Keeping Your Team Safe:
Reducing Pesticide Exposure

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Are Pesticides Safe?
- News Headlines -

- Pesticide Exposure Linked to Preterm Birth
- In-Home Pesticide Exposure and Parkinson's Risk
- Pesticide Traces Found in Kids Here (Seattle)
- Pet Flea Collars May Expose Children to Pesticide Harm
- Living Near Where Pesticides Used May Boost Fetal Death Due To Birth Defects
- Killing Mosquitoes or Killing Humans?
- West Nile Spraying to Begin - Worried Marcy Residents Have Many Concerns
- Are Synthetic Pesticides Sabotaging our Children's Health, Behavior, and Academic Performance?

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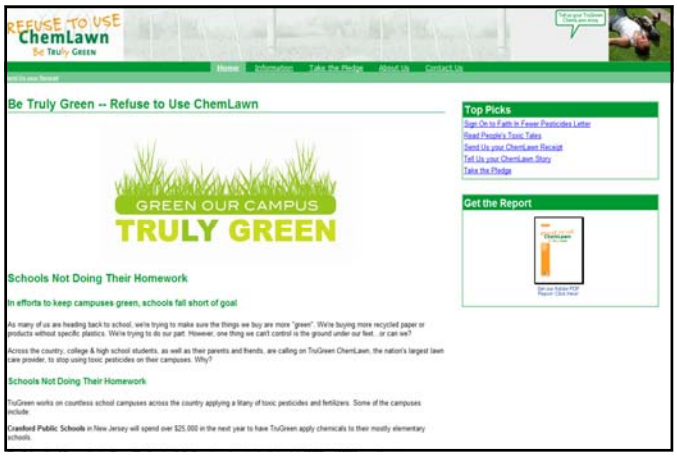

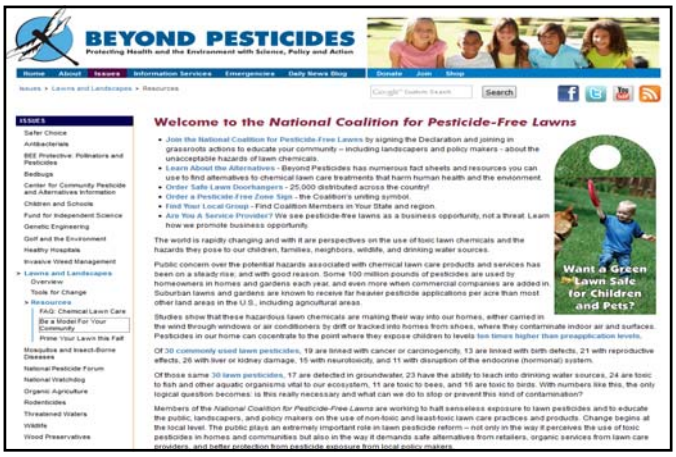

Table 5.5
Annual Amount of Pesticide Active Ingredient Used in the United States by Pesticide Type, 1988–2007 Estimate All Market Sectors

Year	Million Pounds of Active Ingredient						Year	Million Pounds of Active Ingredient					
	Herbi-cides/ PGR	Insecti-cides	Fungi-cides	Other Conv[1]	Other[2]	Total		Herbi-cides/ PGR	Insecti-cides	Fungi-cides	Other Conv[1]	Other[2]	Total
1988	557	132	99	137	266	1,191	1998	555	103	86	168	294	1,206
1989	567	123	98	154	251	1,193	1999	534	126	79	173	332	1,244
1990	564	121	91	173	252	1,201	2000	542	122	74	188	308	1,234
1991	546	114	86	182	226	1,154	2001	553	105	73	157	315	1,203
1992	554	116	81	189	246	1,186	2002	527	130	71	157	321	1,206
1993	527	115	80	192	248	1,162	2003	527	115	76	150	335	1,203
1994	583	124	79	199	244	1,229	2004	521	114	75	175	325	1,210
1995	556	125	77	203	249	1,210	2005	513	104	78	149	308	1,152
1996	578	116	79	222	234	1,229	2006	498	99	73	151	306	1,127
1997	568	112	81	197	270	1,228	2007	531	93	70	163	276	1,133

Note: Excludes wood preservatives, specialty biocides, and chlorine/hypochlorites.
Source: EPA estimates based on USDA/NASS (www.nass.usda.gov) and EPA proprietary data.
1. Other conventional pesticides include nematicides, fumigants, and other miscellaneous conventional pesticides. See Table 3.4.
2. "Other" includes sulfur, petroleum, and other chemicals used as pesticides (e.g., sulfuric acid and insect repellents). See Table 3.11.

