Pesticide safety is mostly the user's responsibility.

- Premarket safety evaluation backs the label use of pesticide products.
- There are about 900 active ingredients in the U. S. and many more products in commercial use.
- Label directions and good judgment are essential for safe pesticide use.

Reference chemical exposures

Chemical	Usual Dose	Toxic Dose	Source	Selected Responses	Lethal Dose
Alcohol Ethanol Blood Level	0.05%	0.1%	Beverages	Blurred vision, staggering, nausea	0.5%
Carbon Monoxide % Carboxy Hemoglobin	<10%	20-30%	Combustion	headache, nausea, fatigue	>60%
Secobarbital (sleep aid) Blood Levels	0.1 mg/dL	0.7 mg/dL	Prescription drug	staggering, slurred speech, drowsiness	>1 mg/dL
Aspirin	0.65 gm 2 tablets	9.75 gm 30 tablets	OTC drug	stomach pain, heartburn, gastric bleeding	34 gm 105 tablets
Acetaminophen Tylenol (over 200 products)	500 mg tablet	7000 mg 14 tablets	OTC drug	nausea, vomiting, liver toxicity	>25,000 mg 50 tablets

Krieger After Gossel and Bricker, Principles of Clinical Toxicology

Dose, Toxicity, Safety

Chemical	Usual Dose	Toxic Dose	Lethal Dose	Margin of Safety	Therapeutic Index
Alcohol Ethanol Blood Level	**0.05%**	0.1%	**0.5%**	2	**10**
Carbon Monoxide % Carboxy Hemoglobin	**<10%**	20-30%	**>60%**	>2	**>6**
Secobarbital (sleep aid) Blood Levels	**0.1 mg/dL**	0.7 mg/dL	**>1 mg/dL**	7	**>10**
Aspirin	**650 mg** 2 tablets	9.75 gm 30 tablets	**34,000 mg** 105 tablets	15	**53**
Acetaminophen Tylenol (over 200 products)	**500 mg** tablet	7000 mg 14 tablets	**>25,000 mg** 50 tablets	14	**50**

After Gossel and Bricker, Principles of Clinical Toxicology

Acute toxicities of selected insecticides

Chemical active ingredient	Usual Exposure	Non-Toxic Level mg/kg	Lowest Toxic Level mg/kg	Use	LD50[a] Oral, rat mg/kg
Cyfluthrin	micrograms mg/1000	2	7.5	Cy-Kick[b]	869-1271
Fipronil		2.5	7.5	Termidor	97
Imidacloprid		5.7 (males) 7.6 (females)	-	Premise/Imaxx	450
Permethrin		5	-	Permethrin	430-4000
Pyrethrin		10	-	Pyrethrins	200-2600

[a] Table salt = 3000 mg/kg (low human lethal est 1000 mg/kg)
[b] Oral unlikely since product is pressurized and producing aerosols.

Non-Toxic Level, Reference dose, Safe use!

DPR reviews registrant labels approved by USEPA to be sure use can be safe in California.

- Californians uses 150-200 million pounds of pesticide active ingredients each year
- The Department of Pesticide Regulation (DPR) oversees residential and commercial pesticide use
- Pesticide Use Reports are a unique feature of California regulation

Important Regulatory Tools of USEPA and Cal-EPA

- Risk Characterization
- Re-evaluation

User experience is invaluable in the process; take part whenever possible.

Danger, Warning, and Caution come from product and active ingredient toxicity testing.

- Signal Words come from acute toxicity testing of products and active ingredients
- Risk of skin and eye contact, ingestion, and inhalation are used to determine *product* Signal Words
- Signal Words represents the most sensitive response (*toxicity*) in the most sensitive test animal
- The tests are often called “The 6-Pack”

Pesticide Toxicology

Label signal words and relative toxicities

Signal Word	Toxicity	Oral Lethal Dose (Human, 150 lbs.)
Danger[a]	Highly toxic	Few drops to 1 teaspoon[b]
Warning	Moderately toxic	1 teaspoon to 1 tablespoon
Caution	Low toxicity	1 ounce to more than a pint

[a] Skull and cross bones + POISON for highly and extremely hazardous a.i.s

[b] Lower doses for children.

