Chapter 5

Pesticide Hazards and First Aid

Chapter 5

National Pesticide Applicator Certification Core Manual
Pesticide Hazards & First Aid

This module will help you:

- Know the different types of effects pesticides can have on your health
- Understand signal words
- Know the routes of exposure
- Recognize symptoms of exposure
- Know when and how to give first aid
Pesticides and Humans

- Insects, rodents, and humans have similar nervous, circulatory, and respiratory systems, so pesticides can affect people too!

- Health effects - short- or long-term

- Physical and chemical risks - explosive or combustible
HAZARD = Toxicity x Exposure

- risk; the potential for injury
- the capacity of a pesticide to cause injury
- the risk of a pesticide contacting or entering the body
Hazard

- Higher toxicity = greater hazard
- Lower toxicity = less hazard
- Higher exposure = greater hazard
- Lower exposure = less hazard

North Carolina Dept. of Agriculture and Consumer Services
High toxicity, Low exposure risk

Low toxicity, High exposure risk
Hazards Increase...

- when mixing and loading the concentrate
- with a very high single exposure
- after many exposures over time
Reduce Hazards!!

- By using least toxic pesticides
- Wearing personal protective equipment

HAZARD = Toxicity x Exposure
Attitude Makes a Difference

- Read and follow the label carefully
- Be aware of the people and the environment in and around treated areas
Poisoning Effects

- Contact
- Systemic
- Allergic
Contact Effects

- **Skin** irritation (dermatitis): itching, redness, rashes, blisters, burns
- **Eyes**: swelling, stinging, burning
- **Nose, mouth, throat** irritation
- Typical of herbicides, fungicides and other products

**Contact injury to the skin is the most common form of pesticide poisoning!**
Systemic Effects

- From pesticides that target animals
  - Insecticides: nervous system
  - Rodenticides: circulatory system
- **Insecticide symptoms:** nausea, vomiting, diarrhea, headache, dizziness, weakness, excessive sweating, tearing, chills, thirst, chest pain, breathing difficulty, body aches & cramps
Allergic Effects

- Contact or Systemic
- Dermatitis, blisters, hives
- Life-threatening shock
- Red or itchy eyes
- Respiratory discomfort, asthma
Routes of Entry: Skin (Dermal)

97% of all body exposure during spraying is by skin contact!
Different parts of the body vary in their ability to absorb pesticides.

- Scalp: 32%
- Ear Canal: 40%
- Abdomen: 18%
- Genital Area: 100%
- Ball of Foot: 13%
- Forehead: 36%
- Armpit: 64%
- Forearm: 9%
- Palm: 12%
- Back of Hand: 21%

Percent Dose Absorbed
Chemical - parathion
Maibach 1974
Greater dermal absorption

- Warm, moist areas: groin, armpits, head, neck
- Cuts, abrasions, and rashes
- Pesticide formulations affect absorption

Diagram showing pesticide formulations:
- Least absorbed: Dry Based, Granular
- Most absorbed: Emulsifiable Concentrate (EC)

The diagram indicates that dry-based formulations are least absorbed, while emulsifiable concentrates are most absorbed.
Routes of Entry: Lungs (inhalation)

Inhalation exposure can occur:

• When using
  Wettable powders
  Dusts
  Gases, vapors
  Sprays

• While mixing and loading

• During applications
Fumigants are active as gases!

Protect yourself from inhalation exposure!
Routes of Entry: Eyes

Eyes are able to absorb surprisingly large amounts of chemical.
Wash your hands!

