



FLUORESCENT TRACER MANUAL

An Educational Tool for Pesticide Safety Educators



2007

Disponible en Español

“And [extension agents] have just taken off and run with it, I mean, they have used it in a number of ways for teaching exposure, and as time has gone on, all of us also figured out different ways to use it...I mean, they kind of adapted...there is just so many different ways you could use it that it really, really, is kind of a fun thing to do.”

~Pat Hipkins
Virginia Tech Pesticide Program

Cover Photographs:

Fluorescent Hands ~ Richard Fenske
Spray Nozzle Cleaning ~ Stacey Holland
Hands-on Training in Cambodia ~ Sinang Lee

FLUORESCENT TRACER MANUAL

AN EDUCATIONAL TOOL FOR PESTICIDE SAFETY EDUCATORS

Kit Galvin¹

Managing Editor

Sinang Lee¹

Editor

Flor Servin²

Ofelio Borges²

Karen Lewis³

Technical Advisors

Richard Fenske¹: Technical Advisor

Stacey Holland¹: Design, Illustration, and Production

Angela Carden¹, and Kathy Hall¹: Copy Editors

Jorge Villaseñor: Spanish Translation, Alba Enterprises

This manual represents the **collaborative efforts** of the following partners to improve pesticide handler education and training. Partners in this collaboration:

¹University of Washington Pacific Northwest Agricultural Safety and Health Center (PNASH)

²Washington State Department of Agriculture (WSDA) Farmworker Education Program

³Washington State University (WSU) Extension



PNASH



WASHINGTON STATE UNIVERSITY
 EXTENSION

Fluorescent Tracer Manual: An Educational Tool for Pesticide
Safety Educators
© 2007 University of Washington.
All rights reserved.
First edition, second printing

This manual was created by the University of Washington (UW) Pacific Northwest Agricultural Safety and Health Center, a component of the Agricultural Centers Program of the National Institute for Occupational Safety and Health.

Permission is granted to reprint and distribute *Fluorescent Tracer Manual: An Educational Tool for Pesticide Safety Educators*, provided that this copyright notice and permission statement is retained.

Please attribute UW appropriately. We would appreciate you providing a copy of reprinted materials and the feedback form to:

PNASH

Department of Occupational and
Environmental Health Sciences
University of Washington
Box 357234
Seattle, WA 98195-7234 USA

Any distribution of *Fluorescent Tracer Manual: An Educational Tool for Pesticide Safety Educators* does not imply or constitute endorsement by the University of Washington, WSDA's Farmworker Education Program, or WSU Extension of companies or products in *Fluorescent Tracer Manual: An Educational Tool for Pesticide Safety Educators*.

Disclaimer: Mention of any company or product does not constitute endorsement by the University of Washington's Pacific Northwest Agricultural Safety & Health Center (PNASH), the Washington State Department of Agriculture's Farmworker Education Program, or the Washington State University Extension.

We wish to thank the many farms and agricultural pesticide handlers who participated in the focus groups, training sessions, and studies. We also thank the PNASh and UW staff and students who conducted studies, reviewed drafts, and provided feedback: Marcy Harrington, Helen Murphy, Maria Tchong, McKinley Rainey, Maria Negrete, Yasmin Barrios, Darren Linker, Robin Russell, and Jennifer Gill; and the following contributors who shared their insight, knowledge, and experience with fluorescent tracers and pesticide handler training, and gave us permission to share their experience with you:

CONTRIBUTORS

Aurora Aragon

University of Leon, Nicaragua

Ramon Benavides

Washington State Department
of Labor and Industries

Carrie Foss

Washington State University

Homero Harari

IFA Corporation for the Development of
Production and Labor Environment, Ecuador

Pat Hipkins

Virginia Tech Pesticide Programs

Donna Houghton

University of Guelph, Canada

Teri Palermo

Centers for Disease Control and Prevention

Jaime Ramon

Washington State Department of Agriculture

Sabina Swift

University of Hawaii at Manoa

Tim Stock

Oregon State University

Margaret Tucker

Washington State Department of Agriculture

Luis Urias

Idaho State Department of Agriculture

Jennifer Weber

Arizona Department of Agriculture

Pou Sovann

Srer Khmer NGO, Cambodia

Sokunthea Koug

Srer Khmer NGO, Cambodia

Supported by:

CDC/NIOSH Cooperative Agreement #5U50OH07544

Washington State Medical Aid and Accident Funds

Contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC-NIOSH or Washington State.

Dear pesticide safety teachers and trainers,

When my colleagues and I first used the fluorescent tracer technique in the early 1980s for our research on dermal pesticide exposure, we quickly came to appreciate its potential as a training tool. After an application, pesticide handlers in our studies saw fluorescent tracer glowing on their skin and clothes, and grasped immediately the extent of contamination that had occurred. Seeing is believing in this case: the message is direct, and more powerful than any lecture. Visualizing skin contamination crosses language and cultural barriers.

Over the years, researchers, educators, trainers, and even artists have asked me, "how do you use tracers and how can I get started?" Others have developed innovative methods on their own for using fluorescent tracers in education and research. The fluorescent tracer technique has been used across the United States, and in Ecuador, Nicaragua, Cambodia, Canada, The Netherlands, and the United Kingdom. Our Fluorescent Tracer Manual project has drawn from all of these methods, and has made them available for the pesticide safety educator or trainer.

I am very pleased that we can offer you this manual as a single source for fluorescent tracer information. Whether you want to do a **Quick Demonstration** to catch a group's attention, evaluate **Workplace Pesticide Application** procedures and personal protective equipment, provide effective **Hands-on Training** for handlers in proper decontamination techniques, or spice up your Worker Protection Standard (WPS) training, you'll find step-by-step field-tested procedures in the manual. And we hope that you will use your own creativity to develop new ways to use the tracer.

The successful completion of this manual comes from a team effort with our collaborators: the Washington State Department of Agriculture, and Washington State University Extension, and my own staff at the Pacific Northwest Agricultural Safety and Health Center. I thank all of them for their commitment and dedication to producing a quality product. I also appreciate the contributions from pesticide handlers, farmers, educators, and researchers who have shared their experiences and innovations with this method, and whose knowledge has been incorporated into the manual. With these new tools in both Spanish and English, we all can move forward toward our goals of minimizing pesticide handler exposures and preventing pesticide-related illnesses.

On behalf of the tracer manual collaborators, I wish you good luck, and remember to have fun!

Richard Fenske

Richard Fenske, Professor and Director
Pacific Northwest Agricultural Safety and Health Center



PNASH

(800) 330-0827

<http://depts.washington.edu/pnash/>



(877) 301-4555

[http://agr.wa.gov/pestfert/
pesticides/workerprotection.htm](http://agr.wa.gov/pestfert/pesticides/workerprotection.htm)



(509) 335-2830

<http://pep.wsu.edu/>

P.S. Let us know how fluorescent tracers worked for you by filling out the survey at the back of the manual, or go online to http://depts.washington.edu/pnash/FT_manual.php for a secure online survey.

CONTENTS

Introduction	1
About this Manual	3
Getting Started with Fluorescent Tracers	5
Health & Safety	7
PART 1: Training Using the Fluorescent Tracer Technique	9
Quick Demonstrations: Light Up Your Discussion	11
Demo #1 – Baseball Cap	12
Demo #2 – Unplug a Spray Nozzle	13
Demo #3 – Dirty Fruits and Vegetables	14
Demo #4 – Handshake	15
Demo #5 – Improper Removal of PPE	16
Demo #6 – Cell Phone, Radio, Cigarette	17
Demo #7 – Pesticide Formulations	18
Demo #8 – Tyvek™ Suit	19
Workplace Pesticide Application: Seeing is Believing	21
Tracer in the Tank	23
Hands-On Activities: Learning by Doing	29
Activity #1: Application Equipment Decontamination	31
Activity #2: PPE Decontamination	37
Activity #3: Unplugging a Spray Nozzle	45
Activity #4: Taking a Bathroom Break	51
Activity #5: Backpack Spraying	57
PART 2: Additional Information	61
Helpful Hints	63
US Worker Protection Standard	64
Where to Obtain Supplies	66
Feedback Form	69
Ordering Information	71

“When workers walk in front of the black lights, the sight of tracer on their skin is a very dramatic demonstration of contamination...It provides a direct experience of exposure for the workers and allows them to discover on their own the problems and maybe the solutions. I am convinced that they are much more likely to embrace those solutions if they have been part of the discovery.”

~ Dr. Richard Fenske
Professor, University of Washington
Director, Pacific Northwest Agricultural Safety and Health Center

INTRODUCTION

For many agricultural workers and their families, pesticide exposure is a serious concern. Each year, as many as 25 million agricultural workers in developing countries may suffer from unintentional acute pesticide poisonings¹. In the United States, the US Environmental Protection Agency estimates that around 10,000 to 20,000 agricultural-related poisoning cases are reported annually. The majority of agricultural pesticide poisoning and injury incidents happen through skin exposure and absorption. Skin exposure occurs when an agricultural pesticide handler mixes and applies pesticides, or comes into contact with pesticide residues on contaminated surfaces, such as unwashed application equipment, or dirty personal protective equipment (PPE).



Using personal protective equipment is extremely important, but it does not provide a guarantee that a pesticide handler will be fully protected from chemical exposure. To test the protectiveness of certain types of PPE in field conditions, Dr. Richard Fenske pioneered the use of the fluorescent tracer technique in the early 1980s as a way to measure pesticide contamination on the skin of agricultural pesticide handlers. When Dr. Fenske studied handlers who used high-volume airblast sprayers in a California citrus grove, the fluorescent tracer technique showed that the pesticide could penetrate the PPE and get under it through openings like the neck². For more than 20 years, the studies of Dr. Fenske and other scientists using the fluorescent tracer technique have revealed that pesticide contamination on the skin is largely unrecognized and is influenced by many possible factors such as:

- Characteristics of pesticides
- Type of protective clothing
- Environmental conditions
- Culture of the workplace
- Methods of mixing and application
- Knowledge and practices of individual pesticide handlers

Researchers recognized early on that the fluorescent tracer technique is also a compelling way to teach agricultural pesticide handlers, managers, farming communities, and other trainers about pesticide exposure. Fluorescent tracers have been used in pesticide safety projects in the US, Canada, Europe, Ecuador, Nicaragua, Cambodia, and Mali. Recently, the Washington State Department of Agriculture has used tracers in their Hands-on Handler Training. As an educational tool, the fluorescent tracer technique can enhance learning, stimulate discussion, and promote safe practices. Most participants will be surprised to see the extent of contamination on themselves or on others. This can leave a lasting impression and motivate workers to protect themselves from pesticide exposure. Seeing skin contamination can help people understand where, how, and why pesticide exposure occurs. With new knowledge, participants can take appropriate steps to minimize pesticide exposure.

¹Jeyaratnam, J. (1990). Acute Pesticide Poisoning: A Major Global Health Problem. *World Health Statistics Quarterly* 43(3):139-44.

²Fenske, R. (1988). Comparative assessment of protective clothing performance by measurement of dermal exposure during pesticide applications. *Appl Ind Hyg* 3:207-213

ABOUT THIS MANUAL

To bring research into practice, the University of Washington's Pacific Northwest Agricultural Safety and Health Center, the Washington State Department of Agriculture's Farmworker Education Program, and the Washington State University Agricultural Extension collaborated to develop and evaluate the fluorescent tracer research technique as a tool to enhance pesticide handler training. This manual is based on the evaluation results and experiences of many researchers and educators, nationally and internationally.



The purpose of this manual is to provide guidance on how to use fluorescent tracers in pesticide safety training. The manual, available in Spanish and English, is for pesticide safety educators, including agricultural extension agents, integrated pest management trainers, farm supervisors and safety managers – anyone interested in teaching about safe farming practices. You can download Spanish or English copies of the manual from the PNASH website (http://depts.washington.edu/pnash/FT_manual.php).

Educators new to the fluorescent tracer techniques should first read the introductory informational sheets, **Getting Started with Fluorescent Tracers** (p. 5) and **Health and Safety** (p. 7), for basic background on the technique and how to use it in a safe manner.

The manual has two parts:

- Part 1 provides examples of how to use the technique in **Quick Demos** (p.11), **Workplace Pesticide Application** (p.21), or **Hands-on Activities** (p. 29). Each example stands alone with step-by-step procedures so you can start training with the technique right away. These examples are meant as guidance and should be adapted to fit the farming methods and equipment relevant to your audience.
- Part 2 provides information on **Helpful Hints** (p. 63) and **Where to Obtain Supplies** (p.66) to help you prepare for training with fluorescent tracers. Information on parts of the **US Worker Protection Standard** (p.64) can be incorporated into discussions of relevant trainings.

Please use the **Feedback Form** (p. 69) or go online to (http://depts.washington.edu/pnash/FT_manual.php) for a secure online survey to share how you use the technique, and to suggest improvements to this manual.

