What's So Bad About Pesticides?

Evaluating Toxicity and Environmental Risks
And
Minimizing Impacts

Southwest Vegetation Management Association Conference
Flagstaff, AZ
November 2008

What are Pesticides?

- Insecticides
- Herbicides
- Rodenticides
- Fungicides
- Bacteriacides
- Mitacides
- Whatever chemical is used to kill a pest.

Most people lump all pesticides together.

So today I'm just going to refer to "pesticides".

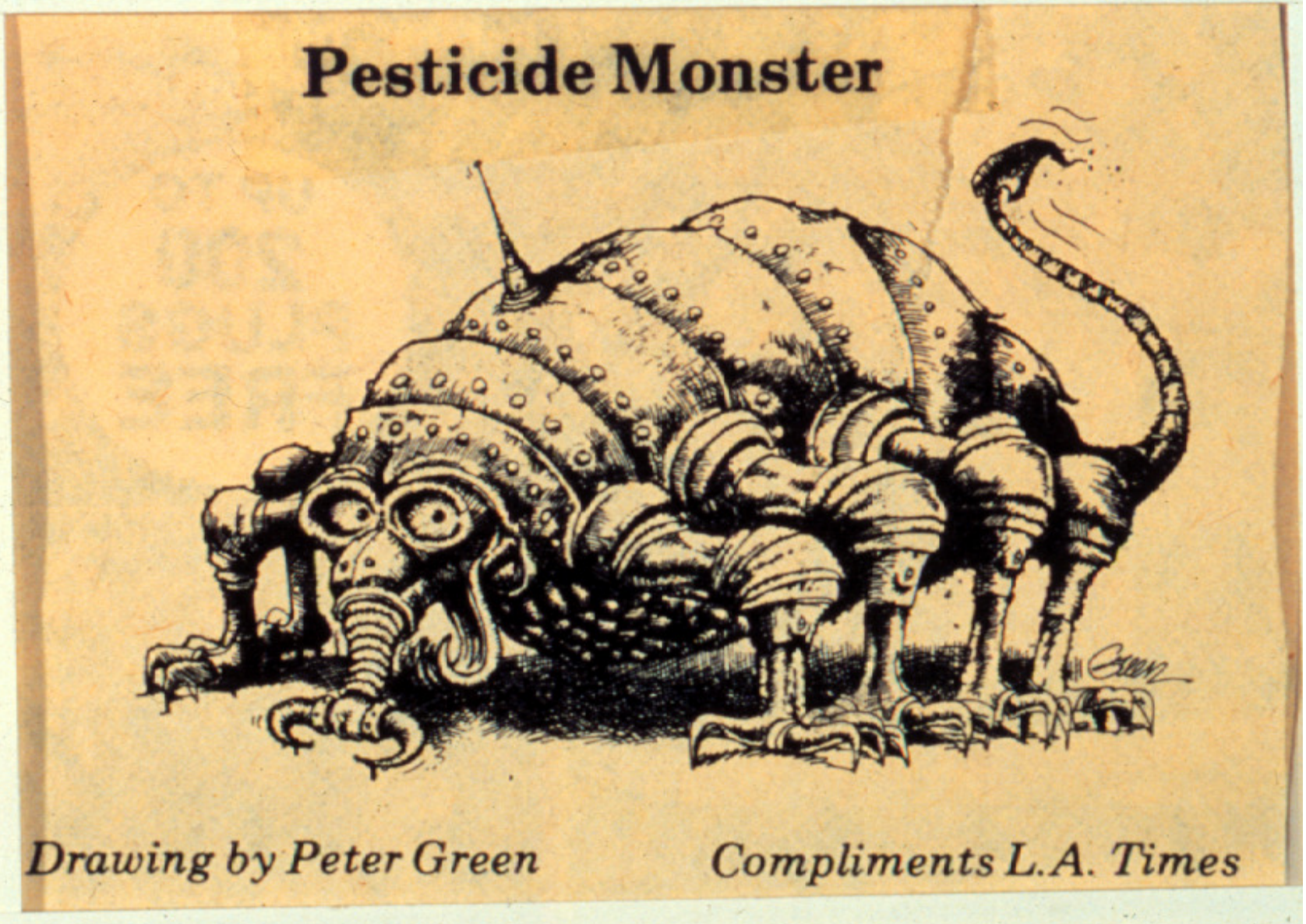
Most people think pesticides are safe

Right?

WRONG!

Most people have little understanding of pesticides and many have fears or concerns based on decades old and sometimes obsolete information or misinformation.

How some people view pesticides:



How many of you have concerns about pesticide safety ???!

Some people think everyone should be using “organic” or “natural” pesticides, because “they are safe for people and for the environment.”

But are they?

Some common concerns and beliefs- both facts and myths:

- Pesticide toxicity and health hazards
- Potential impacts to wildlife and aquatic organisms, like fish and frogs.
- Potential groundwater contamination
- Persistence in the environment

Primary Public Concerns
Myths

- "There are always practical non-chemical ways to control pests."
- "We don't know much about the long-term effects of "chemical" pesticides on health, reproduction, and the environment."
- "'Natural' and 'Organic' pesticides are always safer than "Chemical" pesticides."

Some Things We Know About Pesticides and their Risks

- Immediate (acute) and long-term (chronic) toxicity to a number of test animals, fish, birds, and bees.
- We can evaluate how likely they are to move in the environment.
- We have some idea how long they will persist in various environments.

