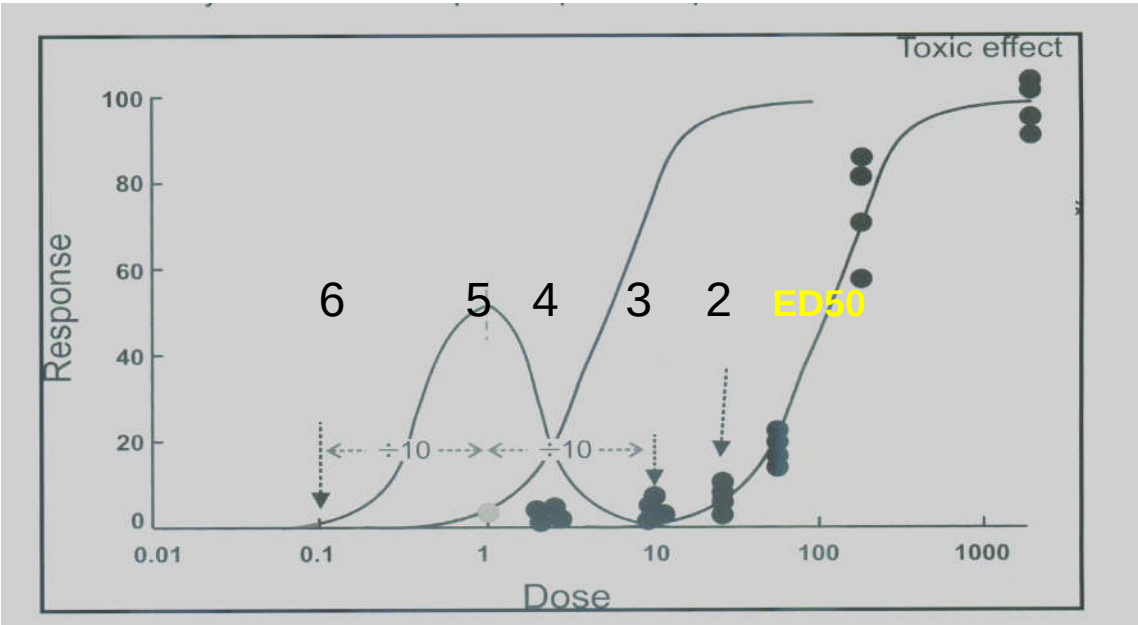
Foods • Drugs • Cosmetics • Pesticides


“Dose-Response Curve”
100%
50%->
None
Response
Dose (Exposure)

Safety Evaluation: Exposure-Response Relationships



What about everyday exposures?



Dose is the *amount* of exposure in a specified *time*.

Response is *toxicity* or the *adverse effect*.

Effective Dose for 50% of the test population (ED50)

2 “threshold”; 3 LOAEL; 4 NOAEL; 5 estimated NOAEL; 6 Reference Dose (3)/(10 *x* 10)


Exposed to a pesticide!
What?

Which compound is **LEAST** toxic to a human applicator (based on acute oral LD_{50}):

Name of insecticide	**Mammalian Toxicity**
Sevin	300 mg/kg
Guthion	13 mg/kg
Kryocide	35 mg/kg
Cypermethrin	250 mg/kg
Cyfluthrin	869-1271 mg/kg

How do we come to a “safe dose?”

- LD50 rat oral 250 mg/kg

Toxicity testing: Developmental effects in rats-decreased weight gain and feed consumption