The key to using fluorescent tracers successfully is to practice ahead, be creative, and have fun doing it!
Your rewards: participants engaged in learning about pesticide contamination and exposure.



PNASH

GETTING STARTED WITH FLUORESCENT TRACERS

Frequently Asked Questions

1. *What is the fluorescent tracer technique?*

The fluorescent tracer technique is a way to mimic pesticide contamination on skin, clothes, and surfaces. A nontoxic chemical called a “fluorescent tracer” is used to mark areas where pesticides get on skin and clothes. Like some pesticides, you cannot see fluorescent tracers when mixed, diluted, and applied as they are invisible under normal lighting. Unlike pesticides, fluorescent tracers glow under a special lamp called a “black light” to show areas of contamination. As a result, the fluorescent tracer technique can provide a clear picture of pesticide contamination on the skin. Patterns of contamination are clues to how pesticide exposure may have occurred. Was there a tear in the personal protective equipment? Did a splash occur? Participants use immediate visual feedback to judge for themselves.

2. *Why is the fluorescent tracer technique an effective teaching tool?*

The fluorescent tracer technique provides an immediate visual and interactive way to learn about pesticide contamination. This is particularly effective for people with limited formal education or literacy skills. The technique makes the training relevant to a participant’s own experiences and stimulates discussion.

3. *How do fluorescent tracers relate to real pesticides?*

Since fluorescent tracers stick to many surfaces that come into contact with skin and clothes, they mimic the behavior of pesticides. Fluorescent tracers usually show the same patterns of contamination as pesticides.

4. *How do you train with the fluorescent tracer technique?*

The fluorescent tracer technique can be used in quick demonstrations, workplace applications, or hands-on activities.

Quick demos can be done in a large group and are relatively easy because they don’t require a lot of time and supplies. An example of a quick demonstration is “contaminating” an item such as a piece of fruit with fluorescent tracer, and then handing it to an unsuspecting participant. The participant will then have residue on his or her hands.

Workplace pesticide applications have agricultural pesticide handlers perform pesticide handling tasks at work with fluorescent tracer in the sprayer tank along with pesticides. These workplace applications can reveal how a handler’s skin and clothing become contaminated. This is an excellent tool to evaluate how well safety procedures and equipment minimize exposure. This type of demonstration can have a profound effect on pesticide handlers, management, and the community. It takes time, supplies, and preparation to perform this at the workplace, but the result justifies the effort.

Hands-on activities use scripted role-plays or instructor-led demonstrations. These hands-on activities have specific messages and learning objectives, such as how to properly decontaminate an airblast sprayer. In order to be successful, the activities require time, supplies, and preparation. They work best for small groups because everyone can be involved.

5. **What are fluorescent tracers?**

Fluorescent tracers or brighteners are common ingredients used in laundry detergents; they give your clothes that “whiter than white” effect. Paper and plastic industries also have used them for a long time. Fluorescent tracers have special properties that make them glow in the dark, they absorb ultraviolet light and reflect bright visible light. Like pesticides, fluorescent tracers can be water-soluble or oil-soluble.

6. **What is a black light?**

Black lights are commonly used in dance clubs to produce a “glow in the dark” effect in a darkened room. They are also used to check for counterfeit money. Black lights emit a type of ultraviolet light called long-wave or UV-A. Special lamps come in different shapes and sizes, from small hand-held battery-operated units to four foot bulbs that require a power outlet. Fluorescent tracers absorb and transform ultraviolet light into visible light – a bright light that glows in the dark.

7. **What supplies do I need and where can I obtain them?**

The fluorescent tracer technique requires three things: (1) a fluorescent tracer, (2) a black light, and (3) a dark area. Fluorescent tracers and black lights can be ordered from companies online or over the phone. You can also find small black lights in party or costume stores. See **Where to Obtain Supplies** (p. 66). To see the contamination, you need a dark area. The darker it is, the easier it is to see the glow.

8. **How do I create a dark area?**

Since fluorescent tracers are invisible in normal light, a dark area with little or no indoor or outdoor lighting is required to see the tracer glow. Be creative when setting up a dark area. Use dark fabric to cover openings and bright objects in the room or have participants huddle around each other. If it’s still not dark enough, consider viewing the tracer contamination at night. The visual effect of the fluorescent tracer technique depends on the brightness of the fluorescent tracer, the strength of the black light, and the darkness of the area. To enhance the glow use stronger black lights, add more tracer to the mixture, or use a brighter fluorescent tracer.

9. **Are fluorescent tracers and black lights safe to handle?**

Fluorescent tracers and black lights are generally considered safe to use. Nevertheless, it is important to use good chemical handling practices: never smell, intentionally inhale, taste or swallow the tracer; properly label all containers containing the tracers; and wash thoroughly with soap and water after handling tracers. For the brief time needed to demonstrate the technique, black lights or UV-A lights are safe for eyes and skin. Nevertheless, do not look directly at the bulb. Use UV-A shielding goggles for added protection. See **Health and Safety** (p. 7).

10. **How can I ensure that the fluorescent tracer activity works?**

Practice ahead of time to ensure the activity goes as planned. See **Helpful Hints** (p. 63).

HEALTH AND SAFETY

Please read these important guidelines on how to use fluorescent tracers, rubbing alcohol and black lights in a safe manner. Whenever using the fluorescent tracer technique, make sure to have the following safety materials:

- ❑ Chemical protective gloves for mixing tracer recipes
- ❑ UV-A shielding goggles for participants to wear when black lights are on
- ❑ Material Safety Data Sheet (MSDS) for the fluorescent tracer being used
- ❑ MSDS for rubbing alcohol (70% isopropanol), if it is used

Black Light Safety

Black lights are commonly used in dance clubs to produce a “glow in the dark” effect in a darkened room. They emit a type of ultraviolet light called long-wave UV-A. Ultraviolet light comes from natural sunlight and artificial sources such as tanning booths. Exposure to UV-A as used in the fluorescent tracer technique, is generally not considered harmful. Exposure to the higher intensity ultraviolet light can cause sunburn and other health effects.



Exposure to black lights for a very long time may irritate eyes and skin and accelerate aging of skin. Looking directly at the bulb may cause eye discomfort. Responses like these are unlikely to happen during the brief time black lights are needed for the fluorescent tracer technique. Nevertheless, take precautions. Do NOT hold the black light within six inches of your or another person’s eyes and do NOT look directly at the bulb. A person being viewed under the black light can wear protective UV-A shielding goggles or can be asked to close his or her eyes.



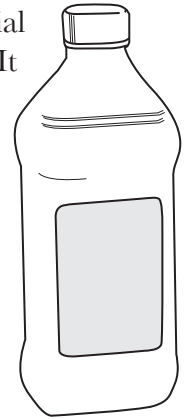
Some products and medications, such as certain antibiotics, allergy medications, and pain relievers, may cause the skin to be more sensitive to UV-A light.¹ This reaction typically occurs when the skin is exposed to stronger sources like sunlight, not during the limited use of the lower intensity lamps described in this manual. If however, someone does experience skin irritation after using the black light, have them seek medical attention.

Fluorescent Tracers

Fluorescent tracers generally have very low acute toxicity. More information can be found on the MSDS provided by the manufacturer. Carefully read the label and MSDS before using a tracer and follow the manufacturer’s instructions. Follow proper chemical handling practices and safety procedures as described on the following page.

Rubbing Alcohol (70% Isopropanol)

Some fluorescent tracer recipes use rubbing alcohol (or 70% isopropanol) to improve the transfer of tracer from contaminated surfaces to clothes or skin. Most of the isopropanol evaporates after it is applied to a surface or personal protective equipment. As with all industrial chemicals, follow good chemical handling practices and proper safety procedures (see below). It is important to take precautions when using isopropanol, because it is flammable, and can be a health hazard if overexposure occurs. Keep isopropanol away from heat, ignition sources (sparks), and flames. Apply tracer with isopropanol in a well ventilated area (outside).



Never apply isopropanol directly to the skin or face, as it can be absorbed through the skin. Inhaling the vapors or getting it on your skin or in eyes can cause irritation. Splashes to the eyes may cause eye damage. Exposure to high concentrations may affect the central nervous system and may produce symptoms such as dizziness, headaches, or nausea. Before using the isopropanol, read the label and the MSDS supplied by the manufacturer and follow directions for safe use, spill cleanup, first aid and emergency measures. Follow proper chemical handling practices and safety procedures as described below.

General Chemical Safety

Handling Practices

- Never smell, inhale, taste, or swallow the product.
- Know the physical and health hazards associated with the product from its MSDS.
- Wear chemical protective goggles and gloves when handling.
- Properly label all containers containing the tracer according to Occupational Safety and Health Administration hazard communication standards (CFR 1910.1200)².
- Store chemicals in a tightly closed container in a cool, dark, and well-ventilated place.

First Aid Procedures (*check the MSDS for specific instructions for each product*)

- Eye contact: If product gets into the eyes immediately flush with water for at least 15 minutes while holding eyelids open. Seek medical advice.
- Skin contact: Flush skin with plenty of water. Get medical attention if irritation occurs.
- Inhalation: If inhalation of dust or vapors occurs, immediately go to an area with fresh air. Get immediate medical attention.
- Ingestion: If ingested, vomiting may occur naturally. Do not induce vomiting. Get immediate medical attention.

Cleanup Methods

- Launder clothing items (baseball caps, sweatshirt, etc.) with detergent.
- Wash off skin with soap and rinse thoroughly under running water. For certain fluorescent tracers, it may take a week for tracer to disappear completely from the skin. *Note: It will only be visible under black light.*
- Scrub tracer off personal protective equipment (gloves, rain suit, boots, etc.) with detergent and rinse thoroughly under running water. Usually tracer is the easiest to remove when it is still wet.

¹Sliney, D. H., (1998). Ultraviolet Radiation . Encyclopaedia of Occupational Health and Safety. 4th Ed. International Labour Organization. Geneva, Switzerland. <http://www.ilo.org/encyclopeda/>.

²OSHA Hazard Communication Standards (CFR 1910.1200) http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10099

PART 1

TRAINING USING THE FLUORESCENT TRACER TECHNIQUE

Quick Demos: Light Up Your Discussion	11
Demo #1 – Baseball Cap	12
Demo #2 – Unplug Spray Nozzle - Demo	13
Demo #3 – Dirty Fruits and Vegetables	14
Demo #4 – Handshake	15
Demo #5 – Improper Removal of PPE	16
Demo #6 – Cell Phone, Radio, Cigarette	17
Demo #7 – Pesticide Formulations	18
Demo #8 – Tyvek™ Suit	19
Workplace Pesticide Application: Seeing is Believing	21
Tracer in the Tank	23
Hands-On Activities: Learning by Doing	29
Activity #1: Application Equipment Decontamination	31
Activity #2: PPE Decontamination	37
Activity #3: Unplugging a Spray Nozzle - Activity	45
Activity #4: Taking a Bathroom Break	51
Activity #5: Backpack Spraying	57



WSDA



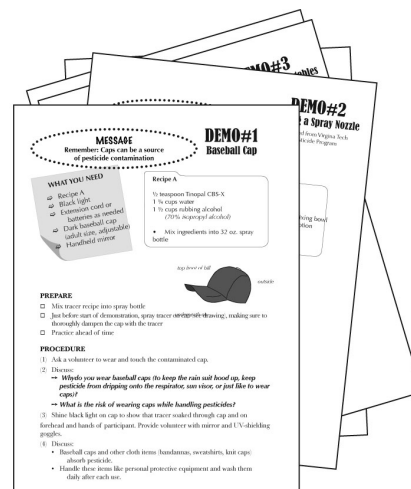
PNASH

QUICK DEMOS

Light Up Your Discussion

Quick demonstrations can be done in a large group and are relatively easy because they don't require a lot of time and supplies. There are eight examples of quick demonstrations in this manual.

- Demo #1 – Baseball Cap
- Demo #2 – Unplugging a Spray Nozzle - Demo
- Demo #3 – Dirty Fruits and Vegetables
- Demo #4 – Handshake
- Demo #5 – Improper Removal of PPE
- Demo #6 – Cell Phone, Radio, Cigarettes
- Demo #7 – Pesticide Formulations
- Demo #8 – Tyvek™ Suit



Below are tracer recipes needed for the quick demos .