Primary Public Concerns About Pesticide Toxicity and Health

Facts

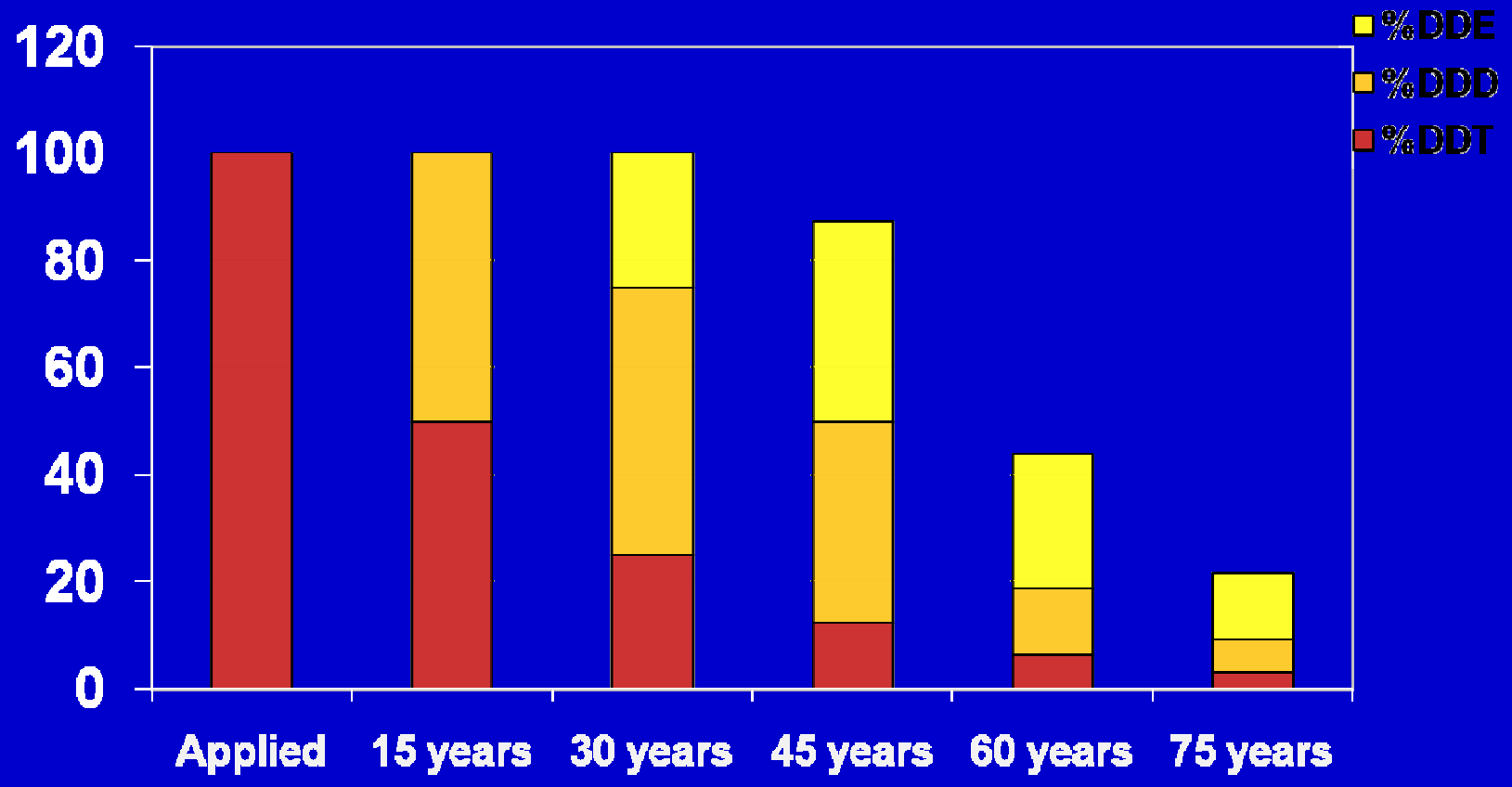
- **"Chemical sensitivity" –part physiological, part psychological**
- **Toxicity – Some pesticides *have* harmed people, fish, and/or wildlife**
- **Some older pesticides *have* had long-term impacts on reproduction (e.g. DDT impacts on birds)**

So how can we be reasonably sure the pesticides we are using today are safe for people and wildlife?

Primary Public Concerns About Pesticide Environmental Impacts Facts

- Groundwater contamination has occurred
- There have been non-target impacts
- Some pesticides do persist in the environment

	Applied	15 years	30 years	45 years	60 years	75 years
%DDT	100	50	25	12.50	6.25	3.125
%DDD		50	50	37.5	12.50	6.25
%DDE			25	37.5	25	12.5



Rachel Carson

1962

Environmental Protection Agency Pesticide Registration Requirements

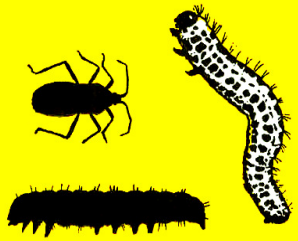
- **ALL pesticides registered now must meet rigorous testing requirements**
- **Testing is by** *independent*, **EPA-approved laboratories following standard protocols.**
- **No pesticide product may be sold until EPA has approved a Label.**
- *When used in accordance with Label requirements*, **there is reasonable assurance of both human and environmental safety because use directions have a** *built in 100-fold protection factor.*

5% Carbaryl
Garden & Pet Dust

31123

Hi-Yield®

5% Carbaryl Garden & Pet Dust



- Ready To Use 5% Dust.
- Kills Over 60 Insects on Fruits, Vegetables, Ornamentals, Trees and Shrubs.
- For Use On Poultry, Dogs and Cats.

Controls Many Insects on Ornamentals, Vegetables, Small Fruits, Pets, Poultry and Aids in the Control of Imported Fire Ants.

FOR HOME GARDEN AND PET INSECT CONTROL ONLY.

ACTIVE INGREDENT:
Carbaryl (1-naphthyl N-methylcarbamate)..... 5.00%
INERT INGREDENTS..... 95.00%
Total 100.00%

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE BACK PANEL FOR ADDITIONAL PRECAUTIONS

NET WEIGHT 20 LBS.

Exopack

FREIGHT SHIPPING BAG
Meeting requirements of
APPLICABLE FREIGHT CLASSIFICATION
Designated by
Exopack
Tifton, Georgia

14190-1 64013857 12-01
11 x 3 x 25

5% Carbaryl
Garden & Pet Dust

Hi-Yield®

5% Carbaryl Garden & Pet Dust

DIRECTIONS FOR USE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING
READ ENTIRE LABEL BEFORE EACH USE
USE STRICTLY IN ACCORDANCE WITH LABEL CAUTIONS AND DIRECTIONS. KEEP PESTICIDES IN ORIGINAL CONTAINER. DO NOT PUT INTO FOOD OR DRINK CONTAINERS.

USER SAFETY REQUIREMENTS

- Wear longsleeved shirt, long pants, shoes plus socks and Chemical boots or rubber gloves when applying this product.
- Change clothing as soon as possible after use.
- Wash the outside of gloves before removing. As with any pesticide product, wash hands thoroughly immediately after handling and before eating, smoking or using the toilet.
- Do not allow children or pets to contact treated area until dust has settled.

Wearing household boots or rubber gloves, use a dust applicator such as a shaker can, dust gun, duster or other bulbous duster, rotary duster or other appropriate duster as available. Dust lightly to cover upper and lower leaf surfaces with a thin, even film of dust. Apply when air is calm to avoid drift and contact with eyes and skin. Start applying at the farthest corner of the treatment area and work backward to avoid contact with dusted surfaces. Allow dust to settle in treated areas before re-entering. For plants above chest high, consider using a liquid Carbaryl product. Do not repeat applications more than once a week.

