



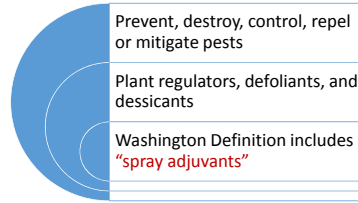
Personal Protective Equipment and Washing Clothes

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Research by Dr. Anugrah Shaw and Carol Black and recently presented research by Thia Walker, CSU



What is a pesticide?



- Herbicide
- Insecticide
- Fungicide
- Miticide
- Molluscicide
- Avicides
- Rodenticides
- Disinfectants
- And more.....



HEALTH RISK = TOXICITY X EXPOSURE

Acute Toxicity = Signal Word

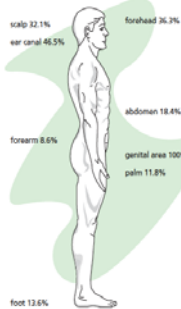
Signal Word = Acute Poisoning

Signal Word ≠ Other Health Effects



Protecting Mixer/Loaders and Applicators

- EPA Risk Assessment – From Jeff Dawson, EPA
- Pesticide Labeling and PPE

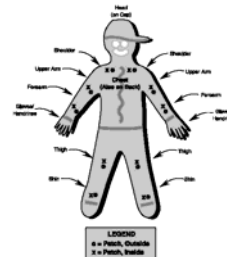


Dermal Risk Assessment for Occupational Users

- Risk assessment defines labeling language
 - Protective garments and gloves
 - Engineering controls
- Other exposures considered
 - Food, water, residential, post-application workers
- Risk assessments completed using task-based scenarios



Monitoring Data - Patch Method



Citation: Durham & Wolfe (1962) *Measurement Of The Exposure Of Workers To Pesticides*. Bulletin of the WHO 26:75-91



Dermal Sampling

Diagram of Inner Dosimeter

Dosimeter – Inner clothing that replicates your skin.

Monitoring Data Hand Exposures

Trapping Method:
(e.g., gloves)

Removal Method:
(e.g., various washes)

Face/Neck Wipe Technique

PPE Mitigations for Risk Management

Mixer/loader *at greatest risk*

Occupational Handler (Mixer/Loader) with coveralls, respirator, and gloves

Engineering Controls-closed system mixing and loading, apron, respirator, and gloves

Risk Assessment – MATH for EPA

Application rate, Treated area size, Dose/day, Body size, Absorption rate, Exposure

$$\text{Exposure (mg/day)} = \frac{\text{Application Rate}}{\text{Area Treated}} \times \text{Unit Exposure}$$

$$\text{Dose (mg/kg - day)} = \frac{\text{Exposure} \times \% \text{ Absorption}}{\text{Body Weight}}$$

$$\text{MOE} = \frac{\text{PoD (mg/kg - day)}}{\text{Dose (mg/kg - day)}}$$

Risk Assessment Results

- MOE – Margin of exposure
 - allows EPA to rank risks based on actual toxicity and EXPOSURE
- Additional uncertainty factors added
 - animals and humans differ (10x)
 - people differ (10x)
 - others added (10x - due to lack of data)
- Math comes out as
 - “not of concern”
 - “risks are of concern” – MUST MITIGATE

How is Toxicity Considered

- Evaluate toxicological data for concerns
 - neurotoxicity
 - reproduction
 - developmental
 - cancer
 - metabolism
- Consider different **effects**, **durations**, and **routes** (e.g., skin or inhaled)
- Decisions based on **most protective measures**




Use-Scenario Defines Exposure

- Who/what/where/how much/# of acres?
- Used to define the scope of an assessment
- Label uses are considered to ensure they are addressed
- Typical use information also considered to reflect common practices

The Pesticide Label

- Risk Assessment
 - Toxicity
 - Formulation
 - Use pattern
 - Dermal exposure
 - Inhalation exposure
 - Closed-mixing systems



VERY RARELY would this much protection be warranted, and extremely doubtful being a solid formulation

The Pesticide Label

Speedzone (2,4 D and dicamba)

- Who is Exposed?
 - Mixer-loaders
 - Applicators
 - Equipment maintenance
 - PPE is noted on the label per task

PRECAUTIONARY STATEMENTS

Hazards to Human and Domestic Animals
CAUTION: Harmful if swallowed, absorbed through skin or inhaled. Causes moderate eye injury. Avoid contact with eyes, skin or clothing, or inhaling spray mist. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

Personal Protective Equipment (PPE)
CAUTION: Some materials that are chemical resistant to this product are barrier laminate, nitrile rubber, neoprene rubber, or Viton. If you want more options, follow the instructions for category E on an EPA chemical resistance category selection chart.

All mixers, loaders, applicators and other handlers must wear:
 • long-sleeved shirt and long pants,
 • shoes and socks,
 • chemical-resistant gloves (except for applicators using ground boom equipment) and
 • chemical-resistant apron when mixing or loading, clearing up spills or equipment, or otherwise exposed to the concentrate.