Recipe A

½ teaspoon Tinopal® CBS-X
 1¼ cups water
 1½ cups rubbing alcohol
 (70% isopropanol)

- Mix ingredients into 32 oz. spray bottle
- Label spray bottle "Recipe A"

Recipe B

¼ teaspoon flour
 1 squirt of GloGerm™ lotion

- Measure flour into a small mixing bowl
- Add one squirt of GloGerm™ lotion onto flour
- Mix ingredients into a paste

Recipe C

2 tablespoon DayGlo™ Invisible Blue A594-5
 2 cups of cornstarch or flour

- Mix ingredients into sealable plastic bag (1 gallon) bag or brown grocery paper bag

Recipe D

¼ teaspoon Tinopal® CBS-X
 2¼ cups water

- Mix ingredients into 32 oz. spray bottle
- Label spray bottle "Recipe D"

DEMO#1

Baseball Cap

PNASH

MESSAGE

Remember: Caps can be a source of pesticide contamination

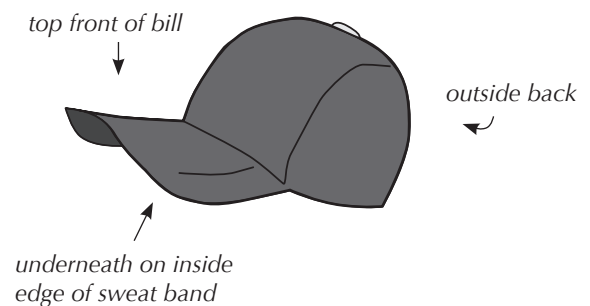
WHAT YOU NEED

- Recipe A
- Black light
- Extension cord or batteries as needed
- Dark baseball cap (adult size, adjustable)
- Handheld mirror

Recipe A

½ teaspoon Tinopal® CBS-X
1¼ cups water
1½ cups rubbing alcohol
(70% isopropanol)

- Mix ingredients into 32 oz. spray bottle
- Label spray bottle "Recipe A"



PREPARE

- Mix tracer recipe into spray bottle.
- Just before start of demonstration, spray tracer on cap (see drawing), making sure to thoroughly dampen the cap with the tracer.
- Practice ahead of time.

PROCEDURE

- (1) Ask a volunteer to wear and touch the contaminated cap.
- (2) Discuss:
 - **Why do you wear baseball caps (to keep the rain suit hood up, keep pesticide from dripping onto the respirator, sun visor, or just like to wear caps)?**
 - **What is the risk of wearing caps while handling pesticides?**
- (3) Shine black light on cap to show that tracer soaked through cap and on forehead and hands of participant. Provide volunteer with mirror and UV-shielding goggles.
- (4) Discuss:
 - Baseball caps and other cloth items (bandanas, sweatshirts, knit caps) absorb pesticide.
 - Handle these items like personal protective equipment and wash them daily after each use.
 - **What are alternatives to the cloth items? What are the pros and cons for these options?**

DEMO#2

Unplug a Spray Nozzle

Adapted from Virginia Tech
Pesticide Program
“Hands-on Manual Lesson Plans”

MESSAGE
Bring proper tools to
safely unplug spray nozzles

WHAT YOU NEED

- Recipe B
- Black light
- Extension cord or batteries as needed
- Toothpick
- Spray nozzle attached to any sprayer

Recipe B

¼ teaspoon flour
1 squirt of GloGerm™ lotion

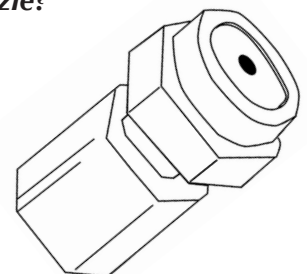
- Measure flour into a small mixing bowl
- Add one squirt of GloGerm™ lotion onto flour
- Mix ingredients into a paste

PREPARE

- Mix tracer recipe into a paste.
- Use toothpick to plug paste in and around spray nozzle.
- Practice ahead of time.

PROCEDURE

- (1) Ask a volunteer to unplug a spray nozzle **WITHOUT** using tools and his/her mouth.
- (2) Discuss:
 - **How do you normally unplug a spray nozzle in the field?**
- (3) Shine black light on participant’s hands and clothing.
- (4) Discuss:
 - Proper tools needed to safely unplug a spray nozzle are:
 - Thin 8-mil nitrile gloves to easily handle small nozzle parts.
 - Crescent wrench to unscrew nozzle from sprayer. *Note: Some spray nozzles may not require this wrench. Check with the manufacturer for appropriate instruction.*
 - Thin wire and toothbrush to unplug nozzle.
 - **Why should you not use your mouth to blow through a spray nozzle?**



DEMO#3

Dirty Fruits and Vegetables

Adapted from Virginia Tech
Pesticide Program
"Hands-on Manual Lesson Plans"

MESSAGE

Wash fruits and vegetables thoroughly and
wash hands with soap and water before eating

WHAT YOU NEED

- Germ Glo® lotion or Recipe D
- Black light
- Extension cord or batteries as needed
- Fruits and/or leafy vegetables

Recipe D

¼ teaspoon Tinopal® CBS-X
2¼ cups water

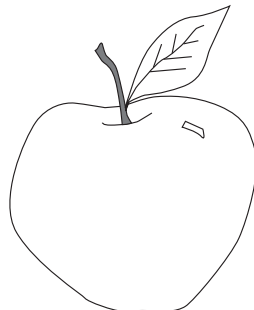
- Mix ingredients into 32 oz. spray bottle
- Label spray bottle "Recipe D"

PREPARE

- Lightly spray Recipe D onto vegetables or smear a small amount of GloGerm™ lotion onto fruits (Do not put so much that it is obvious).
- Practice ahead of time.

PROCEDURE

- (1) Ask for a volunteer to pass out contaminated fruits and/or vegetables. Tell participants to imagine they are out in the field with no wash water available.
- (2) Ask participants to try to remove the pesticide residues and dirt from the fruits and vegetables. Do not have them actually eat the fruits and vegetables.
- (3) Shine black light on participants' hands and clothing.
- (4) Discuss:
 - Pesticide residues on food, application equipment, gloves, and other surfaces are sources of exposure.
 - *Where did pesticide residues on the fruits and vegetables end up?*
 - *How can you reduce exposure from pesticide residues on fruits and vegetables?*



DEMO#4

Handshake

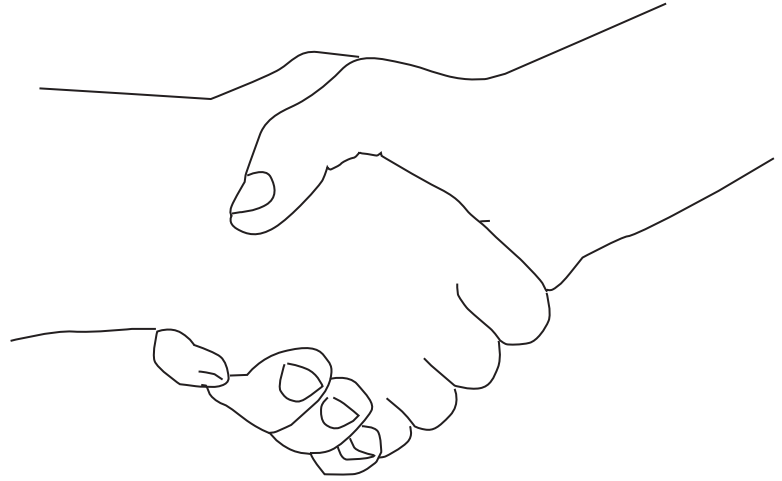
Adapted from Virginia Tech
Pesticide Program
"Hands-on Manual Lesson Plans"

MESSAGE

Wash hands with soap and water
after handling pesticides

WHAT YOU NEED

- Germ Glo® Powder or DayGlo® Invisible Blue (A-594-5) powder
- Black light
- Extension cord or batteries as needed



PREPARE

- Contaminate your hand with just enough tracer powder that the powder does not obviously show.
- Practice ahead of time.

PROCEDURE

- (1) Shake hands with one or two people before you start the training.
- (2) Proceed with your scheduled agenda.
- (3) Shine black light on participants'
 - Hands
 - Clothes
 - Face (participants must close eyes or wear UV-shielding goggles)
 - Training materials
 - Neighbors sitting nearby
- (4) Discuss:
 - **What do you see?**
 - **If this was pesticide, how would it be dangerous?**

MESSAGE

Think “Clean to Clean; Dirty to Dirty”

DEMO#5

Improper Removal of PPE

PNASH

WHAT YOU NEED

- Recipe A
- Black light
- Extension cord or batteries as needed
- 1 chemical-resistant jacket and pant suit

Recipe A

½ teaspoon Tinopal® CBS-X
1¼ cups water
1½ cups rubbing alcohol
(70% isopropanol)

- Mix ingredients into 32 oz. spray bottle
- Label spray bottle “Recipe A”

- 1 pair rubber boots
- Half or full-face respirator
- 1 pair of chemical-resistant goggles
- 1 pair of 15-mil nitrile green gloves
- Black or navy blue hooded sweatshirt

PREPARE

- Dress volunteer in sweatshirt and full-gear PPE.
- Spray a large amount of tracer mixture on PPE suit, gloves, and back of hood.
- Practice ahead of time.

PROCEDURE

- (1) Ask the volunteer wearing the full-gear PPE suit to demonstrate removing PPE improperly. Participants can suggest other improper ways they have seen at their farms.
- (2) Ask volunteer to:
 - Remove raincoat hood with contaminated gloves on and touch head and sweatshirt hood
 - Adjust respirator strap with contaminated gloves on
 - Unsnap raincoat jacket with contaminated gloves on, and touch sweatshirt underneath
 - Carry contaminated PPE jacket over bare arm.
- (3) Shine black light on the volunteer’s skin and clothes.
- (4) Discuss:
 - Think “**Clean to Clean; Dirty to Dirty**” to remember that clean gloves should only touch clean areas and dirty gloves should only touch dirty areas on the outside of PPE.



DEMO#6

Cell Phone, Radio, Cigarette

WSDA, PNASH

MESSAGE

Always decontaminate gloves and hands
before using items that can expose the face
to pesticides

WHAT YOU NEED

- Recipe A
- Black light
- Extension cord or batteries as needed
- Cell phone, hand-held radio, pen or cigarette

- Nitrile gloves
- UV-A shielding goggles
- Handheld mirror

Recipe A

½ teaspoon Tinopal® CBS-X
1¼ cups water
1½ cups rubbing alcohol
(70% isopropanol)

- Mix ingredients into 32 oz. spray bottle
- Label spray bottle "Recipe A"

PREPARE

- Mix Recipe A in a spray bottle.
- Practice ahead of time.

PROCEDURE

- (1) Ask for volunteer(s) to wear gloves. Spray tracer on front and back sides of gloves.
- (2) Ask volunteer(s) to pretend to talk to his/her spouse on the cell phone, hold the radio to the ear, or smoke a cigarette.
- (3) Shine black light on volunteer's face. Allow volunteer(s) to see themselves with the mirror with UV-shielding goggles on.
- (4) Discuss:
 - *How did the volunteer become contaminated with pesticides?*
 - *What should he/she have done to minimize pesticide exposure?*
 - *How can you prevent exposure?*



DEMO#7

Pesticide Formulations

Adapted from Virginia Tech
Pesticide Program
“Hands-on Manual Lesson Plans”

MESSAGE

Different pesticide formulations can lead to different contamination patterns

WHAT YOU NEED

- Recipe C
- Recipe D
- Black light
- Extension cord or batteries as needed

- 1 large gallon-size sealable plastic bag or brown grocery paper bag
- 1 empty bottle
- 2 backpack sprayers or large jars with lid

Recipe D

¼ teaspoon Tinopal® CBS-X
2¼ cups water

Mix ingredients into 32 oz. spray bottle
Label spray bottle “Recipe D”

Recipe C

2 tablespoon DayGlo® Invisible Blue A594-5
2 cups of cornstarch or flour

- Mix ingredients into sealable plastic bag (1 gallon) bag or brown grocery paper bag

PREPARE

- Use Recipe C to make a simulated dry pesticide and put into a bag.
- Use Recipe D to make a simulated liquid pesticide and put into a bottle.
- Practice ahead of time.

PROCEDURE

- (1) Ask for two volunteers:
 - Volunteer 1 will pour simulated dry pesticide into a spray tank.
 - Volunteer 2 will add simulated liquid pesticide into another spray tank.
- (2) Shine black light on participants’ hands, face, clothing, and work area.
- (3) Discuss with participants:
 - *How can the difference in pesticide formulations lead to differences in skin contamination?*



DEMO#8

Tyvek Suit

WSDA, PNASH

MESSAGE

Only wear laminated Tyvek™ suits when handling pesticide; not all Tyvek™ suits are laminated.

Recipe D

¼ teaspoon Tinopal® CBS-X
2¼ cups water

- Mix ingredients into 32 oz. spray bottle
Label spray bottle "Recipe D"

WHAT YOU NEED

- Recipe D
- Black light
- Extension cord or batteries as needed
- 1 unlaminated Tyvek™ suit
- 1 laminated Tyvek™ suit

PREPARE

- Mix Recipe D into spray bottle.
- Practice ahead of time.