Table 5.8
Annual Amount of Pesticide Active Ingredient Used in the United States by Pesticide Type, 1988–2007 Estimates
Home and Garden Market Sector

Year	Million Pounds of Active Ingredient						Year	Million Pounds of Active Ingredient					
	Herbi-cides/ PGR	Insecti-cides	Fungi-cides	Other Conv[1]	Other[2]	Total		Herbi-cides/ PGR	Insecti-cides	Fungi-cides	Other Conv[1]	Other[2]	Total
1988	43	13	13	3	67	139	1998	49	13	8	2	60	132
1989	44	12	13	2	68	139	1999	54	14	10	2	60	140
1990	46	12	10	2	66	136	2000	62	15	11	2	60	150
1991	46	12	9	2	65	134	2001[3]	62	17	12	2	61	154
1992	46	12	8	2	64	132	2002	62	19	11	2	61	155
1993	46	13	8	2	62	131	2003	53	21	11	2	61	148
1994	46	13	8	2	61	130	2004	51	19	10	2	61	143
1995	47	12	8	2	59	128	2005	48	17	9	2	61	137
1996	48	12	8	2	60	130	2006	46	16	7	2	61	132
1997	49	13	8	2	60	132	2007	43	14	7	2	61	127

Note: Excludes wood preservatives, specialty biocides, and chlorine/hypochlorites.
Source: EPA estimates based on USDA/NASS (www.nass.usda.gov) and EPA proprietary data.
1. Other conventional pesticides include nematicides, fumigants, and other miscellaneous conventional pesticides. See Table 3.4.
2. "Other" includes sulfur, petroleum, and other chemicals used as pesticides (e.g., sulfuric acid and insect repellents). See Table 3.11.
3. The previous estimate of herbicide and PGR use for 2001 was revised in the current report to based on new data.

Hazard (Risk) = Toxicity X Exposure

Toxicity = How poisonous is the pesticide?

Exposure = Amount X Duration

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Hazard (Risk) = Toxicity X Exposure

- All pesticides are toxic - they differ only in the *degree* of toxicity.
  - Measure toxicity using an LD_{50} value.
    - LD_{50} – Lethal Dose to kill 50% of the test animals.
      - The lower the LD_{50}, the more toxic the pesticide.

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RELATIVE TOXICITY CATEGORIES OF PESTICIDES

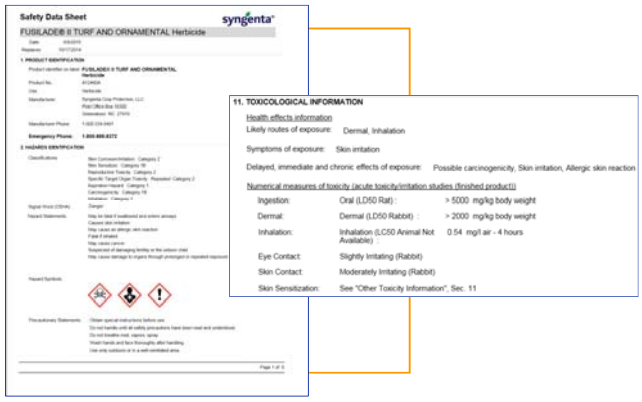
Important Note: This safety worksheet is **not a substitute** for reading the product label and material safety data sheet (MSDS). Always read the entire product label and material safety data sheet prior to each handling of any product or potentially hazardous material. If you don't understand any part of the product safety information, ask your supervisor for an explanation before you use the product.