- LOAEL (threshold) 25 mg/kg
- *NOAEL* *12.5 mg/kg*

Uncertainty factors: (1/10)(1/10)(1/10) = 1/1000

- *Reference Dose* *0.0125 mg/kg*

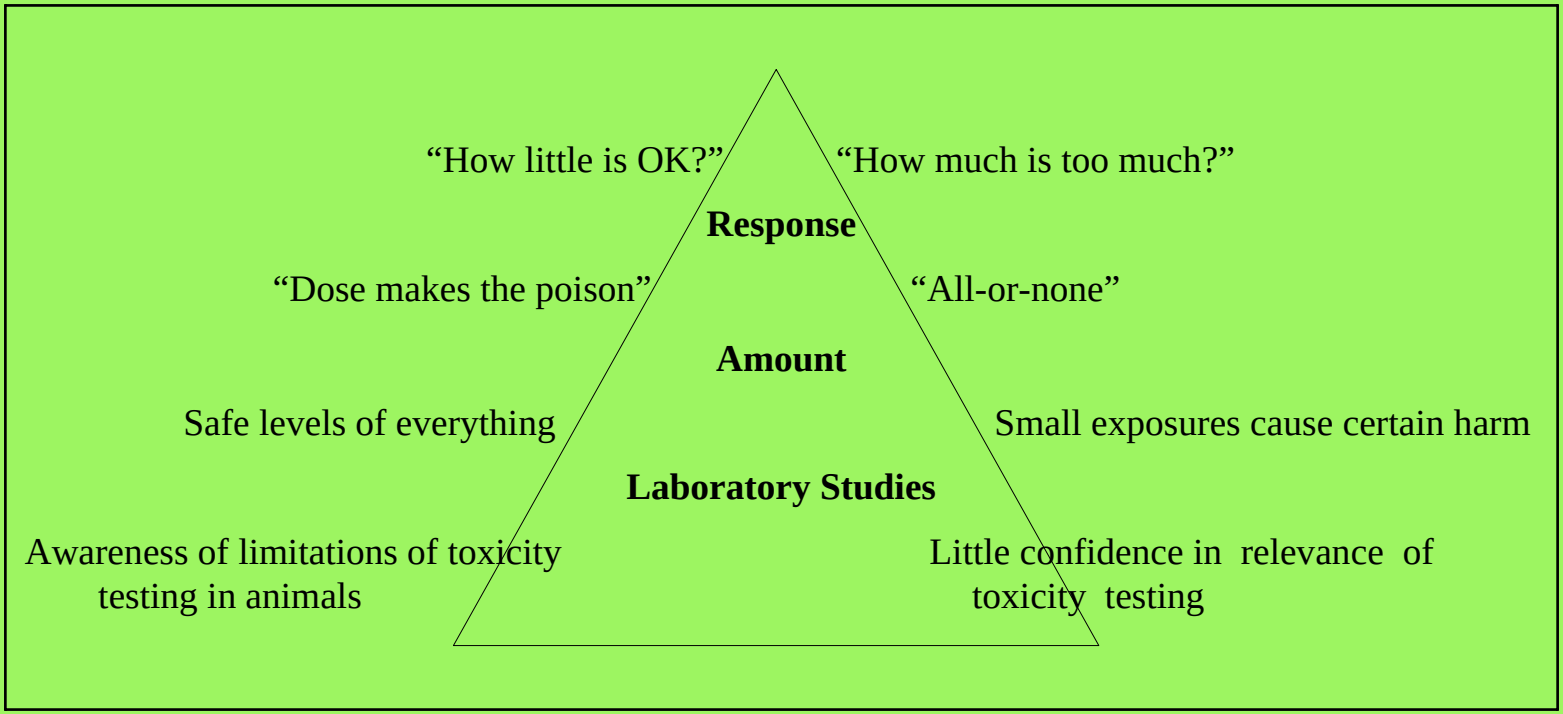
How does contact occur?

Testing and On-the-Job Exposures

- Carrier or vehicle in lab rats, LD50
- Route

- Corn oil 250 mg/kg
  Water 4123 mg/kg
- Mouth 250 mg/kg
  Skin >4000 mg/kg

So What?



Personal Views of Pesticide Exposure

Hazard and **Risk**

Hazards do not become ***risks*** unless a vulnerable population is exposed producing an adverse effect.