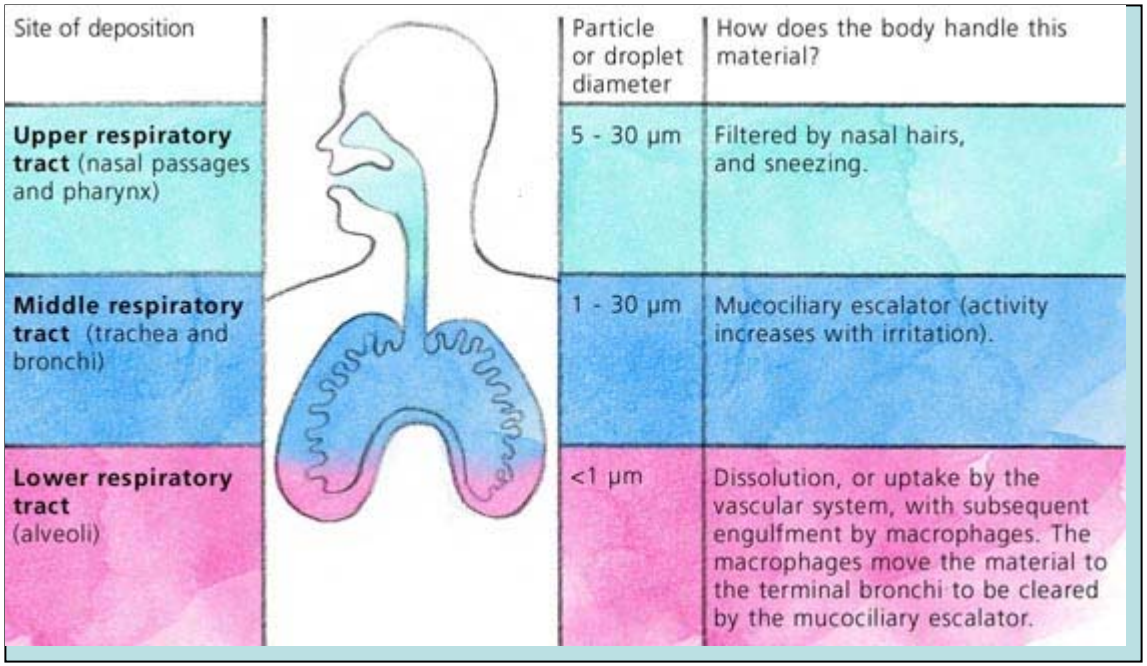
Applicators are most exposed to inert and active ingredients by touch and breathing.

- Human exposures are accidental, unintended, or unavoidable—chemicals are the environment!
- Routes include skin absorption plus inhalation and ingestion (total is aggregate exposure)
- Exposure is contact with the potential for absorption (getting into the bloodstream).
- Applicators or persons who handle, mix or load concentrates or sprays are primarily protected from skin absorption by clothing
- Inhalation is a critically important route of exposure by gases or other very volatile products

Chemicals are the **Environment!**

- Exposure determines dose!
- 10 trillion cells served
  in minutes—multiple receptors
- Entry: skin, lungs, digestive tract
- Metabolic transformations
- Multiple elimination pathways
- You're not a garbage bag!

Absorption is fastest with breathing, but uptake is low because of volatility and contact time.