Toxicity Category	Signal Word on Label.	Oral LD50 (1) (mg/kg) and probable lethal dose (2)	Dermal LD50 (mg/kg) and skin effects.	Eye effects.
I Highly Toxic	**DANGER POISON** (3)	Up to 50 A few drops To a teaspoon	0-200 Corrosive	Corrosive. Corneal opacity not reversible within 7 days.
II Moderately Toxic	**WARNING**	50-500 A teaspoon to an ounce	200-2,000 Severe irritation at 72 hours	Corneal opacity reversible within 7 days. Irritation persists for 7 days.
III Slightly Toxic	**CAUTION**	500-5,000 An ounce to one pint or pound	2,000-20,000 Moderate irritation at 72 hours	No corneal opacity. Irritation reversible within 7 days.
IV Relatively non-toxic	**CAUTION**	Over 5,000 Over one pint or one pound	Over 20,000 Slight irritation at 72 hours	No irritation.

(1) Toxicity of product is generally expressed as a LD50 or LC50 value. This is the lethal dose or lethal concentration to 50% of an animal test population in milligrams of material per kilogram of body weight. The lower the LD number, the more toxic the material.

(2) Probable oral lethal dose for 150 pound person.

(3) If signal word is DANGER by itself, it means that toxicity rating is based on eye and skin irritation.



Rank the fungicides in order of their toxicity:

1. Heritage (azoxystrobin)
2. Daconil (chlorothalonil)
3. Chipco 26GT (iprodione)
4. Compass (trifloxystrobin)

All are equal > 5,000 mg/kg

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LD_{50} Values for Common Fungicides

Fungicide (Common Name)	Trade Name	LD_{50} Oral (mg/kg)	LD_{50} Dermal (mg/kg)
Azoxystrobin	Heritage	>5,000	>2,000
Boscalid	Emerald	>2,000	>2,000
Chlorothalonil	Daconil Ultrex	>5,000	>2,000
Fludioxonil	Medallion	>5,050	>2,020
Iprodione	Chipco 26GT	>5,000	>2,000
Polyoxin D	Endorse	9,600	>2,000
Triadimefon	Bayleton	1,141	>2,000
Trifloxystrobin	Compass	>5,050	>2,000
Thiophanate methyl	3336	>7,500	>10,000

Rank the herbicides in order of their toxicity:

1. Buctril (Bromoxynil)
2. RoundUp (glyphosate)
3. Manor (metsulfuron)
4. 2,4-D

1. Buctril = 250 mg/kg
2. 2,4-D = 300 mg/kg
3. RoundUp = 4,300 mg/kg
4. Manor = > 5,000 mg/kg

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LD_{50} Values for Common Herbicides

Herbicide (Common Name)	Trade Name	LD_{50} Oral (mg/kg)	LD_{50} Dermal (mg/kg)
Metsulfuron	Manor, Blade	>5,000	>2,000
2,4-D	several	300	>2,000
Bromoxynil	Buctril	260	>3,660
Fluazifop-methyl	Fusilade	3,328	>2,420
Glyphosate	RoundUp	4,300	>5,000
MCPA	MCPA	800	>4,000
Pendimethalin	Pre-M, Pendulum	>5,000	>2,000

Rank the insecticides in order of their toxicity:

1. Distance (pyriproxyfin)
2. Talstar (bifenthrin)
3. Dursban (chlorpyrifos)
4. Orthene (acephate)

1. Dursban = 270 mg/kg
2. Talstar = 375 mg/kg
3. Orthene = 980 mg/kg
4. Distance = > 5,000 mg/kg

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LD_{50} Values for Common Insecticides

Insecticide (Common Name)	Trade Name	LD_{50} Oral (mg/kg)	LD_{50} Dermal (mg/kg)
Abamectin	Avid	650	>2,000
Acephate	Orthene	980	10,250
Bifenthrin	Talstar	375	>2,000
Carbaryl	Sevin	246	>4,000
Chlorpyrifos	Dursban	270	2,000
Cyfluthrin	Tempo	826	>2,000
Deltamethrin	DeltaGard	128	>2,000
Imidacloprid	Merit	460	2,000
Isofenphos	Oftanol	20	700
Malathion	Malathion	1,000	4,000
Pyriproxyfen	Distance	>5,000	>2,000
Trichlorfon	Dylox, Proxol	250	>2,100