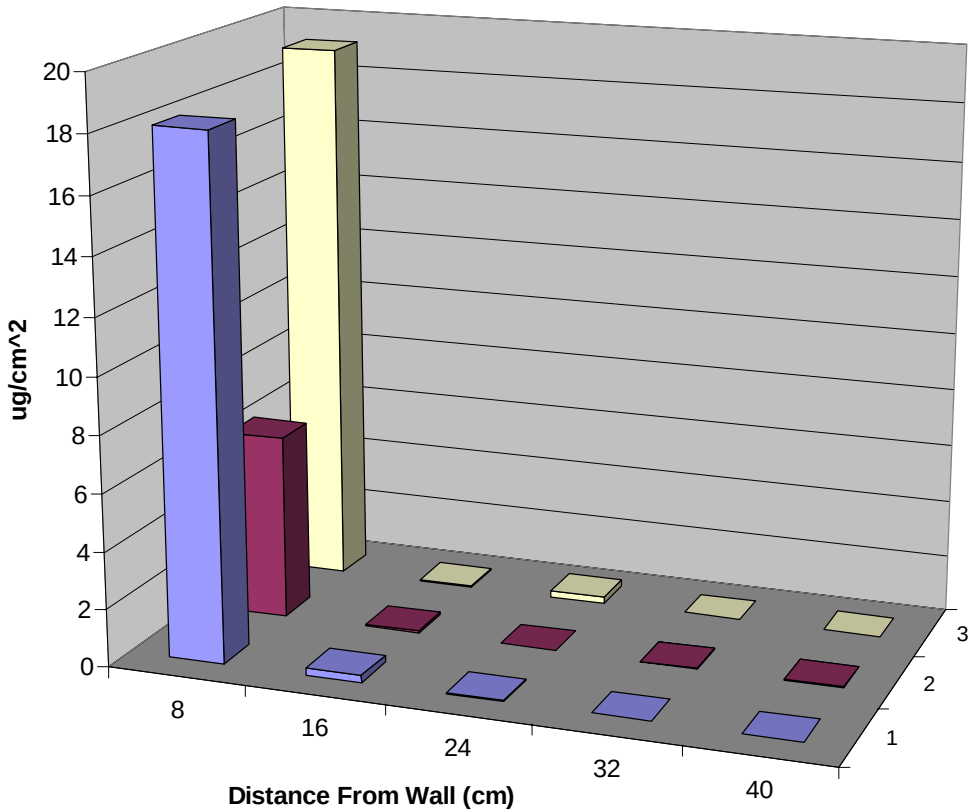
Getting the numbers right for risk assessment!