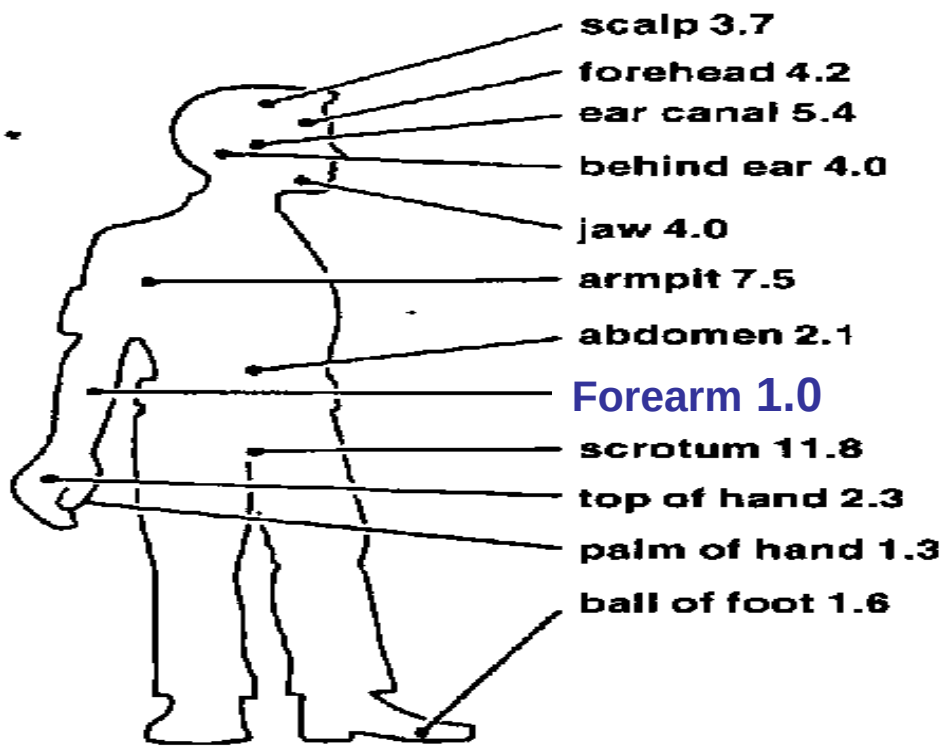


Site of deposition	Particle or droplet diameter	How does the body handle this material?
Upper respiratory tract (nasal passages and pharynx)	5 - 30 μm	Filtered by nasal hairs, and sneezing.
Middle respiratory tract (trachea and bronchi)	1 - 30 μm	Mucociliary escalator (activity increases with irritation).
Lower respiratory tract (alveoli)	<1 μm	Dissolution, or uptake by the vascular system, with subsequent engulfment by macrophages. The macrophages move the material to the terminal bronchi to be cleared by the mucociliary escalator.

Respirators reduce inhalation exposure

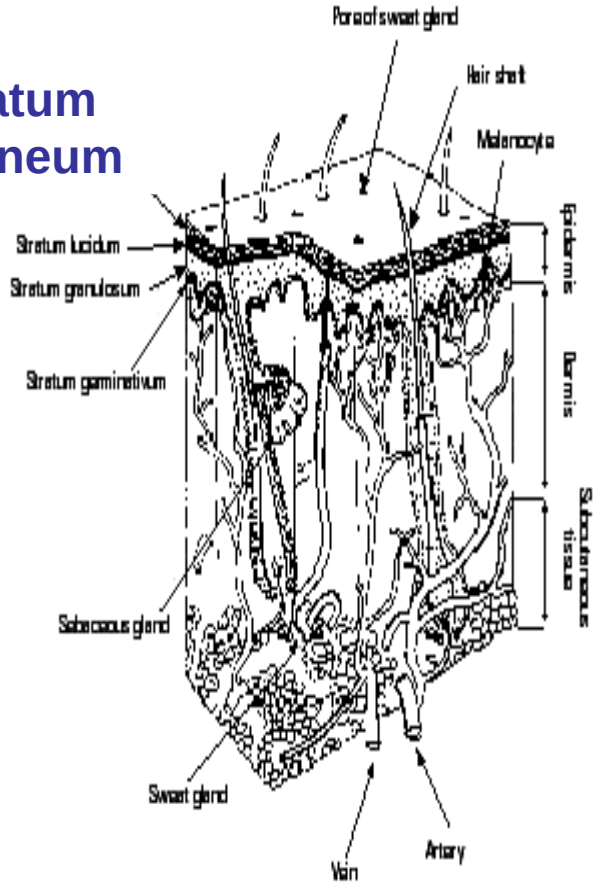
Skin uptake is the most important exposure for product mixers, applicators, and persons who touch treated plants, equipment or indoor surfaces.