PROCEDURE

- (1) Spray tracer onto both Tyvek™ suits.
- (2) Turn suits inside out.
- (3) Pass the contaminated unlaminated Tyvek™ suit to half of the participants.
- (4) Pass the contaminated laminated Tyvek™ suit to the other half of the participants.
- (5) Shine black light on participants' hands.
- (6) Discuss:
 - *How did the unlaminated Tyvek™ suit contaminate participants' hands?*
 - *Why is it important to know whether your Tyvek™ suit is laminated?*
 - *How can you know which Tyvek™ suit is laminated?*





PNASH

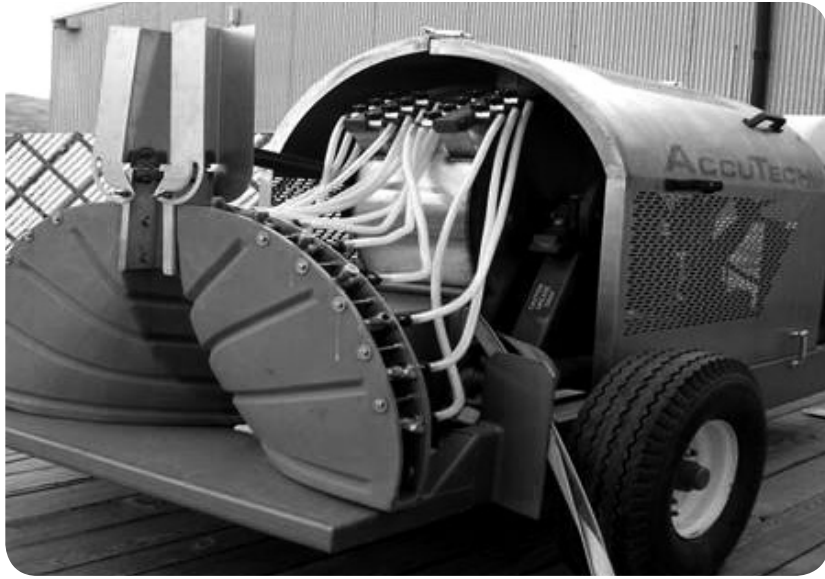
WORKPLACE PESTICIDE APPLICATION

Seeing is Believing

During an actual application, volunteers will mix, load, and apply pesticide as done in normal practice. Tracer will be added to the pesticide. At the end of the application, participants will observe where tracer came in contact the skin and clothes of the volunteers. Group discussion with participants (pesticide handlers, safety staff, managers, and/or community members) will identify factors that can lead to exposure. The activity will help participants understand how pesticide exposure can occur at their workplace and the steps they can take to minimize exposure.

“I think [FT technique] is fabulous. It’s fabulous because pictures [are] worth a thousand words.”

~ Donna Houghton
University of Guelph, Canada



WSDA

TRACER IN THE TANK

PNASH

WHAT THIS APPLICATION CAN SHOW YOU

- Personal protective clothing (PPE) failure
- Skin and clothing contamination
- Work practices that may result in pesticide contamination

WHAT YOU NEED

Tracer Recipe

- Uvitex OB or Tinopal® CBS-X
- Liquid pesticide formulation*
- Scale
- Measuring cups
- Sealable plastic bags (1 gallon)
- Gloves (chemical protective)

Safety Materials

- UV-A safety glasses
- Emergency eyeflush water
- MSDS for tracer used

PPE

- PPE as required on pesticide label or used on farm

Site Requirements

- Crop on which to apply pesticides
- Water source
- Application equipment
- Dark area

Dark Area

- Black light
- Extension cord/batteries if needed
- Flashlight (for when the lights are off)
- Dark fabric or cardboard
- Duct tape
- Handheld mirror
- Black or navy knit shorts, T-shirt or hooded sweatshirt

* Tracer can also be used in the tank without pesticides. Remember to mix, load, and apply the tracer the same as when using pesticides.

WHAT CAN BE MISTAKEN FOR TRACER CONTAMINATION

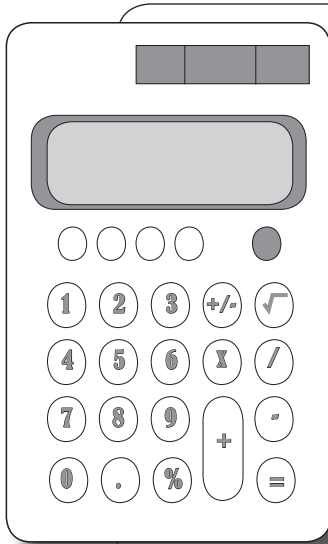
- Lint on dark clothes. Remove as much as possible ahead of time with a lint brush.
- Many soaps or detergents used to wash hands, clothes, and PPE contain fluorescent tracers. Test ahead with the black light and remember to rinse well.
- Dry skin or calloused hands. Check for these under normal lighting.
- Sunscreen, lotion, and makeup powder applied on skin. Ask volunteer to remove before the training.
- Light or white colored clothing and worn-out jeans. View clothing items ahead of time to make sure they do not shine.

PREPARE THE TRACER

Select the tracer that is compatible with the pesticide you are using. This activity works well with liquid formulations, but can be adapted for use with dry formulations. Use Uvitex OB with oil-soluble pesticides and Tinopal® CBS-X with water-soluble ones.

Airblast Sprayer Application:

- Calculate the amount of tracer based on the following example using Uvitex OB:



Tracer application rate: 3.2 ounces (90 grams) tracer per acre.

Coverage: Apply to at least 16 acres.

Tracer: 3.2 pounds for each applicator

Example: an application of Lorsban 4E (Chlorpyrifos) on apples

Tracer: Uvitex OB (Lorsban 4E is oil soluble)

Lorsban 4E container size: 2 1/2 gallon

Lorsban 4E application rate: 2 quarts (1/2 gallon) per acre

Tank coverage: 4 acres per tank.

Tracer: 1 pound tracer per 2 1/2 gallon Lorsban 4E container
(10.4 ounces tracer per pound of Lorsban 4E)

Each applicator will need to apply at least four tank loads

This is an example. Adapt it for use with other pesticides and application equipment.

- Add the tracer to the pesticide container ahead of time.
 1. Put the cap on tightly.
 2. Mix until all the tracer is suspended in the pesticide solution. (You may need to mix the tracer again just before loading the pesticide into the sprayer tank.)
 3. Wear chemical protective gloves and work in a well-ventilated area.
 4. Tracer powder may get on your clothes, skin, and other surfaces. It can be cleaned up with soap and water. After washing your skin, the tracer may still be visible under black light for about a week. It can not be seen under normal lights.
 5. Read the MSDS and follow instructions for safe use. See **Health and Safety** (p.7) for more information.

Backpack Application:

Concentration: 1/2 teaspoon tracer per 4 gallons of water.

Application time: 10-20 minutes at a minimum or one tank.

Mix: Add directly into the back pack sprayer with the other dry pesticides.

Prepare the Dark Area


1. Find a convenient location that is dark and has enough room for everyone. Remove trip hazards.
2. Check for electrical outlets if UV lights need to be plugged in.
3. Turn off lights and test the visibility of the tracer with black light.
4. Cover light leaks and bright objects with black cloth or cardboard.

APPLY THE PESTICIDES WITH TRACER

1. Ask for one or more pesticide handlers to have pesticide and tracer added to their tank during normal application. *Note: If mixing and loading is done by a separate pesticide handler, the mixer can be part of the tracer demonstration because he or she potentially will be exposed to the tracer.*
2. Inform participants this activity uses a black light and fluorescent tracer to see contamination. For the short duration of this training, both are safe to use. Black lights can be found in dance clubs and fluorescent tracers are common ingredients in laundry detergents, soaps, and paper. Advise participants not to look directly into the black lights because that may cause discomfort. See **Health and Safety** (p. 7). When using rubbing alcohol (isopropanol), take extra precaution to avoid eye and skin contact.
3. Provide volunteer(s) with black or navy shorts to wear over work clothes or to be worn under PPE alone. If pesticide handlers wear a T-shirt or hooded sweatshirt under their PPE, provide volunteer(s) a T-shirt or hooded sweatshirt to wear.
4. Instruct the mixer/loader to measure and pour the pesticide as normal. *Note: Mix up the tracer in the pesticide container before pouring as it may settle to the bottom.*
5. Instruct the applicator volunteers to apply the pesticides as done in normal practice.
6. Arrange for other pesticide handlers to observe volunteer(s) as they work.

Pesticide Handling Observations

Observe pesticide handling activities for potential exposure to pesticides. Record your observations. Pay particular attention to how the PPE is worn and used.

<p>Routine activities:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Mixing <input type="checkbox"/> Loading <input type="checkbox"/> Applying <input type="checkbox"/> Removing and decontaminating PPE <p>Non-routine activities in the field:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Adjusting, repairing, maintaining application equipment <input type="checkbox"/> Taking breaks for water or the bathroom <input type="checkbox"/> Removing and adjusting PPE <input type="checkbox"/> Eating <input type="checkbox"/> Rubbing face and eyes <input type="checkbox"/> Using cell phones and radios <p>Environmental conditions:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Wind speed <input type="checkbox"/> Wind direction <input type="checkbox"/> Temperature <p>Other observations: Activities and conditions specific to your farm or orchard.</p>		<p>Observations:</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

DARK AREA

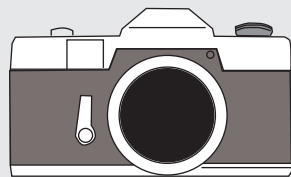
Instructor: Remember this is a fun learning experience for everyone. Pesticide handlers will contribute good ideas in an open and relaxed atmosphere.

1. Invite participants (management, other pesticide handlers) to observe volunteer(s) under the black light. Inform participants this activity uses a black light and fluorescent tracer to see contamination. Remind participants of the common uses of black lights and fluorescent tracer use and of the safety precautions associated with each. Fluorescent tracers have been used extensively on agricultural crops for research and are not known to cause damage to plants. Advise participants not to look directly into the black lights because that may cause discomfort. See Health and Safety (p. 7).
2. Provide the volunteer(s) with UV-shielding goggles and a handheld mirror.
3. Shine the black light on volunteers to show contamination on:
 - PPE before it is washed
 - Skin of volunteer(s)
 - Black shorts and T-shirt or hooded sweatshirt
4. Ask volunteer(s) to observe tracer contamination on himself/herself with the mirror.
5. Compare the tracer results with the field observations.
6. Ask and discuss with participants:
 - What patterns of tracer contamination do you see?***
 - What could have happened to cause the contamination?***
 - How could this endanger your health?***
 - What can be done to minimize or prevent this contamination?***
7. Record solutions and talk about how to address problems through farm policies, procedures, training, and equipment purchase.



OPTIONAL: Taking Pictures in the Dark

- Use manual cameras: single-lens reflex, video camcorders, or digital cameras.
- Use a Wratten™ 2 E filter (UV filter).
- Turn flash off.
- Experiment with different settings: aperture, shutter speeds, and ISO.
- Focus camera on a bright object at same distance as volunteer.
- Use a tripod and slower shutter speeds.



Examples of pesticide contamination patterns found after fluorescent tracers were used in the spray tank during an airblast application in an apple orchard.



PNASH

Photo #1: Tracer on sweatshirt around neck

Problem: Leaky seam – pesticide handler reported a wet neck.

Possible solution: Get new PPE. Check seams before using.



PNASH

Photo #2: Tracer on mixer's sweatshirt sleeve

Problem: Water and pesticides ran down the sleeve when hands were above arms.

Possible solution: Fold glove cuffs so cuff edge is exposed from under the jacket sleeve. Tape jacket sleeve to glove and cover the cuff with tape. (See illustration page 52)

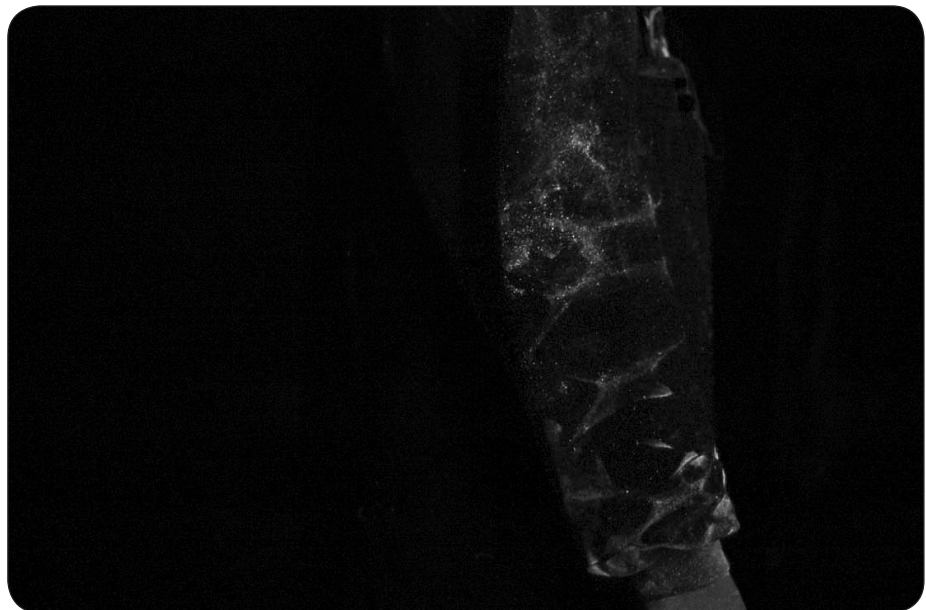


PNASH

Photo #3: Tracer on sweatshirt hood

Problem: PPE hood not drawn tight.