...before eating, drinking, smoking, or going to the bathroom at breaks!!
Possible Harmful Effects from Pesticides

- Acute effects
- Chronic effects
- Delayed effects
Acute effects…

- Occur from a single exposure
- Develop within 24 hrs of exposure
- Any effect is measured
- Toxicity usually expressed as $LD_{50}$ or $LC_{50}$
**LD$_{50}$ and LC$_{50}$**

- **LD$_{50}$** = the *dose* of a substance that *kills* 50% of a population of test animals
  - measured in milligrams of toxicant per kilogram of body weight (mg/kg)

<table>
<thead>
<tr>
<th>Dose:</th>
<th>96 dead</th>
<th>50 dead</th>
<th>12 dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mg/kg</td>
<td>10 mg/kg</td>
<td>1 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

- **LC$_{50}$** = *concentration* of a substance in air or water that *kills* 50% of a test population, measured in parts per million
## Signal Words

<table>
<thead>
<tr>
<th>Signal Word</th>
<th>Category</th>
<th>Toxicity</th>
<th>Oral LD&lt;sub&gt;50&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger-Poison</td>
<td>I</td>
<td>High</td>
<td>0-50 mg/kg</td>
</tr>
<tr>
<td>Peligro</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Danger/Peligro</td>
<td>I</td>
<td>High - Eye or skin damage concerns greater</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>than acute lethal toxicity</td>
<td></td>
</tr>
<tr>
<td>Warning/Aviso</td>
<td>II</td>
<td>Moderate</td>
<td>50-500 mg/kg or skin/eye</td>
</tr>
<tr>
<td>Caution</td>
<td>III</td>
<td>Slight</td>
<td>&gt;500 mg/kg or skin/eye</td>
</tr>
</tbody>
</table>
DANGER - POISON

- Highly toxic by any route of entry

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
AND DOMESTIC ANIMALS
Guthion® Solupak 50%
Wettable Powder Crop Insecticide
IN WATER SOLUBLE PACKETS

For effective economical insect control.

ACTIVE INGREDIENT:
O,O-Dimethyl S-[(4-oxo-1,2,3-benzotriazin-3(4H)-yl)methyl]phosphorodithioate ................................................................. 50%
INERT INGREDIENTS: ........................................................................... 50%
100%

EPA Reg. No. 264-733

DEALERS SHOULD SELL IN ORIGINAL PACKETS ONLY
Keep water soluble packets in their container and store in a cool dry place, but not below freezing (32°F). Protect from heat. Keep away from open flame. Do not heat. Entire inner packets dissolve in water. After opening outer bag, drop the remaining unopened inner packets into spray tank as directed. Do not excessively handle water soluble packet or expose it to moisture, since this may cause breakage.

STOP – Read the label before use.
KEEP OUT OF REACH OF CHILDREN
DANGER POISON
PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(if you do not understand the label, find someone to explain it to you in detail.)

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER

Fatal if swallowed. May be fatal if inhaled. Harmful if absorbed through skin. Causes moderate eye irritation. Do not breathe dust or spray mist. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, using tobacco. Remove contaminated clothing and wash clothing before reuse.
DANGER PELIGRO

• can cause severe eye damage or skin irritation

Causes irreversible eye damage.....
AMINE 4
2,4-D WEED KILLER

For Selective Broadleaf Weed Control in Certain Crops, Turf and Non-Crop Areas.

ACTIVE INGREDIENT:
*Dimethylaniline salt of 2,4-Dichlorophenoxyacetic acid .................. 46.6%
INERT INGREDIENTS: ........................................................... 53.4%
TOTAL ................................................................. 100.0%

*Equivalent to 38.6% 2,4-D acid or 0.74 pounds per gallon.
*Isomer specific by AOAC Method No. 5.275-6.279 (13th Ed.)

KEEP OUT OF REACH OF CHILDREN

DANGER — PELIGRO
Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

(See Below for Additional Precautionary Statements)
EPA REG. NO. 34704-120
EPA EST. NO.
NET CONTENTS 2½ GAL., (9.46 L)

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER — PELIGRO
Corrosive. Causes irreversible eye damage. Do not get in eyes or on clothing. Harmful if swallowed, inhaled, or absorbed through skin. Avoid contact with skin. Avoid breathing spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse. Do not contaminate water used for irrigation, domestic or spray purposes.
Personal Protective Equipment:
Applicators and other handlers must wear: Long-sleeved shirt and long pants, waterproof gloves, shoes plus socks and protective eye- wear. Follow manufacturer's instructions for cleaning/maintaining.