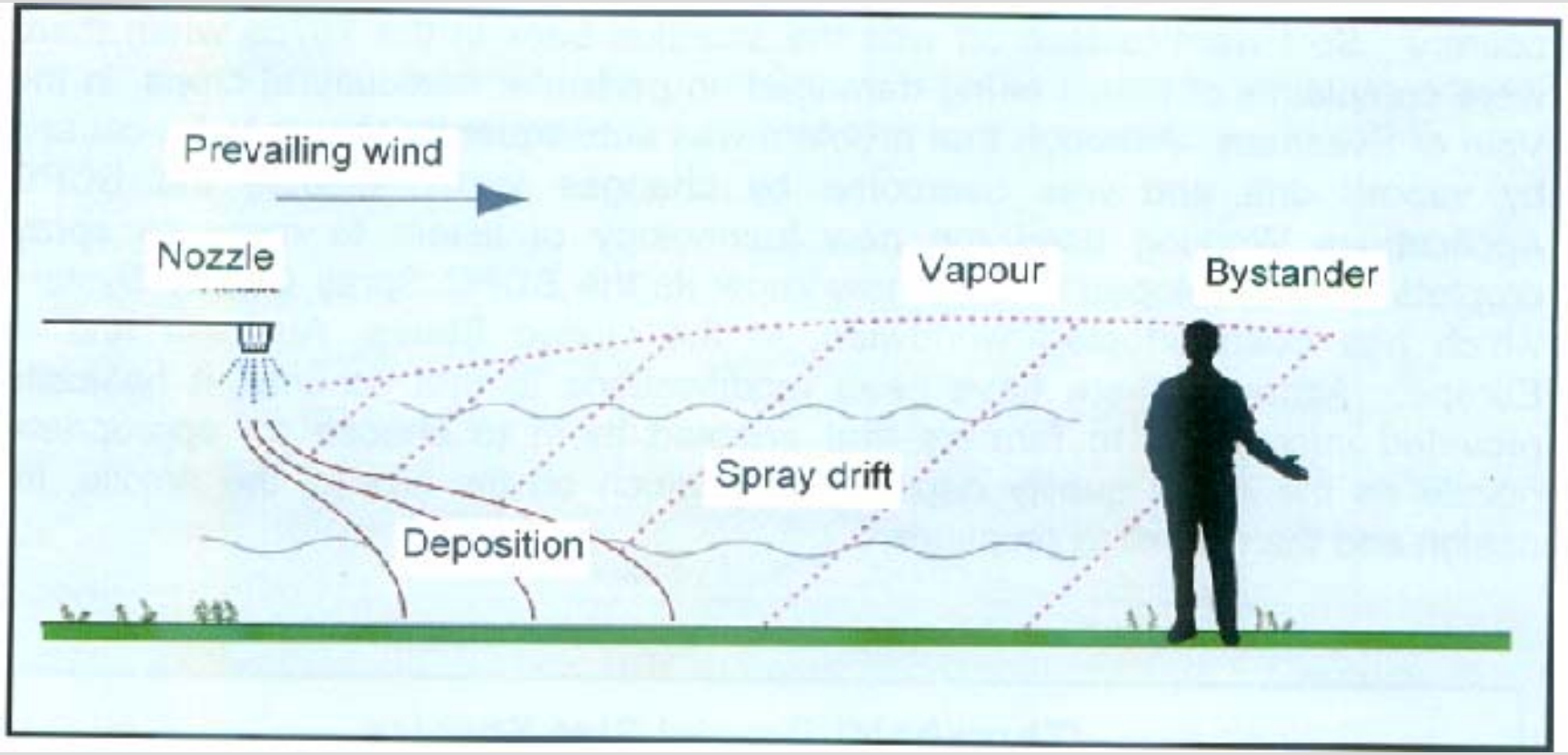
- Intact skin gives multi-layer protection
- Skin qualities and blood supply