Possible solution: Use hoods that are large enough to accommodate PPE and pull drawstring tight.



PNASH

Photo #4: Tracer on sweatshirt sleeve

Problem: Pesticide handler brushed against contaminated surface after removing PPE.

Possible solution: Remove PPE only when you are out of the spray area and away from contaminated surfaces (tractors, sprayers, or other PPE). Receive training on avoiding contamination of work clothes.

HANDS-ON ACTIVITIES

Learning by Doing

Hands-on activities use scripted role-plays and instructor-led demonstrations with volunteers to emphasize safety messages about preventing pesticide exposure. In order to be successful, these activities require time, supplies, and preparation. These hands-on activities work best for small groups because everyone participates. The five activities in this section are provided as guidance and should be adapted to fit the farming methods and equipment relevant to your audience. Activities 1-4 are US-based and can be enhanced with discussion on relevant US Worker Protection Standard (WPS) requirements. See **US Worker Protection Standard** (p.64). Activity 5 is relevant to conditions in developing countries and uses a body-map to encourage participatory learning. Encourage discussion throughout all activities to engage participants.



WSDA

Activity #1: Application Equipment Decontamination

31

This activity emphasizes the importance of application equipment decontamination to reduce pesticide exposure at the workplace. During a role-play exercise, participants will observe tracer contamination on the skin and clothing of people who come into contact with unclean application equipment in the workplace. Participants will learn the proper steps for decontaminating application equipment.

Activity #2: Personal Protective Equipment (PPE) Decontamination

37

This activity emphasizes the importance of decontaminating PPE and practicing good personal hygiene to avoid pesticide exposure. Volunteers will practice how to remove and wash full-gear personal protective equipment (PPE). Participants will learn the principle of “Clean to Clean; Dirty to Dirty” to help them remember how to properly remove PPE.

Activity #3: Unplugging a Spray Nozzle - Activity

45

This activity emphasizes being prepared to safely and efficiently unplug a spray nozzle. Two volunteers will demonstrate unplugging a spray nozzle with and without proper tools and gloves. Participants will learn about possible solutions to common problems encountered when unplugging spray nozzles during application.

Activity #4: Taking a Bathroom Break

51

This activity emphasizes planning ahead to avoid pesticide exposure during a bathroom break. In three different scenarios, three male volunteers will demonstrate partially removing tracer “contaminated” PPE as if they were urinating while in the field during a pesticide application. Participants will learn proper steps to partially remove PPE with and without decontamination supplies immediately available. Note: Procedures for female handlers also are provided.

Activity #5: Backpack Spraying

57

This activity emphasizes the importance of using safer pesticides to protect pesticide handlers’ health in developing countries. During role-play exercises, two volunteers will use a backpack sprayer to demonstrate spraying under conditions found in developing countries. Other participants will handle plants “contaminated” with the tracer. Participants will learn safer pesticide handling practices.



WSDA

ACTIVITY 1

Application Equipment Decontamination*

WSDA, WSU, PNASH

• US WPS:
Equipment Safety
p. 64

During a role-play exercise, participants will observe tracer on skin and clothes of people who come into contact with tracer “contaminated” application equipment in the workplace. After cleaning application equipment, participants will see whether decontamination was done properly. A group discussion will help participants learn the proper steps for decontaminating equipment. Overall, the activity will emphasize the importance of decontamination in reducing pesticide exposure at the workplace.

MESSAGE

Protect people on the farm from pesticide exposures by properly decontaminating pesticide application equipment.

Estimated Total
Activity Time: 45 minutes

LEARNING OBJECTIVES

Upon completing this lesson, participants will know:

- How application equipment can be a source of exposure for pesticide handlers and others in the workplace.
- Proper steps for decontaminating application equipment.

WHAT YOU NEED

Site Requirements

- Outdoors
- Water
- Hose with hand-gun sprayer
- Dark area

Dark Area

- Black light
- Extension cord /batteries (as needed)
- Flash light
- Dark fabric
- Duct tape

Safety Materials

- UV-A safety glasses
- Emergency eyeflush water
- MSDS for Tinopal® CBS-X
- MSDS for rubbing alcohol

PPE

- 1 chemical resistant suit (jacket & pants)
- 1 pair of rubber boots
- 1 half-mask respirator
- 1 pair goggles
- 1 pair green 15 mil unlined nitrile gloves

Role-Playing

- Air blast sprayer
- Tractor or other vehicle
- Long-handled brush
- Hand-held scrub brush
- Wrench
- Liquid detergent (non-fluorescent)
- Bucket for cleaning supplies
- Small dark cloth wipe (lint free & non-fluorescent)
- Shop paper towels
- Cue cards optional (pg. 36)

Tracer Recipe

- ½ teaspoon Tinopal® CBS-X
- 1¼ cup water
- 1½ cup rubbing alcohol (70% isopropyl alcohol)
- 32 oz. spray bottle
- Measuring spoons & cups

*Original developed by Ofelio Borges, for the WSDA Farmworker Education Program’s Hands-on Handler Training.

PREPARE

- Make tracer recipe:
 - Mix ½ teaspoon Tinopal® CBS-X, 1 ¼ cups water, and 1 ½ cups rubbing alcohol in spray bottle. Close spray bottle and shake to mix well.
- Contaminate props:
 - Spray tracer on one side, top, repair location (hitch), and tires of application equipment and let dry.
 - Spray tracer on seat and steering wheel of tractor and let dry.
- Prepare decontamination station:
 - Mix detergent and water into a bucket. Put brushes in bucket and place next to spray tractor.
 - Attach hand-gun sprayer onto hose with valve off and turn on faucet.
- Construct a dark area:
 - Use dark fabric to block out light and cover bright objects, if necessary.
 - Check to make sure area is dark enough to view tracer under black light.
 - Turn black light on and check that PPE and cloth wipe do not shine.
- Cut cue cards (*optional*)



INTRODUCTION

5 minutes

1. Introduce yourself, review learning objectives, and tell participants you need their active participation. As the instructor, lead a discussion but do not lecture; **ask participants direct open-ended questions and let participants spend a few minutes talking about their answers.**
2. Inform participants that this activity uses a black light and fluorescent tracer to see contamination. For the short duration of this training, both are safe to use. Black lights can be found in dance clubs and fluorescent tracers are common ingredients in laundry detergents, soaps, and paper. When using rubbing alcohol (70% isopropanol), take extra precaution to avoid eye and skin contact. Advise participants not to look directly into the black lights because that may cause discomfort. See **Health and Safety** (p. 7).
3. Ask and discuss with participants:
 - Why is it important to decontaminate application equipment?**
 - Protect health of workers and other people on the farm from pesticide exposure.
 - Create a safe workplace.
 - Why is it important to avoid pesticide exposure?**
 - To prevent pesticide illness.
 - Even though the long-term effects on human health from pesticide exposure are not fully understood, the US Environmental Protection Agency has noted that several studies with animals found that some pesticides may cause cancer, miscarriages, or birth defects.

ROLE-PLAY EXERCISE



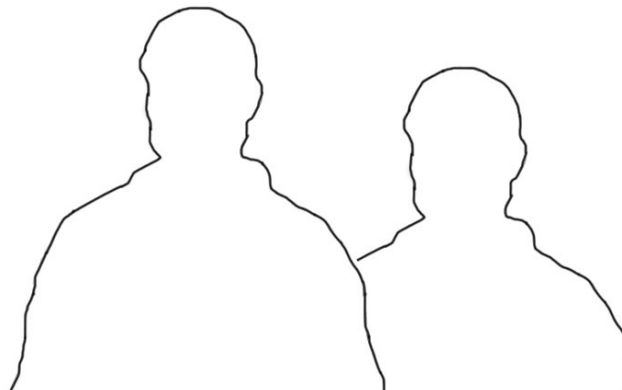
10 minutes

1. Tell participants there will now be a role-play exercise about people on the farm who may become exposed to pesticides. Remind participants a tracer is used to simulate pesticide contamination on the spray application equipment.
2. You will be acting as a farm supervisor. Ask for four volunteers to act as:
 - farm pesticide handler
 - farm pesticide handler’s son
 - mechanic
 - mower
3. Away from other participants, tell volunteers the role-play story. To each volunteer, explain their role and provide them with a cue card if available. Ask them to enter the “stage” when the supervisor (you) starts a conversation with them. Tell actors where you’ve sprayed tracer on the tractor and application equipment. Remind them to touch “contaminated” areas. Direct them to leave the “stage” after their conversation with you ends.
 - Step 1: Supervisor interviews farm pesticide handler about a job as the volunteer leans against the side of the air blast sprayer. The farm pesticide handler’s son plays and sits on the tire, while touching the application equipment.
 - Step 2: Supervisor talks to farm mechanic about a problem on the air blast sprayer. Supervisor hands farm mechanic a wrench and asks volunteer to repair the hitch.
 - Step 3: Supervisor asks mower to start up tractor. Mower goes to sit on tractor seat and holds steering wheel.

4. Ask and discuss with participants after the role-play:

Who could be exposed to pesticides from contaminated application equipment? How?

- farm families
- farm visitors
- field workers
- mechanics
- tractor drivers
- fruit haulers
- office staff
- truck drivers
- others



DEMONSTRATION

10 minutes

1. Ask and discuss with participants:

What application equipment needs to be cleaned?

- Tractor and sprayer as seen in the role-play, and other equipment such as 4-wheeler and backpack sprayer.
- Note worn-out seats with exposed foam will absorb pesticides and become a potential source of contamination.

When should you clean the equipment?

- Decontaminate pesticide residues from equipment before it is used for activities that don't require use of PPE, such as maintenance, repair, and mowing. Otherwise, clean application equipment at the end of the application day or at the end of each application cycle of the pesticide (3-4 days).

What PPE must you wear to clean contaminated application equipment?

- Full-gear PPE as required on the pesticide label, or required by employer.

How do you clean the application equipment?

- Use PPE to avoid contact with pesticides while cleaning.
- Clean application equipment with detergent, water, and a brush.

2. Ask for volunteer(s) to clean the application equipment using a bucket of water, detergent, brushes, and sponges. Dress volunteer(s) in full-gear PPE (chemical-resistant suit, rubber boots, half-mask respirator, goggle, and green 15-mil unlined nitrile gloves) or as required by pesticide label.

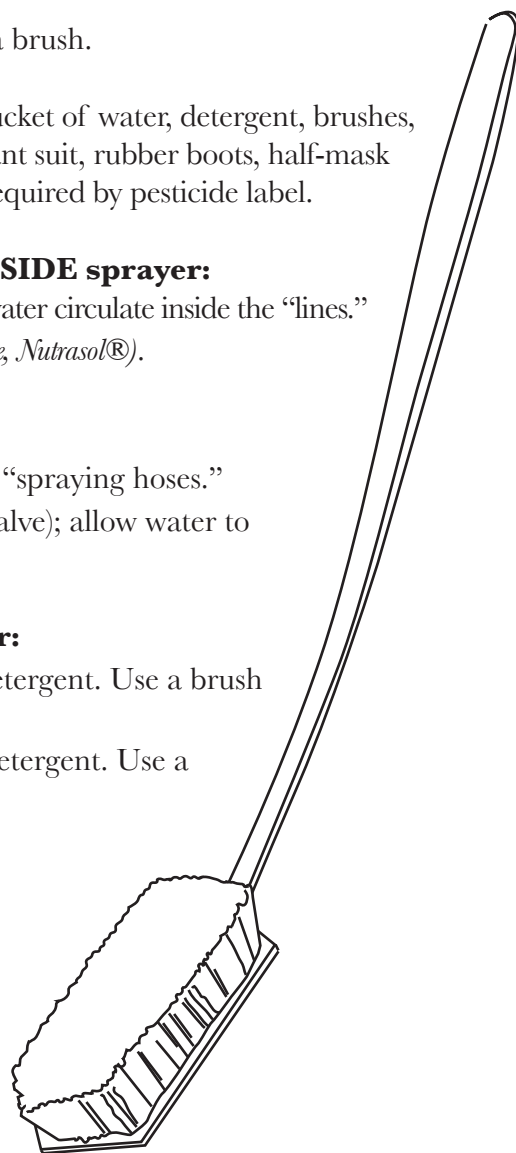
3. Explain or demonstrate for participants the **steps to clean INSIDE sprayer:**

- (1) Partially fill 1/3 or 1/2 of the tank with clean water and let the water circulate inside the "lines."
- (2) Fill tank with clean water and add a cleaning product (*for example, Nutrasol®*).
- (3) Re-circulate solution through the agitator for 5 minutes.
- (4) Increase tractor's RPM to build up pressure to 60 psi.
- (5) Remove and clean nozzles and screens. Open the "lines" or "spraying hoses."
- (6) Open nozzle valve to clean entire system (hoses, filter, and valve); allow water to continuously drain out.