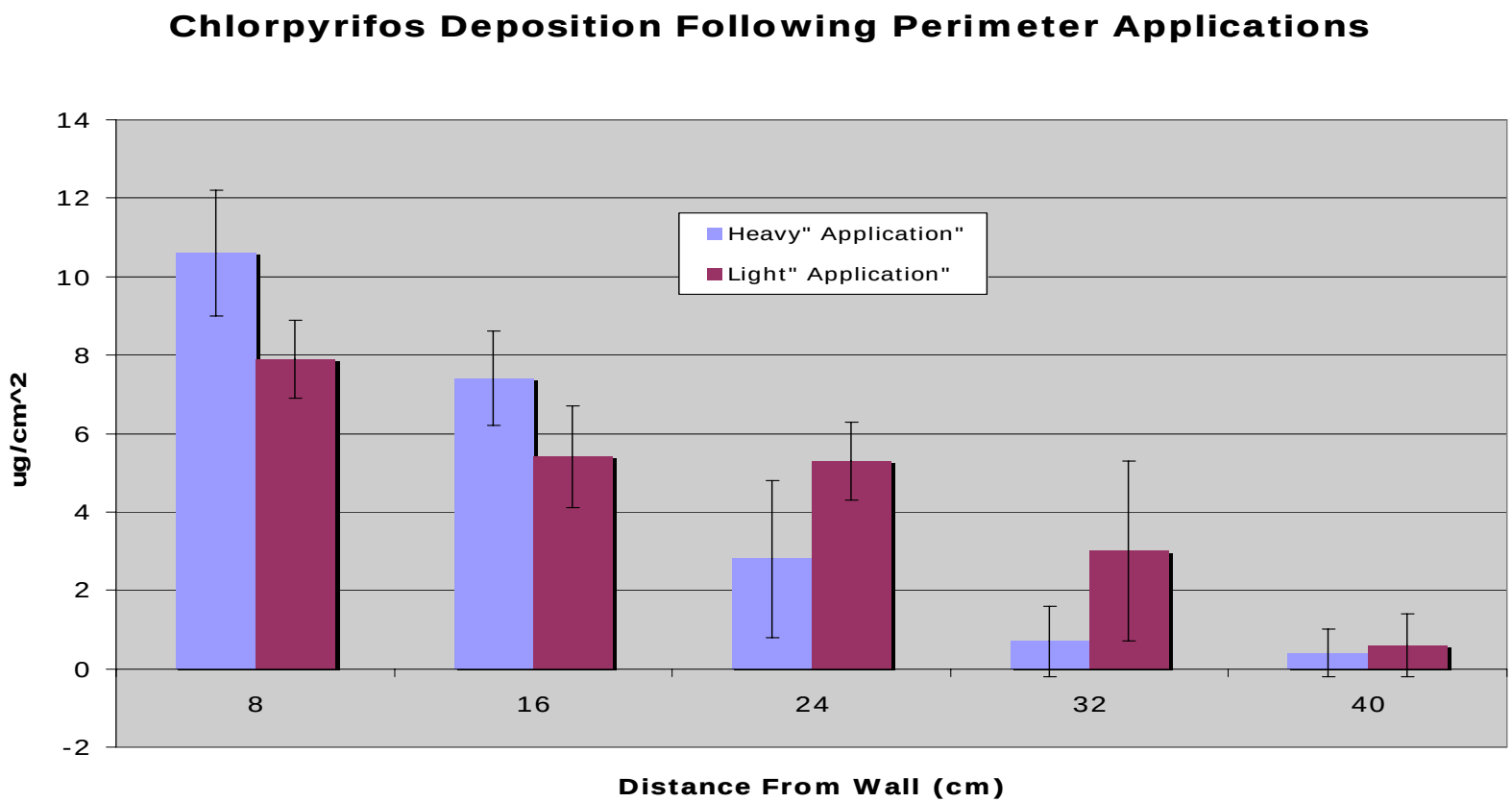
Surface Exposure Potential: Determined by Spray Deposition (ug/cm^2)