Rates of Pesticide Exposure Through the Skin. Rates of absorption through the skin are different for different parts of the body. Compared to dermal absorption rate through the forearm (absorption rate of 1), absorption through the groin area would be more than 11 times faster.

stratum corneum

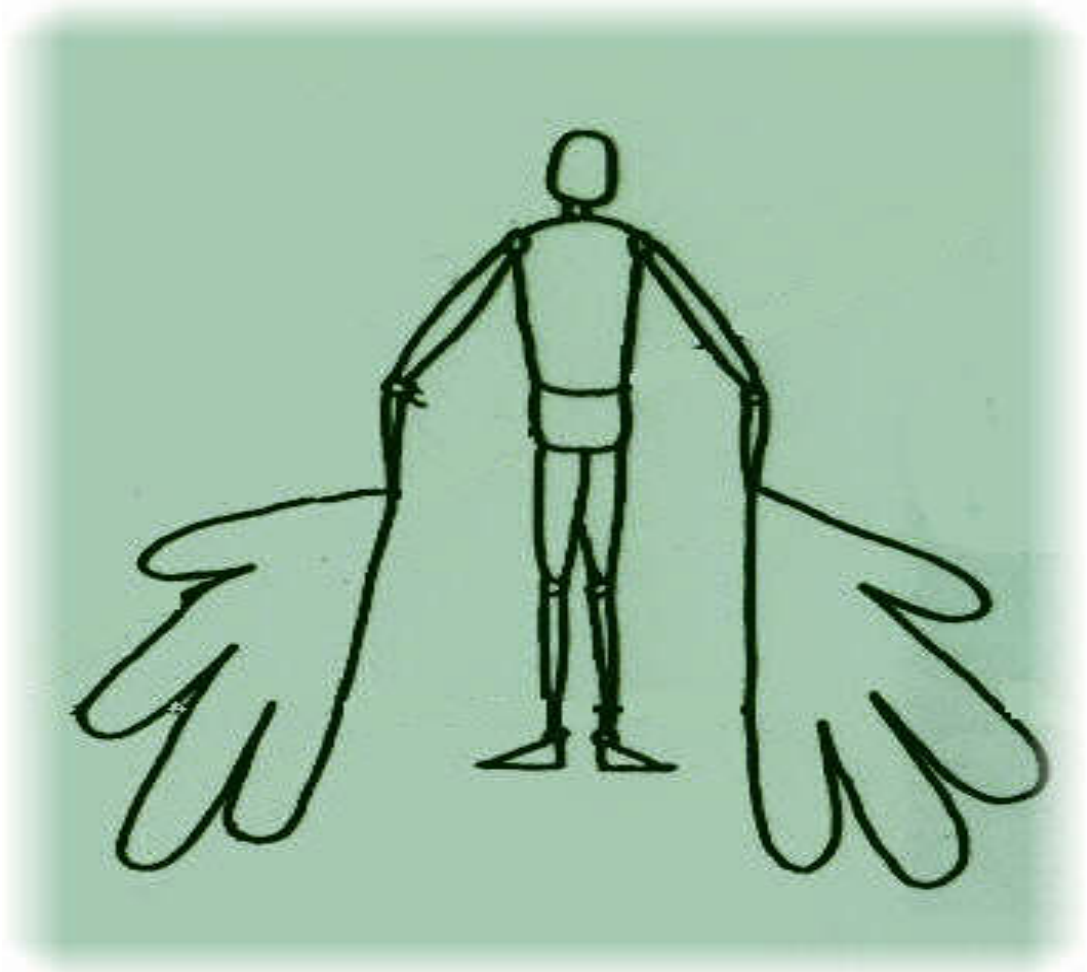



Prevailing wind
Nozzle
Vapour
Bystander
Spray drift
Deposition

Long-sleeved shirts, long pants, socks and shoes are Standard Worker Protection clothing.