GENERAL INFORMATION

Hi-Yield® 5% Carbaryl Garden & Pet Dust is an excellent insecticide formulation for many insects found in home gardens and for insect control on dogs, cats and poultry. Not for use on plants being grown for sale or other commercial use, or for commercial seed production, or for research purposes, for ornamental plants intended for aesthetic purposes or ornamental gardens.

DIRECTIONS

Use sufficient dust to obtain full coverage on upper and lower leaf surfaces, stems and all above ground parts. Apply when insects or their damage first appear. Repeat at 7 to 10-day intervals or as necessary for proper insect control. Some plants and the insects contained are:

ORNAMENTALS, FLOWERS, SHRUBS, TREES: To control Elm Leaf, Rose and Apple Aphids, Rose Slugs, Birch Leaf, Boxwood and Ivy Leaf Miners, Mealy Bugs, Leaf Rollers, Plant Lace Bugs, Boxwood Bugs, Bagworms, Japanese Beetle, Tent Caterpillars and Gypsy Moth. Do not use on COTTON IVY as damage may result.

GRAPES: Grape Leaf Folder, Grape Leafhopper, Grape Leaf Skeletonizer, Grape Berry Moth, Japanese Beetle and Red Banded Leaf Roller

STRAWBERRIES: For control of Meadow Spittlebug, Strawberry Leaf Roller and Strawberry Weevil

BLUEBERRIES: For control of Blueberry Maggot, Cherry and Cranberry Fruitworms and Japanese Beetle.

CRANBERRIES: For the control of Cutworms, Fireworms, Fruitworms, Japanese Beetle and Leafhoppers.

BEANS (Green, Lima, Soap Beans, Cowpeas and Blackeyed Peas): For the control of Mexican Bean Beetle, Bean Leaf Beetle, Leafhopper, Velvetbean Caterpillar, Western Bean Cutworm, Armyworms, Stink Bugs and Tarnish Plant Bug

CUCUMBER, MELONS, PUMPKIN AND SQUASH: For the control of Pickleworm, Melonworm, Cucumber Beetle, Flea Beetle, Leafhopper and Squash Bugs. May cause some leaf injury in Florida.

TOMATO, EGGPLANT AND PEPPER: For the control of Colorado Potato Beetle, Flea Beetle, Leafhopper, European Corn Borer, Fall Armyworm, Lace Bugs, Tomato Fruitworm, Tomato Hornworm, Tarnish Plant Bugs and Stink Bugs.

OKRA: For the control of Stink Bugs. Repeat at 7 day intervals.

CARROTS: For the control of Flea Beetles, Leafhoppers, Six-spotted Leafhoppers (Aster Yellow vector), Armyworms, Spittlebug and Stink Bugs.

CABBAGE, BROCCOLI, BRUSSELS SPROUTS, CAULIFLOWER: For the control of Flea Beetle, Harlequin Bug and Armyworm

PRE-HARVEST LIMITATIONS

No limitations on Beans, Blueberries, Canola, Cucumbers, Eggplants, Melons, Okra, Peppers, Pumpkins, Squash, Tomatoes and Okra. Allow 1 day between dusting and harvesting of Cranberries. Allow 3 days between dusting and harvesting of Cabbage, Cauliflower, Brussels Sprouts, Broccoli, Strawberries and Cowpeas. Subsequent plantings of food and feed crops in treated soil must be made with crops on this or other Carbaryl labels.

DOGS AND CATS: To control Fleas, Ticks and Lice. Using rubber or neoprene gloves, dust lightly over entire animal and massage down to skin. Apply to feet and between toes and on legs. Avoid pet's eyes, nose, mouth and genital areas. Repeat at 7 day intervals if necessary. Dust sleeping quarters, kennels and pet houses and all areas where Ticks and Fleas occur. Be sure to force dust into cracks and crevices. Repeat as necessary to maintain control. Do not use inside the home. Do not apply to rugs and carpets as staining may occur. Do not treat kittens less than 12 weeks old. Do not use on pets with nursing young under 4 weeks of age. This product should not be applied by children. Do not use on pregnant dogs or cats. Consult a veterinarian before using this product on debilitated, aged, pregnant or nursing animals.

POULTRY: Chickens, Ducks, Game Birds, Geese, Pigeons and Turkeys: Lice Treatment: Apply 1 pound to 40 sq. ft. to control Northern Fowl Mites, Chicken Mites, Lice, Fleas and Bed Bugs. Use a scoop and scatter by hand or apply by hand duster. Avoid contamination of nests, eggs, feeding and water troughs. Do not house birds in treated houses within 7 days of slaughter.

HAND APPLICATION TO BIRDS: Use 1 pound to treat 130 birds by means of shaker can or hand duster to control Northern Fowl Mites, Lice and Fleas. Dust nest in yard and fruit areas. Do not contaminate feed or drinking water. The application of this material cannot be repeated within 4 weeks of each treatment. Hand application to birds is a supplement to other treatment for control of these pests. Do not apply to poultry within 7 days of slaughter. Do not treat when birds are under influence of stress.

IMPORTED FIRE ANTS: For use as a mound treatment to control Imported Fire Ants, apply 2 to 4 ounces of product over and around each Fire Ant mound. Six weeks following application, Ant can mound by removing top portion and immediately treat exposed mound surface. Hot boot results apply early in the morning to late evening hours when ants are least active. Treat new mounds as they appear.

STORAGE AND DISPOSAL

Store unused product in original container only in a cool, dry, locked area out of reach of children and pets. Do not re-use empty containers. Securely wrap empty container in several layers of newspaper and discard in trash.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if swallowed, inhaled or absorbed through skin. Avoid breathing dust. Do not take internally. Avoid contact with eyes, skin or clothing. Wash hands thoroughly after use. Avoid contamination of food and feed stuffs. Sensitization may occur after using ANY pesticide product for pets. If signs of sensitivity occur, bathe your pet with mild soap and rinse with large amounts of water. If signs continue, consult a veterinarian immediately. Certain medications can interact with pesticides. Consult a veterinarian before using on medicated animals. Do not use this product on animals simultaneously or within 30 days before or after treatment with organophosphorus cholinesterase inhibiting drugs, pesticides or chemicals. However, flea and tick collars may be immediately replaced.

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Induce vomiting and seek medical attention immediately. Do not induce vomiting or give anything by mouth to an unconscious or convulsing person.
IF INHALED: Remove victim to fresh air. Apply artificial respiration if indicated.
IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.
IF ON SKIN: Remove contaminated clothing and wash clothing and affected area of skin with soap and water. Get medical attention if irritation persists.
NOTE TO PHYSICIAN: Carbaryl is a moderate, reversible cholinesterase inhibitor. Atropine is an antidote.