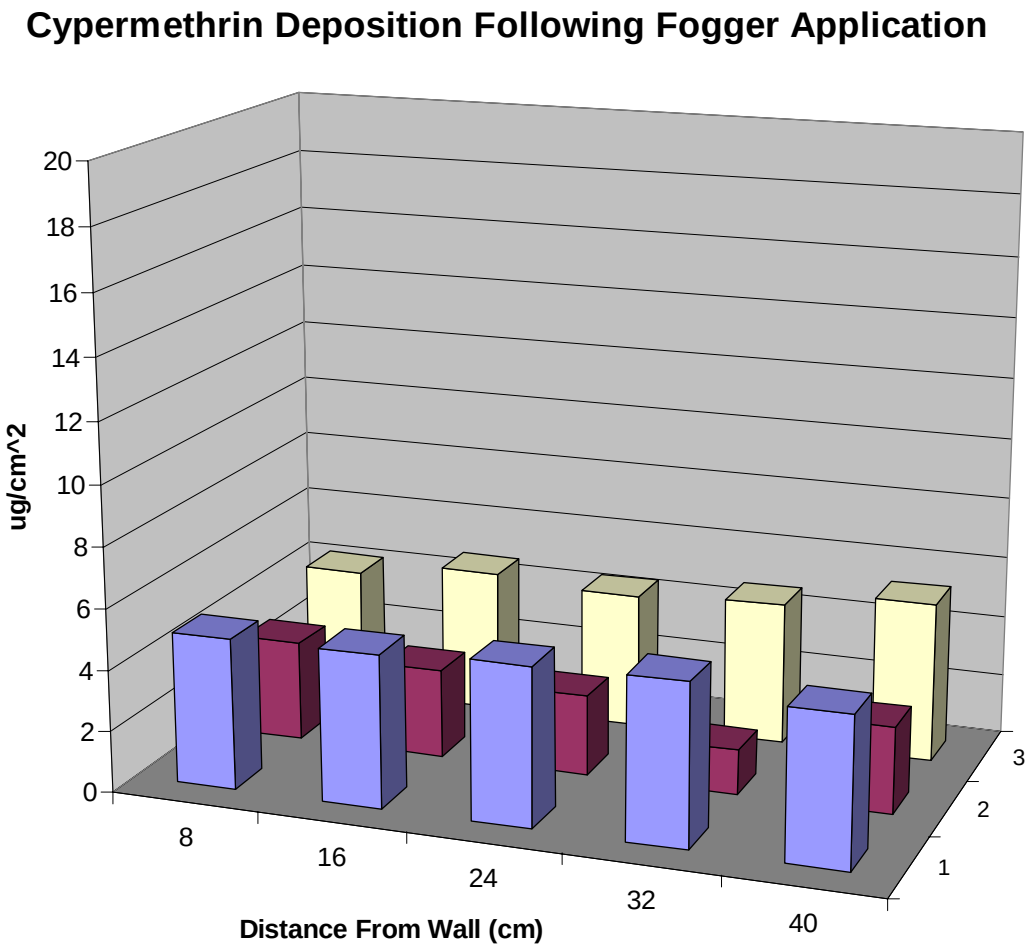
	Room Average
• Crack and Crevice	1.4
• Perimeter (Band)	1.8
• Fogger (Area)	4.1
• Spot Spray	0.2

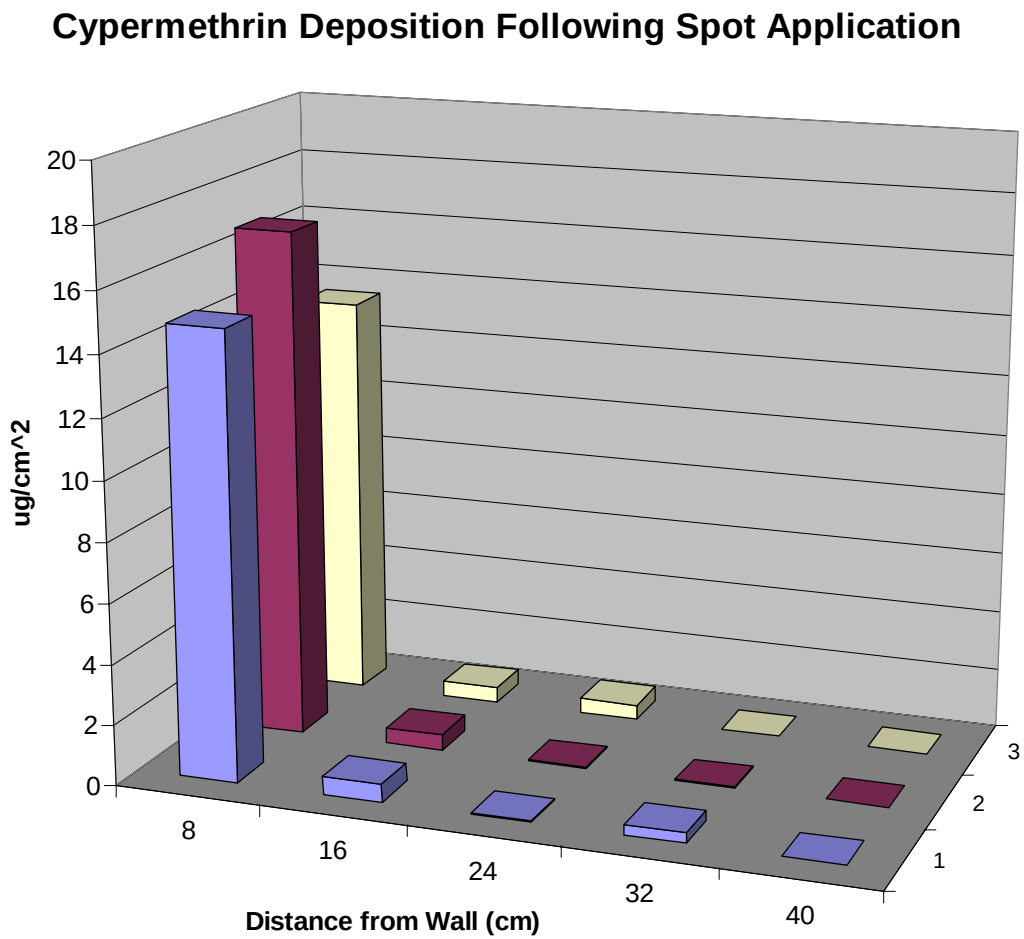
And you are the sprayer!