- Clothing is the first layer of protection from spray particles or surface residues
- Coveralls or other outer garments also retain residues
- Personal Protective Equipment (PPE) provide additional exposure reduction
- Separate work clothes for laundry

PCEP suggests that gloves and hand washing are simple ways to reduce pesticide uptake.



Hands and lower arm may contribute 50-90% of absorbed dose….

Customers keep you in business; Deliver service and Minimize pesticide exposure

- Know products
- Maintain equipment
- Good personal hygiene
- Clean clothes
- Hand protection

- Don’t “overdress”
- Good judgment
- Give responsible service

Pesticide breakdown products are made as soon as uptake occurs, and the primary way the products are eliminated is urine.

- Pesticides are formulated to be applied in a specific way that maximizes usefulness
- Active ingredients are more oil (fat) soluble than their breakdown (metabolic) products
- Breakdown products are also present in the environment, especially the diet, in trace amounts that can interfere with exposure assessment using biological monitoring

2005 CDC Third National Report

EPA survey of U.S. population-chemical inventory

Metals (Lead, mercury, cadmium) 13	Pyrethroid Pesticides 5	Phytoestrogens 6	Tobacco Smoke 1
Organochlorine Pesticides 16	Other Pesticides 5	PAHs 22	
OP Insecticides: DAP 6	Herbicides 6	Cl_x-dioxins & Furans 17	
OP: Specific Metabolites 5	Phthalates 12	PCBs 36	148

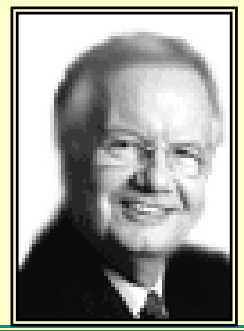
Environmental Chemical Inventories

- CDC/March 2001 27 chemicals
- CDC/January 2003 116
- CDC/June 2005 148
- EWG/Mt.Sinai 167 (total, n = 9)

"the most comprehensive assessment of chemical contamination in individuals ever performed."









Biomonitoring Impact

"The emotional dimension of chemical body burden data poses a major communications and stewardship challenge to industry."

William K. Rawson, Lawyer
Washington, D. C.

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.

STRAWBERRIES

Quantity consumed in a day

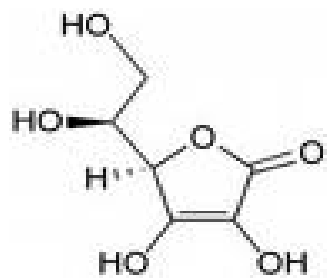
Mean 44 g

USDA, 2002

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!



Product safety evaluation scientifically establishes toxicity thresholds and estimates No Observed Adverse Effect Levels

Regulatory Risk Characterization

- Hazard identification
- Dose-response studies
- Exposure assessment
- Risk assessment

Regulatory Response

How Does DPR Address Issues?

- Adopt known mitigation approaches
- Develop “new” approaches for mitigation
- Request add’l data (Reevaluation) to:
  - Evaluate Problem
  - Find Solutions
- Utilize modeling & other scientific tools to develop specific requirements

To be Professional, you must take part in the process! Actively evaluate what you do. Use your experience to advance Pesticide Science and effective Regulation.