USER SAFETY RECOMMENDATIONS
Users should:
Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

FIRST AID

If in eye:
• Hold eye open and rinse slowly and gently with water for 15-20 minutes.
• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
• Call a poison control center or doctor for treatment advice.

If swallowed:
• Call a poison control center or doctor immediately for treatment advice.
• Have a person sip a glass of water if able to swallow.
• Do not induce vomiting unless told to do so by the poison control center or doctor.
• Do not give anything by mouth to an unconscious person.

If on skin or clothing:
• Take off contaminated clothing.
• Rinse skin immediately with plenty of water for 15-20 minutes.
• Call a poison control center or doctor for treatment advice.

If inhaled:
• Move person to fresh air.
• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.
• Call a poison control center or doctor for further treatment advice.

WARNING AVISO

- Moderately toxic

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
AND DOMESTIC ANIMALS
DANGER

Causes moderate eye damage and/or skin irritation.....
Complete Directions for Use

EPA Reg. No. 524-445

AVOID CONTACT WITH FOLIAGE, GREEN STEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS, DESIRABLE PLANTS AND TREES, SINCE SEVERE INJURY OR DESTRUCTION MAY RESULT.

Roundup Original, Monsanto and the Vine symbol are trademarks of Monsanto Company.

2000-1

Read the entire label before using this product.
Use only according to label instructions.
Read “LIMIT OF WARRANTY AND LIABILITY” before buying or using. If terms are not acceptable, return at once unopened.

OTHERWISE SHALL BE THE PURCHASE PRICE PAID BY THE USER OR BUYER FOR THE QUANTITY OF THIS PRODUCT INVOLVED, OR, AT THE ELECTION OF THIS COMPANY OR ANY OTHER SELLER, THE REPLACEMENT OF SUCH QUANTITY, OR, IF NOT ACQUIRED BY PURCHASE, REPLACEMENT OF SUCH QUANTITY. IN NO EVENT SHALL THIS COMPANY OR ANY OTHER SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES.

Buyer and all users are deemed to have accepted the terms of this LIMIT OF WARRANTY AND LIABILITY which may not be varied by any verbal or written agreement.

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep out of reach of children.

WARNING! AVISO!
Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY. HARMFUL IF SWALLOWED OR INHALED.
Do not get in eyes or on clothing.
Avoid breathing vapor or spray mist.

FIRST-AID: IF IN EYES, immediately hold eyelids open and flush with plenty of water for at least 15 minutes. Get medical attention.
IF INHALED, remove individual to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.
IF SWALLOWED, this product will cause gastrointestinal tract irritation. Immediately dilute by swallowing water or milk. Get medical attention. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks, and protective eyewear. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product’s concentrate. Do not reuse them.
Caution

- slightly toxic

Avoid contact with eyes, skin or clothing.
KUMULUS® DF
fungicide/acaricide

ACTIVE INGREDIENT:
Sulfur ........................................................................................................ 80%
INERT INGREDIENTS: ........................................................................... 20%
TOTAL ................................................................................................... 100%

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID
If Swallowed: Call a Poison Control Center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
If In Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If On Skin or Clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

PRECAUTIONARY STATEMENTS
Hazards to Humans and Domestic Animals
Harmful if swallowed. Avoid breathing spray mist. Avoid contact with eyes, skin, and clothing.
Not Just for Pesticides!

Low Hazard due to Low Exposure!
\( \text{LD}_{50} \) and \( \text{LC}_{50} \) have limitations because...