ENVIRONMENTAL HAZARDS

This product is extremely toxic to aquatic and estuarine invertebrates. Do not apply directly to water. Do not contaminate water by cleaning of equipment and disposal of wastes. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are actively visiting the treatment area.

Buyer assumes all risk of use, storage and handling of this material not in strict accordance with directions given hereunto.

VOLUNTARY PURCHASING GROUPS, INC.
HWY. 82 WEST
BONHAM, TEXAS 75418

EPA REG. NO. 7401-69 **EPA EST. NO. 7401-TX-1**

Active Ingredient – The chemical that kills the pest (i.e. the pesticide”)

ACTIVE INGREDENT:
Carbaryl (1-naphthyl N-methylcarbamate)..... 5.00%
INERT INGREDENTS..... 95.00%
Total 100.00%

Are “Inert Ingredients” Toxic?

The Label is the Law!

DIRECTIONS

Use sufficient dust to obtain full coverage on upper and lower leaf surfaces, stems and all above ground parts. Apply when insects or their damage first appear. Repeat at 7 to 10 day intervals or as necessary for proper insect control. Some plants and the insects controlled are:

ORNAMENTALS, FLOWERS, SHRUBS, TREES: To control Elm Leaf, Rose and Apple Aphids, Rose Slugs, Birch Leaf, Boxwood and Oak Leaf Miners, Mealy Bugs, Leaf Rollers, Plant Lace Bugs, Boxelder Bugs, Bagworms, Japanese Beetle, Tent Caterpillars and Gypsy Moth. Do not use on BOSTON IVY as damage may result.

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BLUEBERRIES: For control of Blueberry Maggot, Cherry and Cranberry Fruitworms and Japanese Beetle.

CRANBERRIES: For the control of Cutworms, Fireworms, Fruitworms, Japanese Beetle and Leafhoppers.

BEANS (Green, Lima, Snap Beans, Cowpeas and Blackeyed Peas): For the control of Mexican Bean Beetle, Bean Leaf Beetle, Leafhopper, Velvetbean Caterpillar, Western Bean Cutworm, Armyworms, Stink Bugs and Tarnish Plant Bug.

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PRE-HARVEST LIMITATIONS

No limitations on Beans, Blueberries, Carrots, Cucumbers, Eggplants, Melons, Grapes, Peppers, Pumpkins, Squash, Tomatoes and Okra. Allow 1 day between dusting and harvesting of Cranberries. Allow 3 days between dusting and harvesting of Cabbage, Cauliflower, Brussels Sprouts, Broccoli, Strawberries and Cowpeas. Subsequent plantings of food and feed crops in treated soil must be made with crops on this or other Carbaryl labels.

DOGS AND CATS: To control Fleas, Ticks and Lice. Using rubber or neoprene gloves, dust lightly over entire animal and massage down to skin. Apply to feet and between toes and on legs. Avoid pet's eyes, nose, mouth and genital areas. Repeat at 7 day intervals if necessary. Dust sleeping quarters, kennels and pet houses and all areas where Ticks and Fleas occur. Be sure to force dust into cracks and crevices. Repeat as necessary to maintain control. Do not use inside the home. Do not apply to rugs and carpets as staining may occur. Do not treat kittens less than 12 weeks old. Do not use on pets with nursing young under 4 weeks of age. This product should not be applied by children. Do not use on pregnant dogs or cats. Consult a veterinarian before using this product on debilitated, aged, pregnant or nursing animals.

POULTRY: Chickens, Ducks, Game Birds, Geese, Pigeons and Turkeys: Litter Treatment: Apply 1 pound to 40 sq. ft. to control Northern Fowl Mites, Chicken Mites, Lice, Fleas and Bed Bugs. Use a scoop and scatter by hand or apply by hand duster. Avoid contamination of nests, eggs, feeding and water troughs. Do not house birds in treated houses within 7 days of slaughter.

HAND APPLICATION TO BIRDS: Use 1 pound to treat 100 birds by means of shaker can or hand duster to control Northern Fowl Mites, Lice and Fleas. Direct dust to vent and fluff areas. Do not contaminate feed or drinking water. The application of this material cannot be repeated within 4 weeks of each treatment. Hand application to birds is a supplement to litter treatment for control of these pests. Do not apply to poultry within 7 days of slaughter. Do not treat when birds are under influence of stress.

IMPORTED FIRE ANTS: For use as a mound treatment to control Imported Fire Ants, apply 2 to 4 ounces of product over and around each Fire Ant mound. Do not irrigate following application. Disturb mound by removing top portion and immediately treat exposed mound surface. For best results apply early in the morning to late evening hours when ants are least active. Treat new mounds as they appear.

Note, however that ….

- A weed does not have to be listed. However, if it is not, the manufacturer will not guarantee product effectiveness on a weed that isn't.
- AND
- For any non-crop use, the *site* must be listed. E.g.:
  - Aquatic
  - Rangeland, Pasture, Meadow
  - CRP, Wildlife Habitat
  - ROW

Testing Required by EPA

Pesticides are evaluated for their effects or potential effects on:

- Humans
- Domestic animals
- Wildlife and fish
- Insects
- Non-target plants

- --and for their Environmental Fate:
  - how long it takes for them to break down in the environment in water and soils and in the presence of sunlight.

Toxicity Tests Required by EPA for Pesticide Registration:

- **Acute toxicity** *(effects of a single dose or exposure)*
- **Chronic toxicity** *(multiple doses over time)*
- **Teratogenicity** *(ability to cause birth defects)*
- **Mutagenicity** *(ability to cause changes in genes)*
- **Carcinogenicity** *(ability to cause cancer)*
- **Reproductive effects over multiple generations**
- **Tissue changes**

Long-term effects on tissues and reproduction are evaluated as the laboratories look for changes in or effects on:

- Spermatogenesis (sperm production)
- Number of conceptions (pregnancies)
- Litter Size & Weights
- Premature Births, Still-Births, Deformities
- Offspring Growth Rate
- Behavior
- Necropsy & Histopathology: 1,000 test animals and 43,000 tissues examined for tissue changes
- Changes in blood parameters

Let’s take a closer look at toxicity

Pesticide Toxicity
Standard Protocols are Followed

- **Pesticides are tested to determine how much is required to kill 50% of a test population**
- *(rats, birds, fish, bees, aquatic organisms etc.)*

- **Tests are also conducted to evaluate harm from inhalation, skin absorption and effects of exposure on eyes.**

LD_{50}

L = Lethal

D = Dosage

50 = 50% of test population exposed die

LD_{50}

- In mg/kg body weight
- Varies by substance
- Varies by species
- May vary by sex
- Estimated for humans

Risk = Toxicity x Exposure

Thinking About BOTOX™?

