Understanding Pesticide Exposure

Increasing Applicator Protection
HAZARD = EXPOSURE x TOXICITY

Exposure - How pesticides enter the body

Toxicity - The potential of a chemical to be poisonous
Parts of the body absorb pesticides at different rates:

- The head is 4 times more absorbent than the hand.
- The genital area is 11 times more absorbent.
4 Methods of Exposure

- Dermal (skin)
- Oral (mouth)
- Inhalation (lungs)
- Eyes
Dermal Exposure

- Through the skin
  - Hands and forearms are most common

- 97% of all pesticide exposures are dermal
Gloves

- Reduce exposure 90+%
- Should be unlined
- Chemically resistant **NOT** leather or cloth
Dermal Exposure

- Rinse exposed area immediately with water
- Remove contaminated clothing
- Wash with plenty of soap and water
Oral Exposure

- Through the mouth
- Mostly occurs because of improper storage
Pesticides removed from their original containers are the highest cause of pesticide poisonings in adults and children.
Rinse mouth with water

Do not induce vomiting if:

- Victim is unconscious or is having convulsions
- Petroleum based product
- Corrosive pesticide
- Label specifies NOT to induce vomiting
Inhalation Exposure

- More common when using fine dusts and mists
- Mixing and loading concentrates
- Lung exposure is the fastest way to the bloodstream
Inhalation Exposure

- Use respiratory protection as directed by the label

PERSONAL PROTECTIVE EQUIPMENT (PPE)
Applicators and other handlers must wear:
- Protective eyewear
- Coveralls over long-sleeved shirt and long pants
- Waterproof gloves
- Shoes plus socks
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing or loading
- For handling activities, a dust/mist filtering respirator (MSHA/NIOSH) approval number prefix TC-21C

Follow manufacturer’s instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.
Inhalation Exposure

◆ Ensure proper respirator fit
  ● facial hair does not allow for a good fit
Inhalation Exposure

- Remove person to fresh air
- Loosen tight clothing
- Keep air passages clear
- Perform artificial respiration if necessary
Eye exposure

- More common when mixing
- When the potential for splashing exists
Eye exposure

- Protective eye wear should be worn when a chance of spill or splash exists
  - Especially when mixing concentrates
Eye exposure

- Wash eye with a gentle stream of clean water for 15+ minutes
- Get medical attention if there is pain or reddening of the eye
First Aid Summary

- Act immediately!
- Stop exposure
- Rinse with clean water
- Read and follow label directions!
- See a doctor and bring the pesticide label
HAZARD = EXPOSURE x TOXICITY

Toxicity = The potential of a chemical to be poisonous.

SIGNAL WORD: LD50
Acute Toxicity

◆ Potential of a pesticide to cause injury from a single dose.

◆ Immediate harm caused by pesticide exposure (within 24 hours)
Acute Toxicity - Symptoms

◆ **Dermal** - skin irritation, itching, reddening
◆ **Oral** - nausea, muscle twitching, sweating, weakness
◆ **Inhalation** - burning of throat and lungs, coughing
◆ **Eye** - temporary or permanent irritation or blindness
Acute Toxicity is measured in \( \text{LD}_{50} \) and \( \text{LC}_{50} \).
Lethal Dose 50

- Amount of a chemical that it takes to kill 50% of the test population
LD_{50}

LD50’s are used to compare the toxicities of different chemicals
What this means…

**HIGHER** \( \text{LD}_{50}/\text{LC}_{50} \) => less toxic

**LOWER** \( \text{LD}_{50}/\text{LC}_{50} \) => more toxic
Signal Words

◆ “Warning signs” on the label that indicate the toxicity of the pesticide to both humans and animals
Signal Words

Signal words measure acute toxicity for skin, mouth, lung and eye exposure.
Danger / Poison

- The oral LD$_{50}$ is up to 50 mg/kg
- Human Exposure – trace to teaspoon is fatal to 150lb. person
Warning

◆ The oral LD$_{50}$ is between 50 and 500 mg/kg
◆ Human Exposure - two teaspoons is fatal to 150lb. person
Caution