- they only measure death rates, not less serious acute effects
- they do not translate directly to humans
- they only measure effects of a single exposure, not multiple exposures
Chronic Effects

Low dose exposures over an extended period of time

- Birth defects
- Toxicity to a fetus
- Production of tumors
- Genetic changes
- Blood disorders
- Nerve disorders
- Reproductive effects
Delayed Effects

- After 24 hours
- After repeated exposures

For example, organophosphates and carbamate INSECTICIDES...
Organophosphates and carbamate insecticides inhibit cholinesterase

- Over-exposure may decrease available cholinesterase nerve enzyme
- Cholinesterase is the nervous system “off switch”. If inhibited, nerves continuously fire
- Over-stimulating muscles, glands, and organs
Familiar Organophosphates (OP) Insecticides

- Diazinon
- Acephate
- Chlorpyrifos (Dursban)
- Malathion
- Metasystox-R

Familiar Carbamates Insecticides

- Carbaryl (Sevin)
- Methomyl (Lannate)
- Aldicarb (Temik)
- Carbofuran (Furadan)
Symptoms from Organophosphate and Carbamate Insecticide Exposure

- **mild**: fatigue, headache, giddiness, sweating, tearing, dizziness or blurred vision, cramps, nausea, vomiting, diarrhea
- **moderate**: numbness, changes in heart rate, general muscle weakness, difficulty breathing and walking, pinpoint pupils, excessive salivation
- **severe**: convulsions and coma
Antidotes for OP and Carbamate Poisoning

- **Organophosphates:**
  - Atropine sulfate, plus
  - Protopam chloride (2-PAM)

- **Carbamates**
  - Atropine sulfate ONLY

- **NEVER USE ANTIDOTES TO PREVENT EXPOSURE!!**
Blood Test: Monitor your cholinesterase levels if you apply organophosphate and carbamate insecticides.
Recognize Symptoms of Exposure

Varies according to the pesticide and the individual

rash, headache, nausea, dizziness
If Exposure Occurs, Administer First Aid

- Dilute the pesticide
  - **On skin:** remove contaminated clothing, wash skin, gently dry and loosely cover
  - **In eyes:** wash across eyes for 15 minutes
  - **If inhaled,** get victim to fresh air and laid down
  - **If ingested, induce vomiting EXCEPT**... and administer activated charcoal in water
  - **DO NOT USE syrup of ipecac**– ineffective!
DO **NOT** Induce Vomiting If…

- victim is unconscious or convulsing
- petroleum products (kerosene, gasoline, oil) were involved
- emulsifiable concentrates used
- corrosive poisons, or strong acids or bases were ingested
Seek medical attention

Take the label

Keep extra copies of the label (and MSDS) in your vehicle and office for emergencies!!
Post Emergency Numbers!

**National Poison Control Center**
1-800-222-1222

**National Pesticide Information Center (NPIC)**
1-800-858-7378
npic.orst.edu
Heat Stress

- Caused by heat, NOT pesticide exposure
- Wearing PPE increases risk
- **Symptoms** (similar):
  - Fatigue, dizziness, altered behavior
  - Clammy skin or hot-dry skin
  - Headache, nausea, chills
  - Severe thirst
  - Heavy sweating or lack of sweating
See a doctor annually!

- Take precautions
- Get regular exercise
- Eat a balanced diet
- Drink lots of water
- Wash hands & face regularly
- Keep food, etc. away from application equipment
CHAPTER 5

Summary

- Hazard = Toxicity x Exposure
- Contact, Systemic, or Allergic effects
- Routes of entry: skin, eyes, mouth, lungs
- Use least toxic pesticides
- Always use PPE!
- Know symptoms of acute & chronic exposure
- Know first aid!
Q1. The ability of a pesticide to cause harm from extended exposures to low doses, years later, is termed:

A. Acute Toxicity
B. Behavioral Toxicity
C. Chronic Toxicity
D. Lactic Toxicity
Q2. HAZARD is the measure of

1. Cholinesterase levels
2. $\text{LD}_{50}$ and $\text{LC}_{50}$ values
3. Oral, skin, eye, and inhalation exposure
4. The capacity of a pesticide to cause injury

A. 1 and 2 only  
B. 1 and 3 only  
C. 1 and 4 only  
D. 2 and 3 only
Q3. The most common way pesticides enter the body is by:

A. Eyes
B. Lungs
C. Mouth
D. Skin
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CHAPTER 5

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