Come enjoy an evening with Dr. [redacted] and learn about the magic of Botox™.

- Presentation by DR. [redacted], who has 16 years of Botox™ experience.
- Light hors d'oeuvres
- Question and answer session
- *Special guests:* Botox Cosmetic™ representative and OBAGI™ skin care representative

Wednesday, June 19, 6:00 p.m.
Ralph & Kacoo's (I-10@ Bluebonnet)

Botox

- Botox is a toxin produced by the bacteria Botulinum.
- It has an LD-50 of 0.00001 mg/kg of body weight, making it one of the most toxic substances in the world.

Acute Rat Oral LD_{50} Mg/Kg

Even sugar has an LD_{50}:

Sucrose (sugar)
29,700 mg/kg

'Excessive water intake' led to death, report says

Fort Jackson officials released preliminary results after an autopsy of the recruit at Fort Gordon, Ga

By DAVE MONIZ
Staff Writer

A Fort Jackson trainee who died ast week suffered an electrolyte im-alance because of "excessive water ntake," a preliminary autopsy shows.

Pvt. Shaheeda R. Mishoe, 20, of Conway became ill Jan. 5 and died a ay later at Palmetto Baptist Medical Center.

Mishoe was an advanced Army rainee assigned to D Company, 69th Adjutant General Battalion, as personnel-services specialist.

Fort Jackson officials released pre-minary results Wednesday after an utopsy at Eisenhower Medical Cen-r at Fort Gordon, Ga.

The Army said Mishoe suffered om hyponatremia, a condition that an result from drinking too much ater or from the body's inability to xcrete water.

Although uncommon, hypona-emia sometimes occurs in the sum-er when people who are overheated nsume a large volume of fluids.

An Air Force trainee died of hy-natremia after drinking large quan-ies in September at Lackland Air Force Base, Texas.

Fort Jackson commanders are investigating the circumstances of Mishoe's death and have offered few details.

Fort Jackson spokeswoman Karen Soule said Mishoe's problems began the morning of Jan. 5, when she complained of dizziness and a headache.

She was transported by ambulance to Moncrief Army Community Hospital, where she suffered a seizure.

Post medical officials then sent Mishoe to Palmetto Baptist Medical Center, where she died the next day.

Dr. John Stewart, director of emergency medicine at Palmetto Richland Memorial Hospital, said hyponatremia has two primary causes.

The first is excessive water consumption.

A second is the body's inability to excrete water, which can be caused by kidney disease, congestive heart failure and cirrhosis.

Mishoe is the second Fort Jackson trainee to die in the past four months. Brian Thomas, an 18-year-old recruit, died last fall from a rare medical problem known as rhabdomyolysis.

Rhabdomyolysis is caused by overheating and results in muscle destruction and, in some cases, kidney failure.

Fort Jackson is the Army's largest basic-training site and trains nearly 40,000 soldiers each year.

Where Can You Find Toxicity Data?
Reliable, Accurate Sources

- Material Safety Data Sheets (MSDS) on the CDMS website.
- FOOTPRINT PPDB website (England)
- E-Pesticide Manual (England)
- ExtoxNet Website - *Caution*
- Websearch – *Beware!*

Cautions:

The MSDS provides toxicity data on the full-strength active ingredient.

AND

Information provided on some websites may be distorted, inaccurate, or out-dated.

Examples (Test)

Acute Rat Oral LD_{50} Mg/Kg

(from least toxic to most toxic)

Glyphosate (a.i. in Roundup)	>	5,000
Clove oil		3,720
Acetic acid		3,310
Sodium chloride (salt)		3,000
Sodium laurel sulfate		1,300
Aspirin		1,000
Triclopyr (a.i. in Garlon)		577+
Caffeine		192
Nicotine		53
Methamidiphos (a.i. in Monitor insecticide)		13
Botox		0.00001

The Dose Makes The Poison

Approximate Lethal Doses:

- Caffeine in 100 cups of strong coffee
- Solanine in 100-400 lbs of potatoes
- Oxalic Acid in 10-20 lbs of spinach or rubarb
- Aspirin in a bottle of 100 tablets

NOTE:

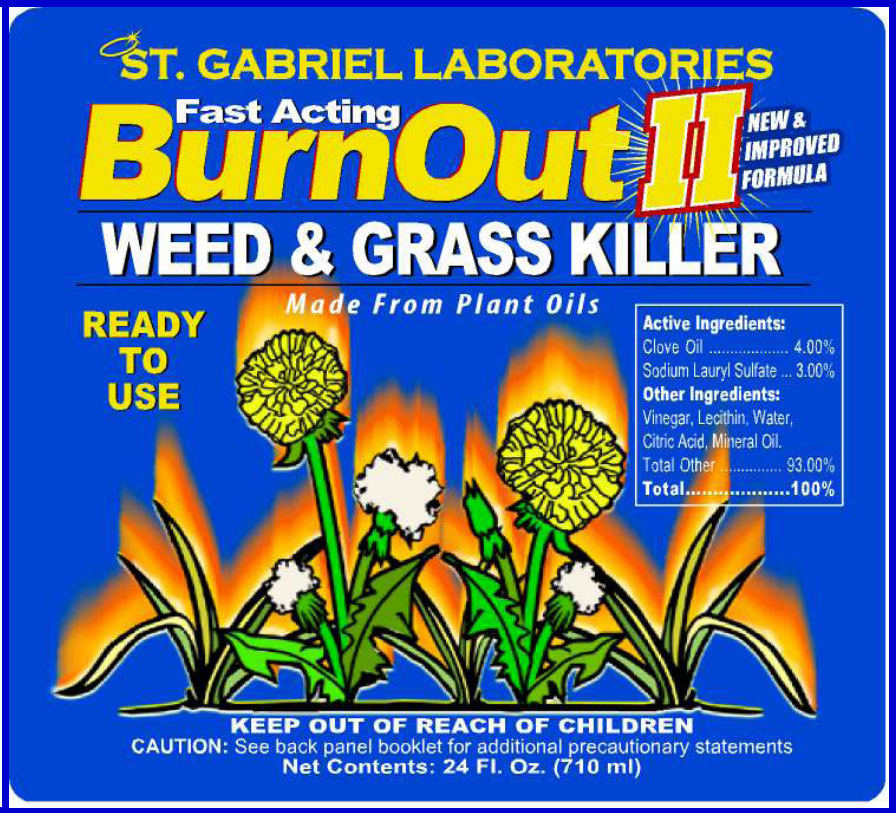
The *higher* the LD-50, the *lower* the toxicity.
(It takes **more** *of the product to kill half the test population.)*

But remember…

The LD-50 or LC-50* tells you the toxicity of the *active ingredient*. However, in the pesticide products you buy, the active ingredient is mixed with "inert ingredients" and sometimes other active ingredients:

***Lethal concentration (in water)**

Roundup Pro vs. Burnout II



Roundup Pro –
Contains 41% glyphosate

Burnout II –
Contains 3% sodium laurel sulfate and 4% clove oil

And...