The Dose Makes the Poison

Chemical	Term	Oral LD50	Pounds to Kill a 150 lb. Human
Benomil	Practically Non-Toxic	10,000 mg/kg	1.50 lbs
Mancozeb	Practically Non-Toxic	8,000	1.40 lbs
Iprodione	Slightly Toxic	5,000	0.75 lbs
Baking Soda	Slightly Toxic	4,220	0.63 lbs
Table Salt	Slightly Toxic	3,000	0.44 lbs
Propiconizol	Slightly Toxic	1,300	0.20 lbs
Aspirin	Slightly Toxic	1,250	0.19 lbs
Orthene	Moderately Toxic	866	0.13 lbs
Sevin	Moderately Toxic	850	0.12 lbs
Caffiene	Moderately Toxic	192	0.027 lbs
Nicotine	Highly Toxic	53	0.008 lbs = 1/8 oz

Hazard (Risk) = Toxicity X Exposure

- Pesticides are potentially dangerous to people if exposure is high.
  - Even a relatively non-toxic pesticide can be dangerous if exposure is high.
- Pesticide Effects:
  - Acute
  - Delayed (Chronic)
  - Allergic

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Acute Effects

- Refers to the effects from a single exposure or repeated exposure over a short time, such as an accident during mixing or applying pesticides
- Illnesses or injury that occur within 24 hours.

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Acute Effects

- Illnesses or injury that occur within 24 hours.
  - **Mild poisoning symptoms:** May be vague and can be compared with the flu.
    - Nausea, headache, tightness of chest, loss of appetite, stomach cramps.
  - **Moderate poisoning symptoms:** More pronounced than mild symptoms.
    - Nausea, trembling, muscular incoordination, excessive saliva, blurring of vision, tightness of chest, difficulty in breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhea, tearing from eyes, profound weakness, rapid pulse, cough.

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Acute Effects

- Illnesses or injury that occur within 24 hours.
  - **Severe poisoning symptoms:**
    - Vomiting, diarrhea, excessive sweating, inability to breathe, convulsions, fever, intense thirst, and coma.

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Delayed (Chronic) Effects

- Effects of long-term or repeated lower level exposures to a toxic substance.
  - Do not appear immediately after first exposure - may take years
    - Cancer
    - Injury to Unborn Children
      - Birth Defects, Miscarriage, Still Birth
    - System Problems
      - Anemia, Hard-to-stop bleeding, Paralysis
      - Liver and Kidney disorders

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Delayed (Chronic) Effects

- Carcinogenicity - ability to produce cancer or to assist carcinogenic chemicals;
- Mutagenicity - ability to cause genetic changes;
- Teratogenicity - ability to cause birth defects;
- Oncogenicity - ability to induce tumor growth (not necessarily cancers);
- Liver damage;
- Reproductive disorders (reduced sperm count, sterility, miscarriage);
- Nerve damage (including accumulative effects on cholinesterase depression associated with organophosphate insecticides);
- Allergenic sensitization (development of allergies to pesticides or chemicals used in formulation of pesticides).

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Allergic Effects

- Asthma
- Shock
- Skin Irritation - chaffing, rashes
- Sneezing, Itchy, watery eyes

1st exposure sensitizes the body.

2nd exposure causes the allergic reaction.

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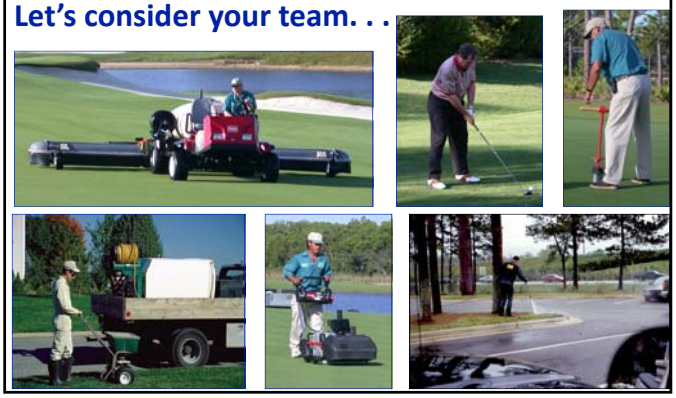
Let's consider your team. . .



But what about . . .

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Pesticide Exposure

- Routes of Entry
  - –Eyes
  - –Skin
  - –Lungs
  - –Oral

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Routes of Entry

******EYES******

- Accidents often occur during mixing and loading.
  - – Splashes from adding chemicals to the tank.
- Hose breaks.
- Wind blown drift.
- Rubbing of eyes.