4. Instruct volunteers to **clean OUTSIDE tractor and sprayer:**

- (1) Wash exterior of tractor with a solution of water and soft detergent. Use a brush to remove any residue.
- (2) Wash exterior of sprayer with a solution of water and soft detergent. Use a brush to remove any residue.
- (3) Rinse sprayer and tractor with plenty of water.

5. Wipe cleaned area of the sprayer with a lint-free dark cloth.



DARK AREA

—————→ 5 minutes

1. Shine the black light on volunteers to see contamination on:
 - Hands of actors
 - Back of pants of farm worker's son and mower
 - Back of jacket of farm worker
 - Cloth used to wipe clean sprayer



2. Ask and discuss with participants:
How did the person become exposed to pesticides?
Is this something that could happen at your workplace?



Notes:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



ACTIVITY 1

Cue Cards

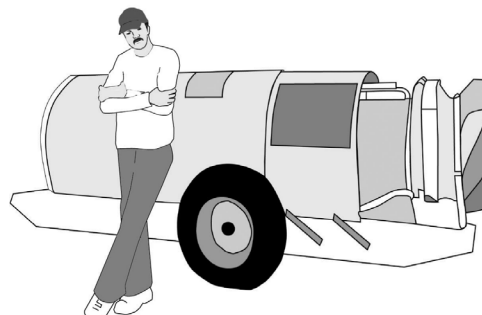
SUPERVISOR

- Interview farm pesticide handler about a job.
- Ask farm mechanic to repair the hitch of the air blast sprayer and hand him the wrench.
- Tell mower to start up tractor.



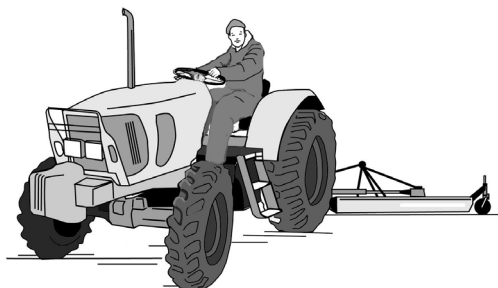
FARM PESTICIDE HANDLER

Lean against the contaminated side of the air blast sprayer as the supervisor interviews you about a job.



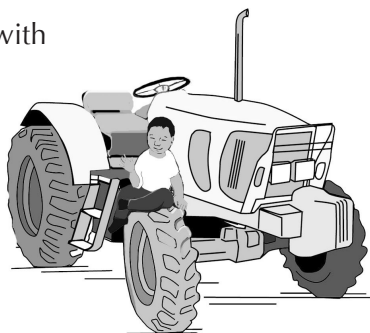
MOWER

When the supervisor asks you to the start tractor, sit on tractor seat and hold steering wheel.



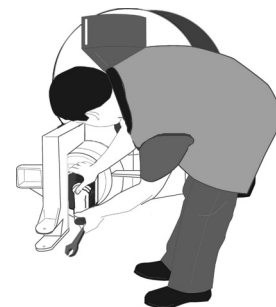
FARM PESTICIDE HANDLER'S SON

Sit on tire and play with application equipment.



MECHANIC

When supervisor gives you a wrench, go and pretend to repair the hitch on the air blast sprayer.



Instructor: Provide actors with cards that direct them on what to do during the role-playing exercise. Make sure they understand their roles.

ACTIVITY 2

Personal Protective Equipment (PPE) Decontamination*

WSDA, WSU, PNASH

• US WPS:
PPE Cleanup and
maintenance and site
decontamination.
(p. 64-65)

Volunteers will practice removing and washing full-gear reusable personal protective equipment (PPE) “contaminated” with tracer. After cleaning, participants will observe tracer on the skin and clothes of volunteers. Participants will learn the principle of “Clean to Clean; Dirty to Dirty” to help them remember how to properly remove PPE. Group discussions will emphasize the importance of decontaminating PPE and practicing good personal hygiene to avoid pesticide exposure.

MESSAGE

Minimize skin contamination to pesticides by properly removing and washing PPE.

Estimated Total
Activity Time: 45 minutes

LEARNING OBJECTIVES

Upon completing this lesson, participants will:

- Learn the principle of “Clean to Clean; Dirty to Dirty” to help remember how to properly remove PPE.
- Know the proper steps for removing and washing PPE, including the respirator.
- Understand the importance of personal hygiene and laundering clothes worn underneath PPE.

WHAT YOU NEED

Site Requirements

- Outdoors or indoors with floor drain
- Water
- Hose with hand gun-sprayer
- Dark area

Dark Area

- Black light
- Extension cord/batteries (as needed)
- Flashlight
- Dark fabric
- Tape

Safety Materials

- Emergency eyeflush water
- MSDS for Tinopal® CBS-X
- MSDS for rubbing alcohol
- UV-A safety glasses

PPE

- 1 chemical-resistant suit (jacket & pants)
- 1 pair rubber boots
- 1 rain gear hat or chemical-resistant brimmed hat
- 1 half-respirator
- 2 organic vapor cartridges
- 2 pre-filters
- 1 pair of chemical-resistant goggles
- 1 gallon-sized sealable plastic bag

for respirators

Cleaning PPE

- 2 dish basins
- Shop paper towels
- Liquid detergent (non-fluorescent)
- Bucket for cleaning supplies
- Scrub brushes
- Sponges
- Table

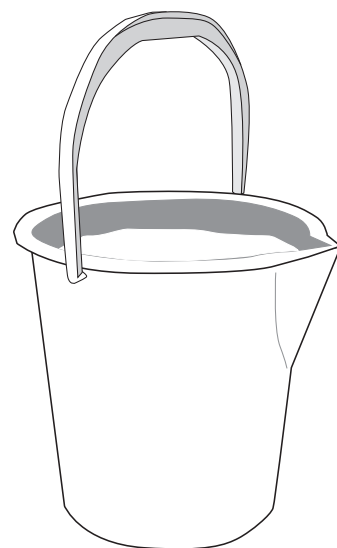
Tracer Recipe

- ½ teaspoon Tinopal® CBS-X
- 1¼ cups water
- 1½ cups rubbing alcohol (70% isopropanol)
- 32 oz. spray bottle
- Measuring spoons & cups

*Original developed by Ofelio Borges, for the WSDA Farmworker Education Program's Hands-on Handler Training.

PREPARE

- Make tracer recipe:
 - Mix ½ teaspoon Tinopal® CBS-X, 1¼ cups water, and 1½ cups rubbing alcohol in spray bottle. Close spray bottle and shake to mix well.
- Prepare decontamination station:
 - Mix detergent and water in a bucket. Put brushes and sponges in bucket and place on table.
- Construct a dark area:
 - Use dark fabric to block out light and cover bright objects, if necessary.
 - Check to make sure area is dark enough to view tracer under black light.
 - Turn black light on and check to make sure that PPE does not shine.
- Instruct volunteer:
 - Ask for one volunteer to put on in full-gear PPE required to spray pesticides.
 - Provide volunteer with chemical-resistant suit (jacket and pants), nitrile gloves, boots, respirator, and goggles.
 - Ask volunteer to listen after putting on the PPE.



INTRODUCTION

—————→ 10 minutes

Instructor: Understand that many pesticide handlers take safety precautions to avoid exposure while mixing, loading and applying. However, some do not continue to take precautions after they are done with the application. Help participants gain awareness about pesticide residues on PPE after the application.

1. Introduce yourself, review learning objectives, and tell participants you need their active participation. As the instructor, lead a discussion but do not lecture; **ask participants direct open-ended questions and let participants spend a few minutes talking about their answers.**
2. Inform participants this activity uses a black light and fluorescent tracer to see contamination. For the short duration of this training, both are safe to use. Black lights can be found in dance clubs and fluorescent tracers are common ingredients in laundry detergents, soaps, and paper. Advise participants not to look directly into the black lights because that may cause discomfort. When using rubbing alcohol (isopropanol), take extra precaution to avoid eye and skin contact. See **Health and Safety** (p. 7).

3. Tell participants they will hear some terms throughout the training. For each term in table below, ask a participant, **what does the word mean to you?**

COMMON TERMS

decontamination

- Proper removal and washing of personal protective equipment (PPE) with soap and water
- Should be done before the applicator takes any break or at the end of the application day
- Includes personal hygiene practices, like washing hands with soap and water before eating or going the bathroom

pesticide exposure

- Being in contact with pesticides or pesticide residues

pesticide residue

- Pesticides that remain on surfaces of crops, application equipment, and PPE
- Pesticide handlers can come into contact with pesticide residues left on contaminated crops, PPE, and equipment

4. Ask and discuss with participants:

Why is it important to decontaminate your PPE?:

- To remove pesticide residues that could remain on the PPE after an application.
- To prevent pesticide contamination of work clothes and ultimately the skin when PPE is not washed or not washed well. *Note: Liquid formulations, especially oil-based pesticides, are absorbed through the skin more quickly than dry pesticides.*
- To prevent the respirator from malfunctioning when unwashed respirator valves do not seal properly. This may put the pesticide handler at risk for exposure.
- To reduce allergic skin reactions, irritation, or contact dermatitis that may occur when certain pesticides get on the skin.

Why is it important to avoid pesticide exposure?

- To prevent pesticide illness.
- The long-term effects on human health from pesticide exposure are not fully understood. The US Environmental Protection Agency noted that several studies on animals found that some pesticides may cause cancer, miscarriages, or birth defects, so it is important to minimize pesticide exposure.

Why is it important to perform personal hygiene?

- Handlers might have pesticide residues on some unprotected parts of their bodies such as their necks, parts of their faces, and hands. These pesticide residues might be taken home and transferred to other family members and furniture. Practice good personal hygiene and decontamination steps before leaving the worksite to prevent further absorption of pesticides into the skin and transfer of pesticides to others at home.

DEMONSTRATION

25 minutes

1. After the volunteer has properly dressed in PPE, spray tracer on the entire PPE suit, gloves, and back of hood. Gently spray on side of respirator and goggles. Do NOT spray directly on face.
2. Ask and discuss with participants:
Do pesticide droplets land on your PPE when you are spraying?
 - Many of the pesticide handlers will answer “yes” unless they spray in an enclosed cab. Discuss the possibilities for exposure when pesticide handlers get out of enclosed cab and what they need to do.***When must you decontaminate PPE?***
 - PPE must be decontaminated each time it is used and taken off. It should never be worn or taken home. It must be inspected for wear and tear and if there is wear and tear, it should be replaced.
3. Tell participants the volunteer needs their help on the proper steps to remove and wash chemical-resistant full-gear PPE. (When the pesticide label does not require full-gear, adjust the steps to fit with the PPE they will be wearing.)
4. Ask the volunteer to take off the contaminated PPE items. Have him give the items to a different participant to wash.
5. Tell participants to think **“Clean to Clean; Dirty to Dirty”** to remind them that clean gloves should only touch clean areas and dirty gloves should only touch dirty areas on the outside of the PPE.
6. Ask and discuss with participants:
What is the first thing you do before taking off your PPE?
 - Use a hose or shower head to rinse entire PPE suit while you are still wearing it.***Why do you need to do this step?***
 - To remove as much pesticide residue as possible.
7. Instruct volunteer to demonstrate the first step.

BEFORE TAKING OFF PPE

➤ **Step 1: Rinse entire PPE suit with a hose or showerhead.**

This removes as much pesticide residue as possible to minimize further contamination. *Note: This step does not apply if gloves are worn outside of sleeves during overhead application.*



WSDA

8. Instruct volunteer to demonstrate the following steps. Discuss with participants how they do it at their workplace. Ask participants:

What do you do next?

- Let participants respond then explain the correct steps. Ask volunteer to demonstrate each step.

TAKING OFF PPE EXCEPT GLOVES: HOOD, RESPIRATOR, GOGGLES, JACKET, PANTS

- **Step 2: Take off hood or hat by grabbing it from contaminated outside part.**

Dirty Gloves ⇔ Dirty Outside Hood or Hat

Handlers naturally want to take off PPE around their heads and faces early because of practicality, heat, and nuisance issues. Removing the hood or hat must be done first in order to remove the respirator and goggles.



- **Step 3: Take off respirator by grabbing it from the canister or cartridges and gently pull it forward and up.**

Dirty Gloves ⇔ Dirty Cartridges

Wearing a respirator can restrict movement and vision. The respirator is removed to make it more comfortable to take off other PPE. With gloves still on, grabbing the cartridges is easier than unhooking the respirator straps. Handlers may be tempted to take off gloves too early if they unhook the respirator straps. If a full-face respirator is used, separate eye protection will be needed for the next steps.