That may be diluted again before you use it.

Roundup Pro (a.i. glyphosate) is diluted for spraying weeds (usually to a ½ to 2% solution)

and

applied at a rate of
1 to 5 quarts of Roundup Pro/acre.

One application needed

Testing comparison showed 95% weed control.

BUT….

Burnout II (a.i.s sodium laurel sulfate and clove oil, advertised as "Nature's Alternative to Roundup"):

is used full strength

at an acre equivalent of

72 gallons per acre.

And 3 applications were needed,

totalling 216 gallons per acre.

Testing comparison showed only 62% weed control

So on each acre equivalent….

- **You would apply between less than a half a quart to just over 2 quarts of the a.i.** glyphosate (LD50 >5,000)

- **But you would apply about 6.48 gallons of the a.i. sodium laurel sulfate** (LD50 1,300), **and 8.64 gallons of the a.i. clove oil** (LD50 3,720) **…..**

…..making that "natural alternative" ***over 30 times more toxic than Roundup Pro as applied in the environment.***

AND……

Burnout II also contains vinegar

(dilute acetic acid-- LD50 3,310)

as an

“Other Ingredient”

One more point

We don't know what kind of effects that much sodium laurel sulfate and clove oil would have in the environment

EPA lists sodium laurel sulfate and clove oil as "generally considered safe" and they don't regulate them as rigorously as registered pesticides.

No testing has been done on their effects on bees and wildlife, on other non-target effects, or on how long they persist in the environment. We don't have any data!!.

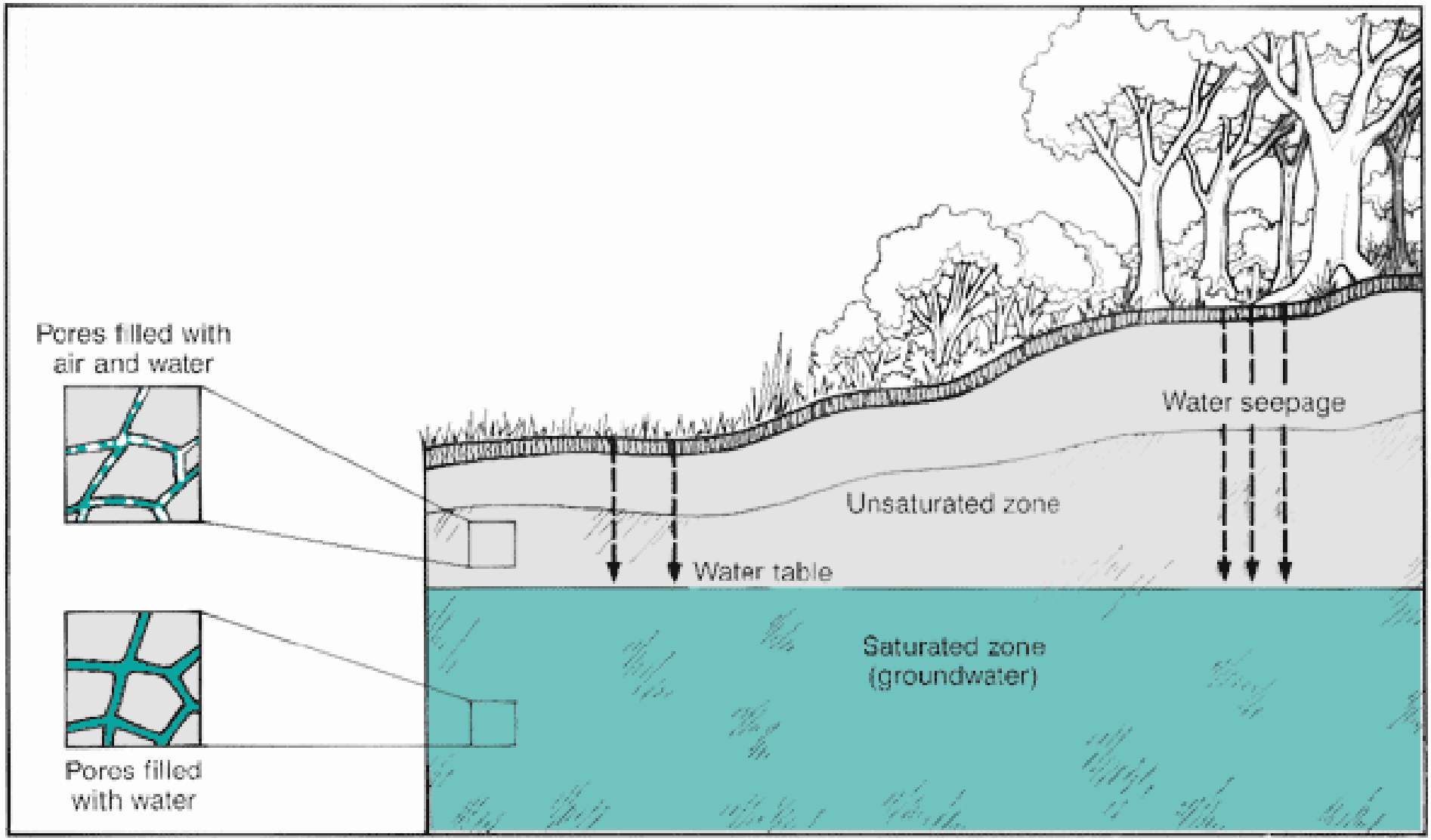
Chronic Toxicity

- No observable effects level (NOEL). Threshold
- 10-fold margin of safety built in for "unknowns"
- Additional 10-fold margin of safety built in for individuals with greater sensitivity (e.g. young children, elderly)
- I.e. there is a 100 fold protection factor built into the product label as to how the pesticide is marketed and used.

So what you have is a 100-fold margin of safety. BUT….

- That margin of safety depends on you following the label, including:
  - correct application rate
  - protective clothing
  - restricted entry interval

What about other concerns, like groundwater contamination?