Product safety evaluation scientifically establishes toxicity thresholds and estimates No Observed Adverse Effect Levels

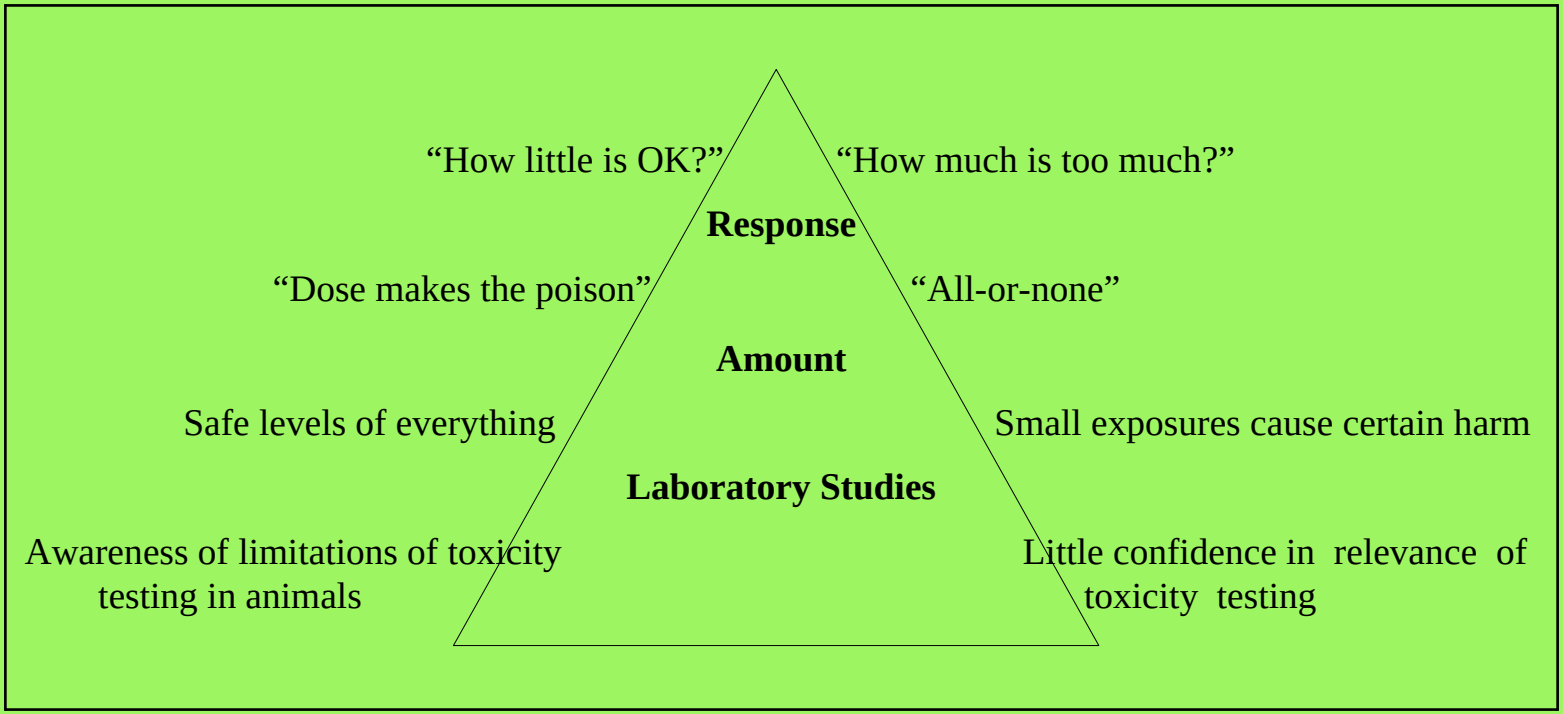
Regulatory Risk Characterization

- Hazard identification
- Dose-response studies
- Exposure assessment
- Risk assessment

Our Common Experience

- Health is a state of being
- *Hazards* become *risks* when a vulnerable population is harmed by exposure
- Humans thrive in a complex chemical world.

So What?



Personal Views of Pesticide Exposure

*Hazards become risks **only** if a vulnerable population is exposed producing an adverse effect.*