Deltamethrin Deposition Following Crack and Crevice Application




Chlorpyrifos Deposition Following Perimeter Applications
14
12
10
8
6
4
2
0
-2
ug/cm^2
Heavy" Application"
Light" Application"
8
16
24
32
40
Distance From Wall (cm)


Cypermethrin Deposition Following Fogger Application
ug/cm^2
0
2
4
6
8
10
12
14
16
18
20
8
16
24
32
40
Distance From Wall (cm)
1
2
3


Cypermethrin Deposition Following Spot Application
ug/cm^2
20
18
16
14
12
10
8
6
4
2
0
8
16
24
32
40
Distance from Wall (cm)
1
2
3

Surface Exposure Potential
6-yr old child

	ug/cm^2	mg/day[a]	
• C & C	1.4	3.2	0.5 (15%)
• Band	1.8	4.2	2.1 (50%)
• Area	4.1	9.8	9.8 (100%)
• Spot	0.2	0.6	0.01 (2%)

[a]EPA 18 mg/day

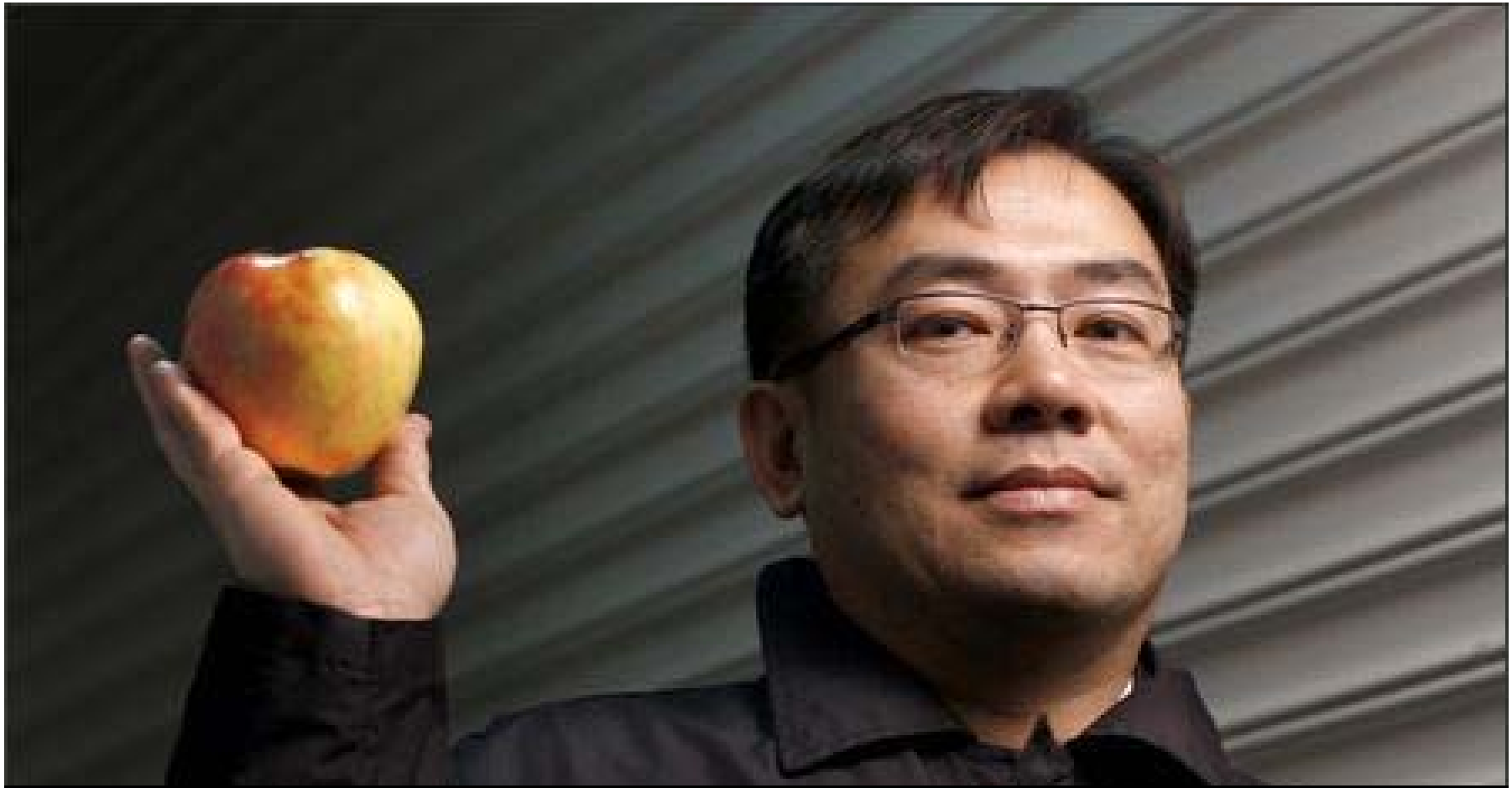
And you are the sprayer!

An estimated 90% of the people who buy organic produce do so to avoid pesticide residues….

The Organic Center

Personal Chemical Exposure Program, UC Riverside

Manufacturers, regulators, universities, users, and others who should know better, have done a very poor job of public education.



Chensheng Lu, holding a Washington apple, studied the pesticide levels in Mercer Island children. The children ate a variety of conventional produce from area groceries and then switched to organic.