Pores filled with
air and water
Water seepage
Unsaturated zone
Water table
Saturated zone
(groundwater)
Pores filled
with water

Factors Affecting Pesticide Mobility

(Potential for Groundwater and/or Surface Water Contamination)

Rainfall and evaporation: In the Southwest, evaporation exceeds rainfall much of the year

Depth to groundwater.

Soils : Sandy soils, as found in river valleys, facilitate movement down; clay soil layers reduce movement.

Factors Affecting Pesticide Mobility

(Potential for Groundwater and/or Surface Water Contamination)

How well the pesticide binds with soil: Koc.*

Pesticides with high Koc can bind strongly with soils and are unlikely to move laterally or downward. E.g.

Glyphosate (a.i.. in Roundup)	Koc 24,000
Fluazifop-p-Butyl (a.i. in Fusilade)	Koc 5,700

Pesticides with low Koc may move readily. E.g.

Triclopyr amine: (a.i. in Garlon 3A	Koc 20
Picloram (a.i. in Tordon 22K:	Koc 16

*** The "chemical-specific organic carbon partition coefficient"**

Examples: Herbicide Koc

• Glyphosate		24,000	
• Triclopyr	Amine:	20	Ester: 780
• 2,4-D	Amine	20	Ester: 100
• Dicamba		2	
• Picloram		16	
• Imazapyr		8.81	
• Imazapic		206	
• Aminopyralid		10.8	
• Clopyralid		6	

Factors Affecting Pesticide Mobility

(Potential for Ground- and/or Surface-Water Contamination)

Soils: **Organic matter (decomposed plants) supports bacteria that break pesticides down.**

Solubility in Water: **How much of a substance can be dissolved in water. Eg.:**

Triclopyr amine:	430	(soluble)
Triclopyr ester :	23	(not very soluble)
2,4-D Amine:	796,000	(extremely soluble)
2,4-D Ester:	100	(not very soluble)
Clopyralid	300,000	(extremely soluble)

Factors Affecting Potential for Groundwater Contamination

- **Pesticide persistence (half-life):**

  How long it will remain in the environment.

  Half-life is the time in which half of a pesticide (the a.i.) is broken down.

Most pesticides break down in the environment eventually.

Exceptions include some "organic" pesticides such as copper and sulphur which remain permanently in the environment and accumulate.)

Examples: Herbicide Half-Life*

• Glyphosate	Avg. 47 days
• Triclopyr	Avg. 46 days
• 2,4-D	< 7 days
• Dicamba	28 days
• Picloram	20 to 300 days (Avg. 90 days)
• Imazapyr	30 to 150 days (2 days in sun)
• Imazapic	31 to 410 days (Typical 120 days)
• Aminopyralid	35 days

*Half-life less than 30 days: Non-persistent

Half-life 30 to 100 days – Moderately persistent

Half-life more than 100 days - Persistent

Half-life is important because….

The longer a mobile pesticide remains in the environment, the more likely it is to have non-target impacts,

Where Can You Find Data on Koc, Solubility, and Half-life?

Best Web Source I've Found:

Footprint PPDB Website

Search "Footprint Pesticides Database"

click on the British Flag at the left.

Water pH Effects on Pesticides

Examples:

- **Glyphosate**: Most effective at pH 5-5.5; Less effective as water alkalinity increases.

- **Sulfonylurea herbicides** work better when more alkaline. Decreasing pH reduces solubility and herbicidal activity.

- Carbaryl (insecticide) Half-life affected by pH
  - 100-150 days at pH of 6
  - 2-3 days at pH of 8

Use Adjuvants and Diluents Correctly

- ***Use recommended adjuvant types only***.
- ***Know the pH of the water your are mixing your pesticide with***, and adjust with a buffer if it will improve performance (e.g. Roundup; Sevin)
- ***Don't use acidifying agents*** with sulfonylurea herbicides (like Oust, Plateau)

When You Plan to Use a Pesticide you need to :

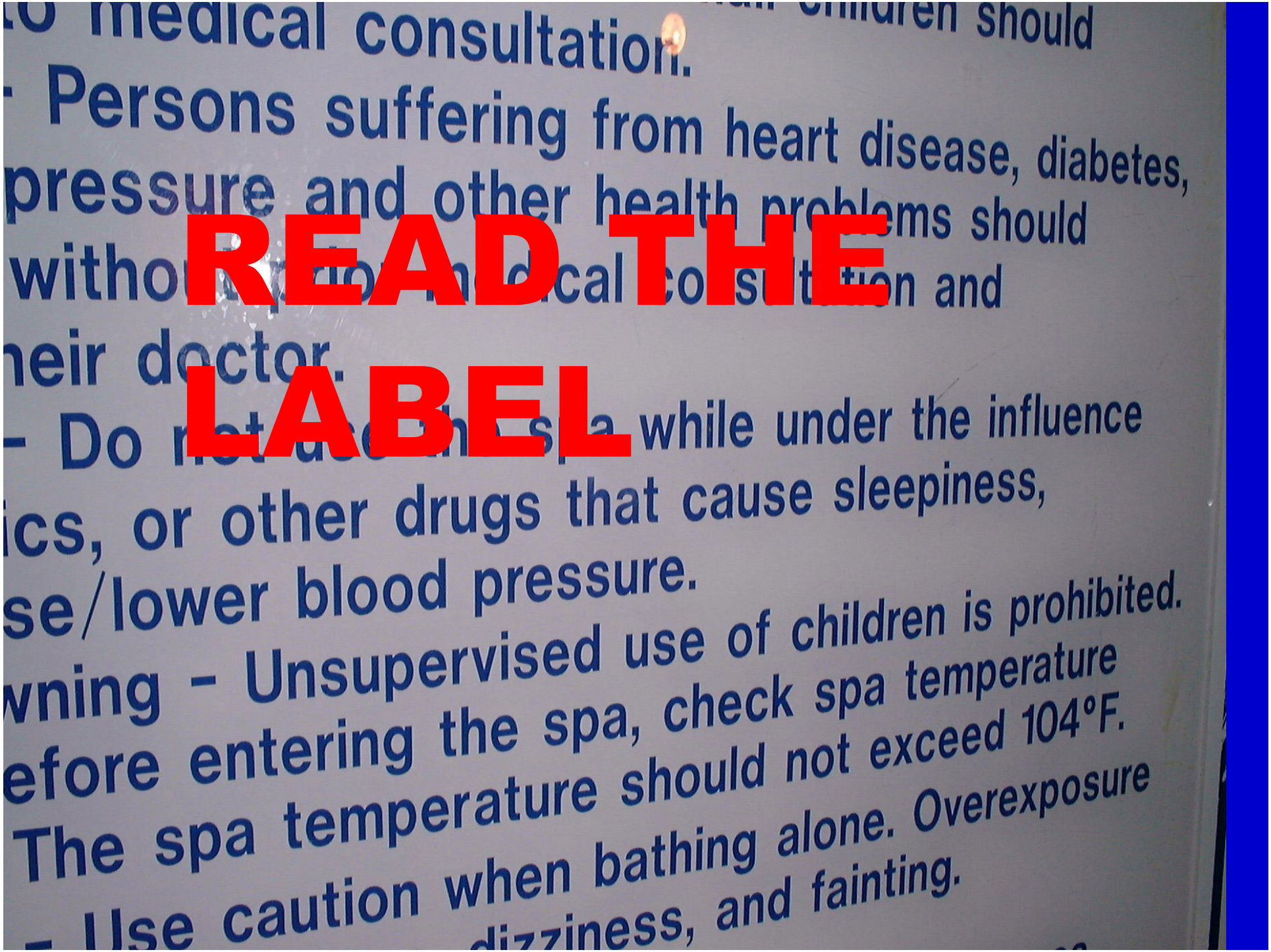
- **Verify that the pesticide can be used in the target site.**
- **Verify the pesticide and the *product* is the most effective for the target pest(s)**
- **Apply at the time of year when it will be most effective.**
- **Evaluate the pesticides you are considering using for:**
  - **Toxicity *as applied in the environment***
  - **Application *rate* / a.i. or a.e. per acre**
  - **Persistence in the environment (*half-life*)**
  - **Mobility (*Solubility and Koc)***