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Choose Right Equipment

Eye Protection

Especially important during mixing and loading.

- Glasses
- Goggles
- Face Shields

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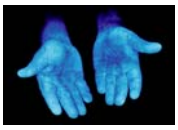
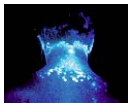
Routes of Entry

SKIN

- Most likely route because blood vessels are near the skin.
  - Fluorescent Dye Indicator Studies.
    - Hands receive the most exposure.
    - Foreheads and Mouth area.
    - Genital areas.





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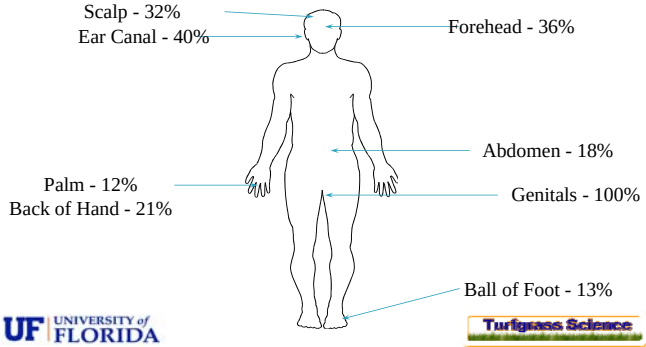
How Much Pesticide Will Skin Absorb?



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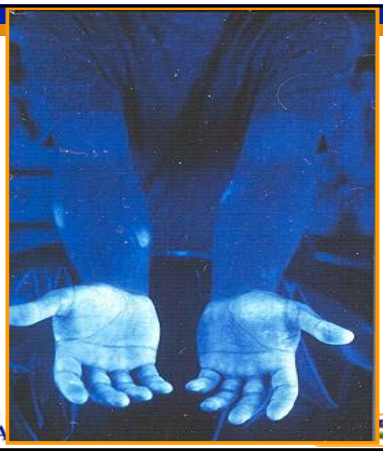

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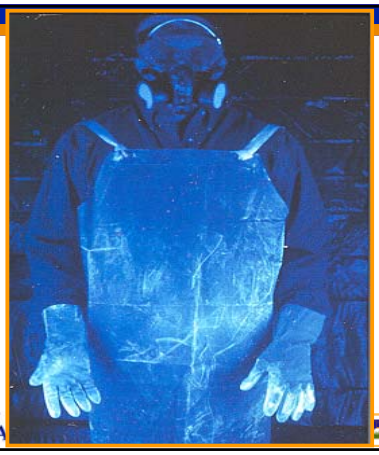

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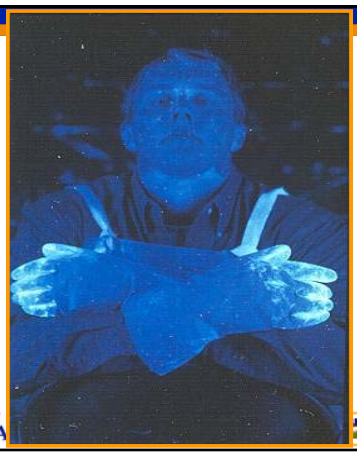

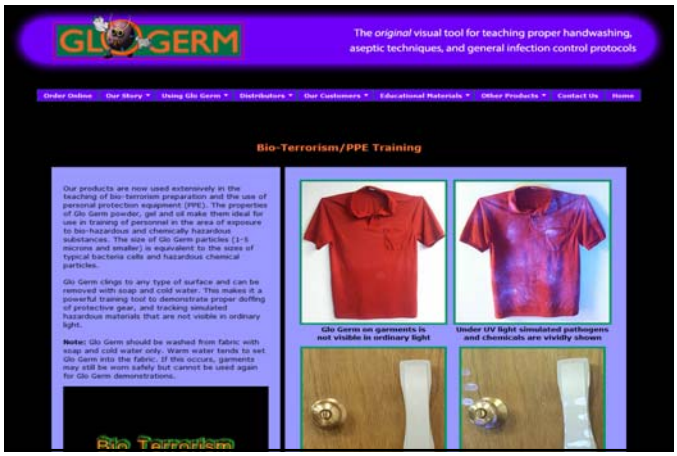

Routes of Entry

******SKIN******

– Cuts, Scrapes, and Rashes
  - 100% of pesticide can enter.