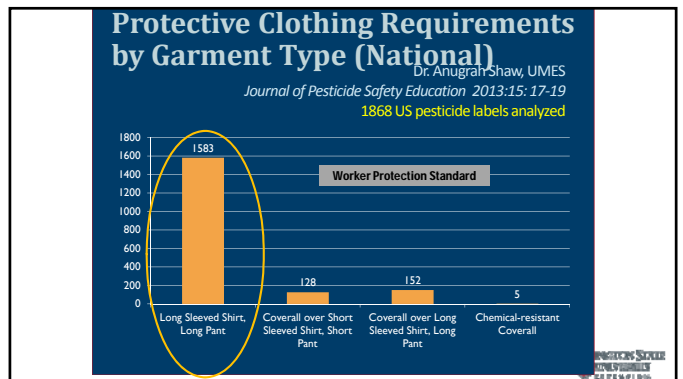
Defining Labeling Language Based on Acute Toxicity (40 CFR 156.212)

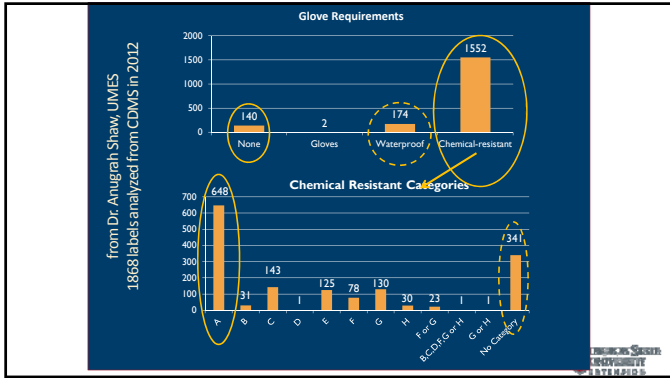
Acute Toxicity Category	WPS-Required Dermal PPE
Toxicity Category I Danger	Acute Dermal and Acute Dermal Irritation: Coveralls, long sleeved shirt, long pants, gloves, apron, headgear
Toxicity Category II Warning	Based on Acute Dermal and Acute Dermal Irritation: Coveralls, short sleeved shirt, short pants, gloves, apron, headgear
Toxicity Category III Caution	Based on Acute Dermal and Acute Dermal Irritation: Long sleeved shirt, long pants, gloves
Toxicity Category IV Caution	Based on Acute Dermal and Acute Dermal Irritation: Long sleeved shirt, long pants

Coverall is cotton or cotton polyester


Dual layer covering skin

Single layer covering skin





Gloves – The Beginning



- A.D. Little and EPA/ORD
- 100 tests
- 20 pesticide formulations
- 13 glove materials

- Permeation Resistance of Glove Materials to Agricultural Pesticides
- 1993 - Guidance Manual for Selecting Protective Clothing for Agricultural Pesticides Operations
 - A.D. Little, peer-reviewed by EPA

Gloves – The Basis

- Solvents generally permeate first*
- Labels are based on solvent types
- Labels should list TYPE of glove, not code
- Label - means gloves can be worn all day

Carrier Solvent	Selection Category Type
No solvent or aqueous solvent	A -- waterproof
Ketones	B
Alcohols	C
Acetates	D
Aliphatic Petroleum Distillates	E
Aromatic petroleum Distillates < 40%	F
Aromatic petroleum Distillates > 40%	G
Halogenated Hydrocarbons	H





Doing Laundry


Research from Thia Walker, Colorado State University presented at the National Pesticide Applicator Certification and Safety Education Workshop August 20-22, 2018 in San Antonio, Texas.

RECOMMENDED LAUNDRY PROCEDURE

(BASED ON 1980'S- EARLY 1990'S RESEARCH)



- DON'T PACK CLOTHES TOO TIGHTLY.
- PREWASH OR PRESOAK USING HOT WATER, IF POSSIBLE.
- USE LONGEST OR HEAVY DUTY WASH CYCLE, HIGHEST WATER LEVEL.
- EXTRA RINSE USING HOT WATER, IF POSSIBLE.
- USE HEAVY DUTY LIQUID DETERGENT.



Provides information on handling & washing contaminated clothing.

Also....

- Recommended cleaning washer after decontaminating clothing

And recognized:

- Laundry detergents have changed
- Lack of information on efficacy of front- or top-load HE machines
- Mandated energy saving settings (cold water rinses, water saving settings)
- Lack of information on synthetic or 'breathable' fabrics

RESOURCES

A SURVEY OF USE AND LAUNDERING PRACTICES FOR GARMENTS WORN BY PESTICIDE APPLICATORS
<https://AAPSE.WILDAPRICOT.ORG/RESOURCES/DOCUMENTS/AAPSE%20PUBLICATIONS/JPSE/ARTICLES/79/79-112-1-AS.PDF>

LAUNDERING PESTICIDE-CONTAMINATED WORK CLOTHES NDSU EXTENSION SERVICE PS1778
<https://WWW.AG.NDSU.EDU/PUBLICATIONS/CROPS/LAUNDERING-PESTICIDE-CONTAMINATED-WORK-CLOTHES>

CONTACT INFORMATION

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