Use Low-Impact Application Methods

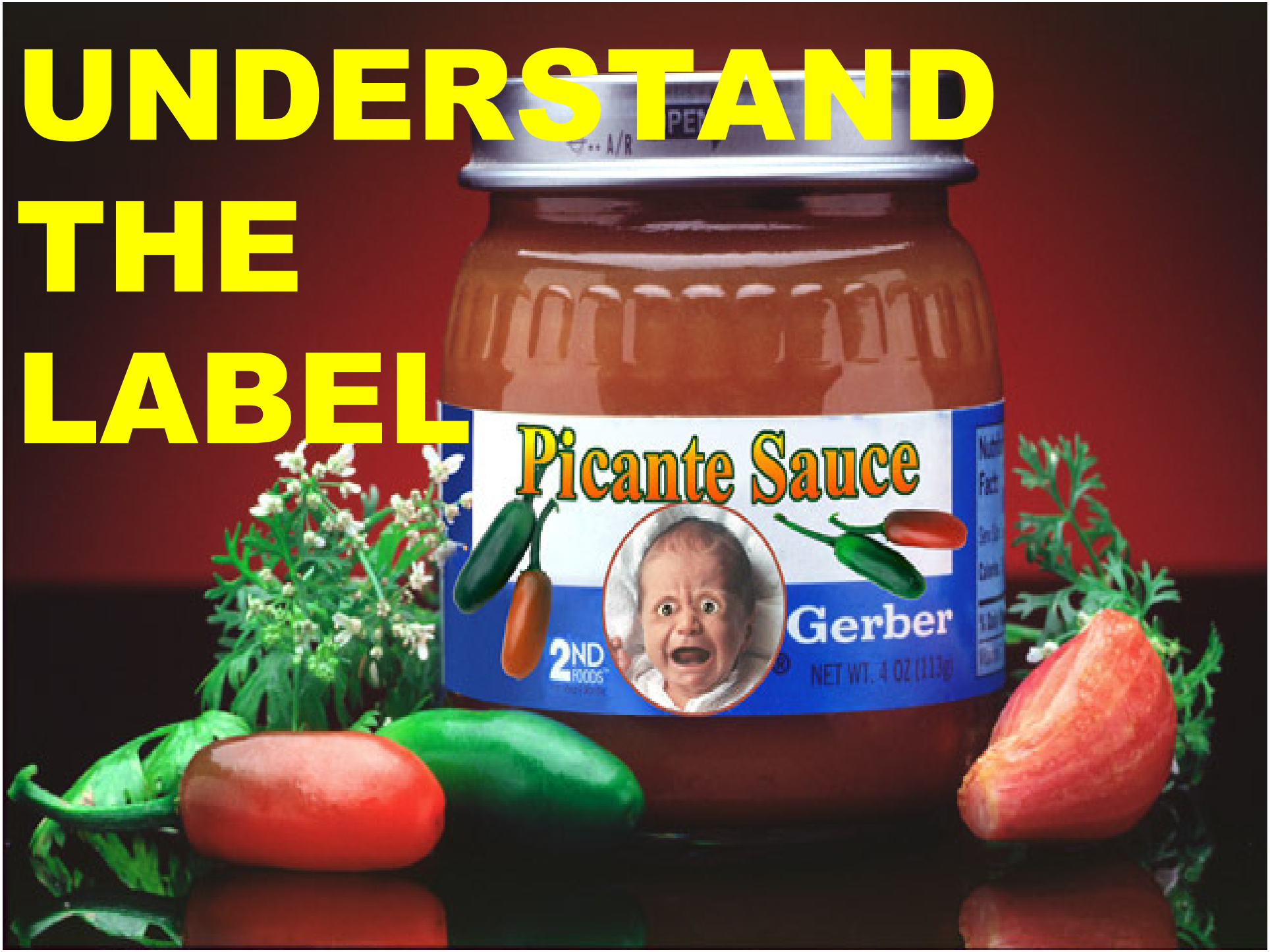
- Know your herbicides and use the safest effective one for the job and the site. Use recommended application rates.
- Cut stump applications for trees. Apply immediately.
- Oil-basal (to bottom 12”-18” of stems) for small trees and shrubs.
- Rosette applications – fall/early spring (if best timing for species)
- Thinvert System applications using back-pack sprayers
- Time all applications seasonally for best results.

SAFE AND EFFECTIVE USE OF PESTICIDES DEPENDS ON YOU!

NEVER exceed the application rate indicated on the label for your particular application, site, and species


medical consultation.
Persons suffering from heart disease, diabetes,
pressure and other health problems should
without medical consultation and
their doctor.
Do not
while under the influence
ics, or other drugs that cause sleepiness,
se/lower blood pressure.
wning - Unsupervised use of children is prohibited.
efore entering the spa, check spa temperature
The spa temperature should not exceed 104°F.
Use caution when bathing alone. Overexposure
dizziness, and fainting.
READ THE
LABEL

UNDERSTAND THE LABEL



FOLLOW INSTRUCTIONS
ON THE LABEL
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Questions?

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