- The oral LD_{50} values are 500 mg/kg and above
Danger

◆ Can be a potential skin and/or eye irritant
## Toxicity - 4 Categories

<table>
<thead>
<tr>
<th>TOXICITY CATEGORY</th>
<th>ORAL LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>SIGNAL WORD</th>
<th>APPROX. ADULT LETHAL DOSE (ORAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0-50</td>
<td>DANGER/POISON</td>
<td>Few drops to 1 teaspoon</td>
</tr>
<tr>
<td>II</td>
<td>50-500</td>
<td>WARNING</td>
<td>1 teaspoon to 1 ounce</td>
</tr>
<tr>
<td>III</td>
<td>500-5,000</td>
<td>CAUTION</td>
<td>1 ounce to 1 pint or pound</td>
</tr>
<tr>
<td>IV</td>
<td>&gt;5,000</td>
<td>CAUTION</td>
<td>More than 1 pint or pound</td>
</tr>
</tbody>
</table>
Chronic Toxicity

Potential of a pesticide to cause injury from repeated or prolonged small doses of pesticides.
Chronic Toxicity

- Delayed - time lapses between exposure and effects (don’t appear immediately)
- Result of repeated exposure to the same pesticide or one with a similar mode of action
- On rare occasions can be from a single exposure
Chronic Toxicity Can Cause

- Cancer
- Tumors
- Birth defects
- Impotence
- Infertility or sterility

- Blood Disorders (anemia, inability to clot)
- Brain damage
- Paralysis
- Emphysema, asthma
- Kidney problems
REMEMBER:
Repeated low-level exposure to chemicals that have potential to cause long-term effects can greatly increase the risk of chronic adverse effects.
Why are some pesticides a greater health risk?

The nervous system of insects and humans have common characteristics.
Nervous System

- Nerves communicate by electrical signals
- Special proteins called “transmitters” carry the electrical signal across the gap between two nerves
Nervous System

- Other proteins called enzymes, clean out the gap so the nerve is ready for the next signal
- Insects and humans have some of the same transmitters and enzymes
Organophosphates (OP)

- Higher toxicity
- Large single exposure can cause acute poisoning
- Exposures over time “add up” in the body leading to poisoning
Organophosphates (OP)

- Exposure interferes with an important nervous system enzyme, cholinesterase.
- Causing nerves to continuously send messages to the muscles.
- Causes twitching, convulsions, seizures, and possibly death.
Carbamates

- Also interferes with cholinesterase
- Broken down by the body
- Can cause acute poisoning
Symptoms of OP and Carbamate Poisoning

- **Mild** - headache, fatigue, dizziness
- **Moderate** - muscle twitching, unable to walk, pinpoint pupils
- **Severe** - unconscious, seizures, death
Cholinesterase Test Program

- Consult your doctor
- Monitor changes in cholinesterase levels by
  - Get off season base line test in January or February followed by periodic testing during the season
Allergens

◆ Anything that causes allergies
◆ Need more than 1 exposure to the product
◆ After the 1st exposure, the body develops a negative response
◆ When exposed again, the body responses negatively = allergic reaction
Allergies can

- Trigger an asthma attack
- Cause shock
- Cause rashes, blisters, contact dermatitis
- Cause itchy, watery eyes, sneezing
The signs and symptoms of a pesticide poisoning are similar to **Heat Stress**.
Heat Stress Symptoms

- Exhaustion, headache, nausea, chills, dizzy
- Thirsty and dry mouth
- Clammy skin or hot, dry skin
- Heavy sweating or not sweating
- Confused, slurred speech, irrational
- Death
Heat Stress Symptoms

Pupils of a heat stress victim are normal

Pupils of an OP pesticide poisoning victim are pinpoint (constricted)
Heat Stress

- Move to shade
- Rapidly cool victim - splash or sponge cool water on skin
- Drink as much water as possible
- Stay calm and call for help
HAZARD = EXPOSURE \times TOXICITY

The best way to avoid a pesticide poisoning is to protect yourself by reading the label and wearing personal protective equipment.
Caring for Protective Clothing

- Wash separate from family laundry
- Use **HOT** water
- Wear gloves as an extra precaution

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**
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This presentation was prepared by Kerry H. Richards, PhD, Sharon I. Gripp, and Richard J. Johnson, of the Pennsylvania State University, Pesticide Education Program.

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