➤ **Step 4: When dirty goggles block vision:**

- 1- wash gloves while wearing them
- 2- remove goggles
- 3- wash and dry goggles
- 4- put goggles back on or replace with clean goggles

Since eye protection must be worn for the next steps, handlers must have clear vision in order to minimize further contamination. Gloves must be washed before taking off goggles so that the face does not get contaminated.



➤ **Step 5: Take off jacket by carefully unbuttoning or unzipping jacket without touching clothes underneath.**

Dirty Gloves ⇔ Dirty Outside Jacket

Even if gloves have been washed, they could become recontaminated while unbuttoning the jacket, therefore, avoid touching clothes underneath.



➤ **Step 6: Remove pants:**

Clean Foot ⇔ Clean Inside Pants

- 1- take one foot out of the boot
- 2- pull off pant leg from that foot
- 3- return foot back into the boot
- 4- repeat procedure with other foot

If PPE pant legs are removed while wearing PPE boots, the inside of the pant legs will become contaminated, making the pants harder to clean. Pants need to come off before boots because boots are required to be worn while washing the PPE items later. Wearing boots will prevent a handler's work shoes from contact with contaminated water.



9. Ask and discuss with participants:

What must you have on to wash the PPE you took off?

- You must have on at least gloves, eye protection, and boots.

10. Instruct participants holding a dirty PPE item to wash it according to steps on the following page.

Discuss with participants how washing is done at their workplace. Tell them to imagine that they are wearing gloves, eye protection and boots as they practice cleaning PPE.

WASHING PPE WITH SOAP & WATER: RESPIRATOR, SUIT, BOOTS, GOGGLES, GLOVES

- **Step 7: Wash outside of gloves while wearing them.**
- **Step 8: Wash respirator:**
 - 1- remove cartridges and throw out pre-filters; throw out cartridges used for 8 hours
 - 2- wipe cartridges with less than 8 hours of use with a wet towel
 - 3- dry cartridges with single-use paper towels and then store in a sealable plastic bag
 - 4- take apart respirator and wash parts in warm soapy water with soft sponge
 - 5- rinse respirator parts under running water
 - 6- air dry or wipe dry with single-use towels
 - 7- after parts are dry, inspect, reassemble, and store in a sealable plastic bag separate from cartridges
 - 8- store respirator in a cool, dry area of locker or rubber container to prevent damage
- **Step 9: Wash PPE suit (outside/inside) on flat surface:**
 - 1- scrub side-to-side with soapy water to minimize splashing
 - 2- rinse under running water
 - 3- hang dry in clean area
 - 4- store in lockers, if available
- **Step 10: Wash boots while wearing them.**

Boots are washed after washing all PPE items taken off earlier.
- **Step 11: Remove, wash and dry goggles.**
- **Step 12: Rewash gloves.**
 - 1- remove gloves
 - 2- wash hands with soap and water



11. Instruct volunteer on the last steps.

LAST STEPS: INSPECTION & STORAGE

- **Step 13: Inspect and discard damaged PPE.**
- **Step 14: Go to clean area to remove and store boots. Put work shoes back on.**
- **Step 15: Remove, dry, and store gloves.**

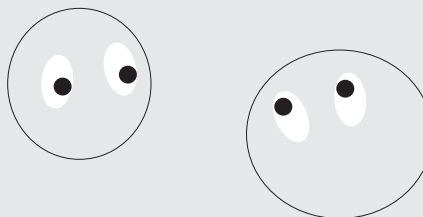
DARK AREA

—————→ 10 minutes

1. Give volunteers UV-A shielding goggles.
2. Shine the black light on PPE to see if tracer remained after washing.
3. Ask and discuss with participants the importance of washing properly to reduce pesticide residues.

Why could it be difficult to clean PPE?

- Hard-to-clean areas (seams)
- Oil-based pesticides harder to remove
- Not enough time
- Late or tired at end of shift
- Not having an appropriate flat surface place to clean PPE
- Not having proper cleaning supplies and tools



4. Shine the black light on skin of volunteers. Compare what uncontaminated skin and contaminated skin look like under the black light. **Make the connection to the importance of practicing good personal hygiene and laundering work clothes.**
5. Ask and discuss with participants:

When should pesticide handlers wash themselves?

- Pesticide handlers should take a shower at the end of the pesticide application or as soon as possible after the application. If facilities are available at the worksite, take a shower and put on clean clothes before leaving to avoid taking pesticide residues home. It is important to wash your body and scalp thoroughly with soap and water and to scrub your nails.

Why is it important to take a shower and put on clean clothes as soon as possible after the application?

- Even though a pesticide handler might wear the PPE correctly during pesticide handling, a significant amount of pesticide residues could accumulate on his or her face and neck.
- Pesticide handlers can still become contaminated from pesticide residues on work clothes worn under chemical-resistant suits.
- Pesticide residues can penetrate the skin and might cause skin irritation and other health problems.

Why must you launder your work clothes? How?

- Even when PPE is properly worn, work clothes can still become contaminated with pesticide residues.
- It is important to change out of and wash contaminated work clothes as soon as possible after an application. If used for repeated applications, unwashed work clothes can accumulate pesticide residues.
- To protect handlers' families from being exposed to pesticides, it is important to wash and store work clothes separately from family laundry and other clothes.

ACTIVITY 3

Unplugging a Spray Nozzle*

WSDA, WSU, PNASH

Two volunteers will demonstrate unplugging a spray nozzle from an air blast sprayer with and without proper tools and gloves. Participants will observe tracer on the spray nozzle, tools, gloves, skin, and clothing of the volunteers. Participants will discuss possible solutions to common problems encountered when unplugging spray nozzles during application. Overall, the activity will emphasize being prepared to safely and efficiently unplug a spray nozzle using proper tools and gloves. *Note: Activity can be modified for other types of spray nozzles. Contact manufacturer for appropriate instructions on how to unplug other nozzle types.*

MESSAGE

Be prepared, protect yourself: unplug spray nozzles safely and efficiently with proper tools to avoid pesticide contamination.

**Estimated Total
Activity Time: 40 minutes**

LEARNING OBJECTIVES

Upon completing this lesson, participants will know:

- Proper tools and gloves to safely and efficiently unplug a spray nozzle: thin 8-mil nitrile gloves, crescent wrench, thin wire, and toothbrush
- Proper steps for unplugging a spray nozzle safely and efficiently
- Possible solutions to common problems when unplugging a spray nozzle

WHAT YOU NEED

Site Requirements

- Outdoors with hose if using a spray tractor or indoors with sink if using a backpack sprayer
- Dark area

Dark Area

- Black light
- Extension cord or batteries (as needed)
- Flashlight (for when lights are off)
- Dark fabric
- Duct tape

Safety Materials

- UV-A safety glasses
- Emergency eyeflush water
- MSDS for Tinopal® CBS-X
- MSDS for rubbing alcohol

Demonstrations

- 2 spray nozzles on sprayer or backpack sprayer
- Toothpaste or twig
- 2 pairs of 15-mil green unlined nitrile gloves

- 1 pair of 8-mil nitrile gloves (blue or purple)
- Liquid detergent
- Tooth brush
- Thin soft plastic wire (floral wire or heavy duty fishing line)
- Crescent wrench
- 2 pairs of goggles
- 2 half-mask respirators

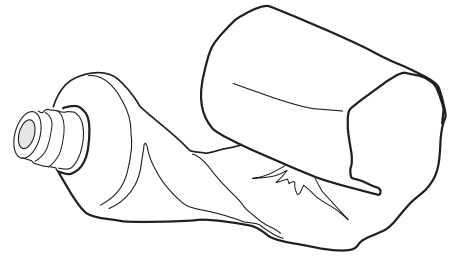
Tracer Recipe

- ½ teaspoon Tinopal® CBS-X
- ¼ cup water
- ½ cup rubbing alcohol (70% isopropyl alcohol)
- 32 oz. spray bottle
- Measuring spoons & cups

*Original developed by Ofelio Borges, for the WSDA Farmworker Education Program's Hands-on Handler Training.

PREPARE

- Make tracer recipe:
 - Mix $\frac{1}{2}$ teaspoon Tinopal® CBS-X, $1\frac{1}{4}$ cups water, and $1\frac{1}{2}$ cups rubbing alcohol in spray bottle. Close spray bottle and shake to mix well.
- Contaminate spray nozzles:
 - Plug spray nozzles with toothpaste or twig.
 - Attach spray nozzles to spray tank or backpack sprayer.
 - Spray tracer on spray nozzles.
- Construct a dark area:
 - Use dark fabric to block out light and cover bright objects.
 - Check to make sure area is dark enough to view tracer under black light.
 - Turn black light on and check gloves to make sure they don't shine.
- Instruct volunteers:
 - Ask for 2 volunteers to demonstrate unplugging a spray nozzle using different tools and glove type. Provide goggles and respirators to volunteers (optional).
 - Tell Volunteer 1 (who will have no tools) that he or she can remove gloves, if necessary, to perform the tasks.



INTRODUCTION

10 minutes

1. Introduce yourself, review learning objectives, and tell participants you need their active participation. As the instructor, lead a discussion but do not lecture; ask participants direct questions and let participants spend a few minutes talking about their answers.
2. Inform participants this activity uses a black light and fluorescent tracer to see contamination. For the short duration of this training, both are safe to use. Black lights can be found in dance clubs and fluorescent tracers are common ingredients in laundry detergents, soaps, and paper. When using rubbing alcohol (70% isopropanol), take extra precaution to avoid eye and skin contact. Advise participants not to look directly into the black lights because that may cause discomfort. See **Health and Safety** (p. 7).
3. Ask and discuss with participants:
 - Why should you know the proper steps to unplugging a spray nozzle?**
 - To avoid pesticide exposure
 - To avoid wasting time
 - To do the job right
 - Why is it important to avoid pesticide exposure?**
 - To prevent pesticide illness
 - The long-term effects on human health from pesticide exposure are not fully understood. The US Environmental Protection Agency noted that several studies on animals found that some pesticides may cause cancer, miscarriages, or birth defects, so it is important to minimize pesticide exposure.
 - What is the first thing you do when you are in the field with an air blast sprayer and suddenly find you have a plugged nozzle?**
 - For safety, you must first turn off the Power Take Off (PTO) and fan.
 - It is also recommended that you turn off the tractor.

4. Tell participants the volunteers will demonstrate unplugging a spray nozzle with and without the proper tools and gloves. Ask participants to imagine volunteers have on the required personal protective equipment (PPE) for the application.
5. Tell participants the items you are providing the volunteers with different equipment:
 - **Volunteer 1** will wear 15-mil thick green nitrile gloves.
 - **Volunteer 2** will wear 8-mil thin nitrile gloves underneath 15-mil thick green nitrile gloves. *Note: nitrile gloves are chemical-resistant and are NOT the same as latex gloves. Also, the US Worker Protection Standard does not require employers to provide 8-mil nitrile gloves.* He or she will also have a crescent wrench, toothbrush, and thin soft plastic wire.
These tools should not be used for other purposes.

DEMONSTRATION – VOLUNTEER 1

—————→ 10 minutes

1. Instruct Volunteer 1 on the following steps and discuss with participants.

TAKING SPRAY NOZZLE APART

Instructions	Discussion
(1) Unscrew nozzle from sprayer.	<p><i>Is the glove type useful for this step?</i></p> <ul style="list-style-type: none"> • No, glove is too thick and/or too big. <p><i>What problems may occur?</i></p> <ul style="list-style-type: none"> • Handler may become frustrated and remove gloves.
(2) Remove gloves to unscrew nozzle. Then put gloves back on.	<p><i>How could this lead to pesticide exposure?</i></p> <ul style="list-style-type: none"> • Bare hands are exposed to pesticides.
(3) Take nozzle apart.	<p><i>Is the glove type useful for this step?</i></p> <ul style="list-style-type: none"> • No, the wrong size or material makes it harder to handle small nozzle parts. <p><i>What problems may occur?</i></p> <ul style="list-style-type: none"> • Nozzle parts may be dropped or lost because thick gloves are awkward for handling small parts. • Time may be wasted by looking for dropped and replacement parts. • Handler may become frustrated and remove gloves. • Problem continues if employer is not aware of the issues with the gloves.

2. Ask and discuss with participants:

What are possible solutions to the problem of not wearing the proper gloves to unplug spray nozzle?

- Use 8-mil nitrile gloves underneath 15-mil nitrile gloves during application for added protection. Remove 15-mil nitrile gloves and keep 8-mil nitrile gloves on when handling nozzle parts because thinner gloves provide dexterity.
- Tell your employer about the problem so he or she can provide the right gloves.

3. Continue to instruct Volunteer 1 on the following steps and discuss with participants.

UNPLUGGING SPRAY NOZZLE

Instructions

(4) Unplug nozzle.

Discussion

Is just having proper gloves useful for this step?

- No, proper tools are needed to unplug nozzle safely and efficiently.

What problems may occur?