Harmful pesticides found in everyday food products

Mercer Island children tested in yearlong study

What about the pesticide residue exposure in food that the consumer wants to avoid…

Residue to Dose

- Residue level,
  ppm to ppb
- Amount eaten, g

- 50 g strawberries
- 1 ppm insecticide

- 50 g x 1 ug/g = 50 ug

- Dosage is amount per body weight
- 50 ug/100 kg *or*
  0.5 ug/kg

If 2 tablets acetaminophen per 100kg

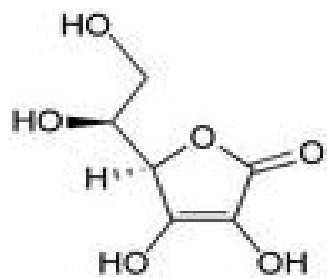
- 10,000 ug/kg

Pesticide residues are tiny!

Insecticide and fungicide residues may be on produce in tiny amounts…parts per billion

For a child to get even a NO EFFECT dose, they would have to eat over 1000 average servings and their parents more than 3-times that much!

But it just can't happen, because the natural Vitamin C in the berries would make both of them sick long before they could even get to the NO EFFECT dose!



Your experiences with pesticides
and
Public and Regulatory
Perceptions of Pesticide
Safety and Risk, 2009

Simply don’t match! Get it right!

My personal recommendation:
Demonstrate safe pest management…

- Everything goes someplace.
- Exposure is inevitable at some level.
- Even zero isn't none!
- Exposure is not an effect.
- *How little is OK?* Usual amounts.
- What is *usual*? Read and heed label.