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Pesticide Ingredients

- ACTIVE – responsible for killing the pest
- INERT – makes the formulation safer, more effective and easier to handle
- ADJUVANT – may or may not already be present in the product; used for the same reason as the inert ingredients

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Liquid Formulations and Abbreviations

- EC or E – emulsifiable concentrate
- RTU – ready to use
- AS – aqueous suspension / solution
- S, SL or SC – water soluble liquids
- AS, F, FL, L or WDL – flowables, water-dispersible liquids

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Dry Formulations and Abbreviations

- D – dusts
- B – baits
- G – granular
- WP or W – wettable powder
- SP or WSP– soluble powder
- DF – dry flowable
- WDG – water dispersible granule

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Rank most absorbed to least absorbed

1. Emulsifiable Concentrates
2. Dusts
3. Baits
4. Water Dispersible Granules
5. Water Dispersible Liquids
6. Flowable
7. Soluble Concentrate

1. Emulsifiable Concentrates
2. Soluble Concentrate
3. Flowable
4. Water Dispersible Liquids
5. Water Dispersible Granules
6. Dusts
7. Baits

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Pesticide Formulation

Increasing Absorption

Least Absorbed | Dry Based | Water Based | Emulsifiable Concentrates | Most Absorbed

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Practical Considerations

- Adjuvants:
  - Penetrants & Emulsifiers
    - Can allow pesticide to enter skin more quickly.
  - Stickers
    - Allows pesticides to stick to PPE and skin.

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Personal Protective Equipment (PPE)

Choose the Right Equipment.

Clean and Maintain it Properly.

Use PPE Correctly.

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PRECAUTIONARY STATEMENTS *(continued)*

Personal Protective Equipment (PPE)

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for Category E on an EPA chemical resistance category selection chart.

Applicators and handlers (other than mixers and loaders) must wear:

- Long-sleeved shirt and long pants
- Chemical-resistant gloves, such as barrier laminate or nitrile rubber or Viton® or neoprene rubber
- Shoes plus socks

Mixers and Loaders must wear:

- Long-sleeved shirt and long pants
- Chemical-resistant gloves, such as barrier laminate or nitrile rubber or Viton or neoprene rubber
- Shoes plus socks
- Protective eyewear
- Chemical-resistant apron when mixing or loading

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

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing/PPE 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.

The more toxic a pesticide, the more PPE that is required

CAUTION	WARNING	DANGER
Regular work clothes—long-sleeved shirt, long pants, shoes & socks, waterproof gloves	Coveralls over work clothing, shoes & socks, chemical-resistant gloves, eyewear	Coveralls over work clothing, chemical-resistant gloves and footwear, respiratory and eye protection

Source: Iowa State Univ.

Choose Right Equipment

Chemical Resistant PPE

- Cotton, Canvas, and Leather are not chemically resistant.
  - Avoid clothe lined shoes, hats, gloves, etc.

Source: Iowa State Univ.

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Routes of Entry

******LUNGS******

- Pesticides are more likely to enter through your lungs if you are spraying in poorly ventilated areas.
  - Protected areas – limited air movement

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Routes of Entry

******ORAL******

- Not likely to swallow large amounts of pesticide unless someone puts chemicals in food and beverage containers.
  - Pop Bottles, Milk Containers, etc.
- Small amounts of pesticides are likely to enter if eating, drinking, smoking, or chewing tobacco & gum.

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Clean and Maintain Properly

Contaminated PPE is dangerous!

- Dispose of PPE contaminated with pesticides labeled with the signal words ***danger*** or ***warning***
- Wash contaminated work clothes and PPM separately.
  - Hot water with heavy duty detergent.
  - Rinse twice.
  - Wash the washing machine.

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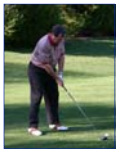
Let's consider your team. . .



Questions or Comments

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Mention of trade names in this presentation is solely for providing specific information. It is not a guarantee or warranty of the products named, and does not signify that they are approved to the exclusion of others of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

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