- Handler may choose not to unplug nozzle.
- Nozzle parts may be dropped or lost because thick gloves are awkward for handling small parts.
- Calibration setting may be changed on air blast sprayer by switching to incorrect settings or wrong size nozzle replacement.
- Handler may become frustrated and remove gloves.
- Handler may use mouth to blow on nozzle.

How could this possibly lead to pesticide exposure?

- Bare hands, mouth, and face become exposed to pesticides.

ASSEMBLING SPRAY NOZZLE

Instructions

(5) Assemble nozzle parts and screw nozzle back onto sprayer.

Discussion

What problems may occur?

- Same problems as when taking spray nozzle apart.
- Assembling parts incorrectly can change calibration setting on air blast sprayer.

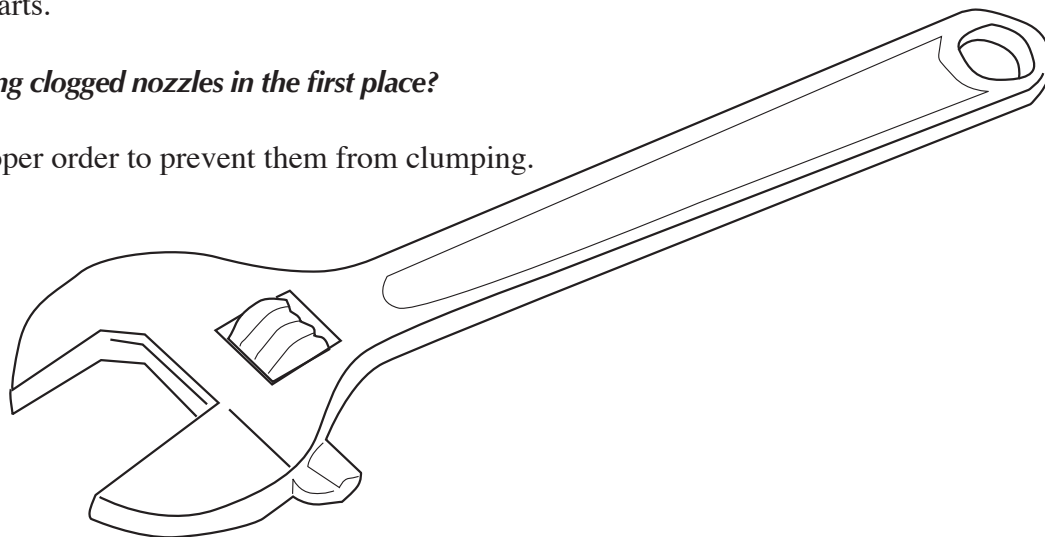
3. Ask and discuss with participants:

What are possible solutions to the problem of not having proper tools to unplug spray nozzle?

- Keep a crescent wrench, toothbrush, and thin soft plastic wire or other relevant tools hooked to the tractor or carry them with you at all times.
- Carry extra nozzle parts.

How can you prevent having clogged nozzles in the first place?

- Use clean water.
- Mix pesticides in proper order to prevent them from clumping.



DEMONSTRATION – VOLUNTEER 2

10 minutes

1. Tell participants that Volunteer 2 will demonstrate the proper steps to unplug a spray nozzle wearing thin 8-mil nitrile gloves underneath thick 15-mil nitrile gloves and using a crescent wrench, toothbrush, and thin wire.
2. Tell participants to imagine that Volunteer 2 will first stop the sprayer in an untreated area and turn off PTO and fan.
3. Instruct Volunteer 2 on the following steps and discuss with participants.

Instruct Volunteer 2 to:

- (1) Remove thick gloves without contaminating inside thin gloves.
- (2) Use crescent wrench to unscrew spray nozzle.
Note: Only relevant for certain nozzle types.
- (3) Take nozzle apart.
- (4) Use toothbrush to remove debris from filter.
- (5) Use thin wire to unplug holes in nozzle and swirl part.
- (6) Assemble nozzle parts and screw nozzle back onto sprayer.
- (7) Put thick gloves back over thin gloves.

Discuss with participants:

Is crescent wrench useful for this step?

- Yes, for nozzles of air blast sprayer or when needed.

Is the glove type useful for this step?

- Yes, thin gloves make it easier to handle small parts.

Is the toothbrush useful for this step?

- Yes, toothbrush can quickly remove debris.

Is the thin wire useful for this step?

- Yes, thin wire can quickly unplug nozzle.

Are the tools useful for this step?

- Yes.



4. Tell participants to imagine that at the end of the application Volunteer 2 will **go to the decontamination or mixing and loading site to:**
 - Wash inside and outside of thick gloves with soap and water.
 - Replace thin gloves.
5. Ask and discuss with participants:
What are the benefits of using proper tools and gloves to unplug a spray nozzle?
 - Prevent pesticide exposure because handlers wear gloves.
 - Save time.
 - Reduce chance of losing parts and changing calibration settings.
 - Can complete the task correctly, efficiently, and safely.

DISCUSSION

—————→ 5 minutes

1. Ask and discuss with participants:

What are some other problems that can make it difficult for you to unplug a spray nozzle safely and efficiently? What are possible solutions to these problems?

- Fatigue, heat, and limited time may frustrate you and make you want to remove PPE.

Possible solutions include:

- Move application equipment to untreated area.
- Work in a shaded area if possible.
- Take the time to do it correctly.
- Use clean water so that the nozzle does not clog.
- Be prepared, and have appropriate tools.

- You may not understand the operation of application equipment, including nozzle configurations.

Possible solutions include:

- Request training from your employer on proper application equipment operation so you can safely and efficiently use the equipment.

DARK AREA

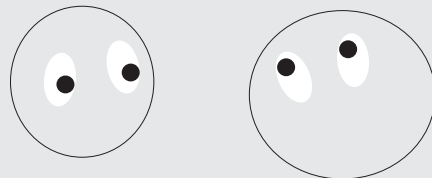
—————→ 5 minutes

1. Shine black light on volunteers, gloves, and tools to show contamination on:

- Hands of volunteers
- Gloves
- Tools: crescent wrench, toothbrush, and thin soft plastic wire
- Spray nozzle

2. Review how to safely and efficiently unplug a spray nozzle:

- Wear thin 8-mil nitrile gloves underneath 15-mil nitrile gloves.
- Hook crescent wrench, toothbrush, and thin soft plastic wire or other appropriate tools onto tractor at all times.
- Perform tasks in an untreated area to prevent accidental exposure and shaded area to prevent heat stress.
- Be prepared.



ACTIVITY 4

Taking a Bathroom Break

WSDA, PNASH, WSU

Three male volunteers will demonstrate different ways to partially remove personal protective equipment (PPE) as if they were going to urinate while in the orchard during pesticide application. There are three demonstrations: Volunteer 1 will pretend to go to the bathroom without carefully removing PPE; Volunteer 2 will decontaminate gloves and hands and properly remove part of the PPE; and Volunteer 3 will not have decontamination supplies immediately nearby. Participants will observe tracer contamination on the hands and clothing of the volunteers. Participants will discuss the risk of pesticide exposure when going to bathroom without decontaminating hands first. Overall, the activity will emphasize the importance of planning ahead to avoid pesticide exposure while urinating. *Note: Alternative steps for female participants are also provided at the end of this activity.*

MESSAGE

Plan ahead so you can protect yourself from pesticide contamination when urinating during application.

**Estimated Total
Activity Time: 45 minutes**

LEARNING OBJECTIVES

Upon completing this activity, participants will:

- Know skin is the most common route of pesticide exposure for pesticide handlers.
- Know genital area is where pesticides can most readily be absorbed into the body.
- Plan ahead so you have time for taking bathroom breaks where decontamination supplies are available.
- Learn the principle of “Clean to Clean; Dirty to Dirty” to help remember how to properly remove PPE.
- Know steps to partially remove PPE and avoid pesticide contamination.

WHAT YOU NEED

Site Requirements

- Outdoors with water hose or indoors with sink
- Dark area
- Table

Hand-Washing Station

- Liquid soap (*non-fluorescent*)
- Shop paper towels

Dark Area

- Black light
- Extension cord/batteries (*as needed*)
- Flashlight
- Dark fabric
- Tape

Safety Materials

- Emergency eyeflush water
- MSDS for Tinopal® CBS-X
- MSDS for rubbing alcohol
- UV-A safety glasses

Tracer Recipe

- ½ teaspoon Tinopal® CBS-X
- 1¼ cups water
- 1½ cups rubbing alcohol (*70% isopropanol*)
- 32 oz. spray bottle
- Measuring spoons & cups

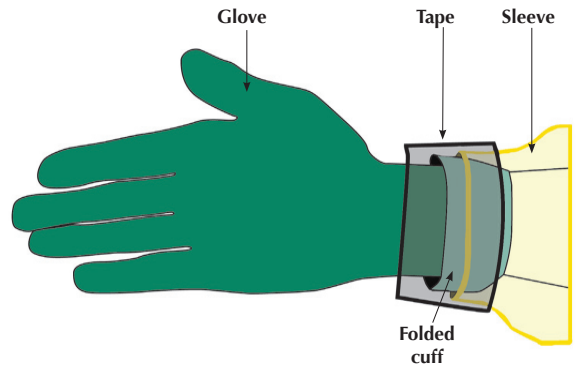
Demonstration

(1 set per demonstration)

- 1 chemical-resistant rain suit
- 1 pair goggles
- 1 half-mask respirator
- 1 pair 8-mil nitrile single-use gloves
- 1 pair 15-mil green nitrile gloves
- 1 set organic vapor cartridges
- 1 pair black or navy knit shorts
- 1 black or navy T-shirt or hooded sweatshirt
- Duct tape

PREPARE

- Make tracer recipe:
 - Mix ½ teaspoon Tinopal® CBS-X, 1¼ cups water, and 1½ cups rubbing alcohol in spray bottle. Close spray bottle and shake to mix well.
- Prepare hand-washing station:
 - If outside, attach hand-gun sprayer to hose, turn off sprayer, and turn on faucet.
 - Place soap and hand towels next to water source.
- Construct a dark area:
 - Use dark fabric to block out light and cover bright objects, if necessary.
 - Check to make sure area is dark enough to view tracer under black light.
 - Turn black light on and check that PPE and black clothes do not shine. Remove lint from black clothes, if necessary.
- Instruct volunteers:
 - Ask for 3 MALE volunteers to demonstrate different ways to partially remove PPE before urinating.
 - Ask them to wear black shorts and T-shirt or hooded sweatshirt over their clothes and underneath PPE.
 - Cuff thick 15-mil green nitrile gloves, make sure that the end of the glove cuff hangs below the edge of the jacket sleeves, and duct tape the sleeve to the glove covering the end of the cuff. Make sure ends of tape are folded for easy removal.
 - Spray tracer on PPE suit and both sides of gloves. Do NOT spray around the face.



INTRODUCTION

—————→ 10 minutes

1. Introduce yourself, review learning objectives, and tell participants you need their active participation. As the instructor, lead a discussion, but do not lecture; **ask participants direct questions and let participants spend a few minutes talking about their answers.**
2. Inform participants that this activity uses a black light and fluorescent tracer to see contamination. For the short duration of this training, both are safe to use. Black lights can be found in dance clubs and fluorescent tracers are common ingredients in laundry detergents, soaps, and paper. Advise participants not to look directly into the black lights because that may cause discomfort. See **Health and Safety** (p. 7).
3. Ask and discuss with participants:
Why is it important to know how to properly go to the bathroom when wearing PPE?
 - So you avoid pesticide exposure.

Why is it important to avoid pesticide exposure?

To prevent pesticide illness.

- The long-term effects on human health from pesticide exposure are not fully understood. The US Environmental Protection Agency noted that several studies on animals found that some pesticides may cause cancer, miscarriages, or birth defects, so it is important to minimize pesticide exposure.

4. Tell participants that 3 MALE volunteers will demonstrate different ways to partially remove tracer-contaminated personal protective equipment (PPE) as if they were urinating during pesticide application. Goggles and respirator must stay on when going to the bathroom if they are required or used. *Note: Procedures for female volunteers also included at end of this activity.*
- **Volunteer 1** will not decontaminate beforehand and will not be careful when partially removing PPE as if to urinate.
 - **Volunteer 2** will follow recommended steps on how to partially remove PPE properly and use decontamination supplies before urinating.
 - **Volunteer 3** will follow recommended steps on how to partially remove PPE properly without using decontamination supplies before urinating.

DEMONSTRATION - VOLUNTEER 1

—————→ 10 minutes

1. Instruct Volunteer 1 to pretend to be a handler **who is not careful when taking off PPE** for a bathroom break during an application. Demonstrate in front of participants.
2. Ask and discuss with participants:
 - What did Volunteer 1 do or didn't do? Was it right or wrong? Why?***
 - What is the most common route of exposure for pesticide handlers?***
 - Skin can easily come into contact with pesticide residues on contaminated surfaces, such as treated plants, unwashed application equipment, or dirty work clothes.
 - Where on your body are pesticides most readily absorbed through the skin?***
 - Genital area! This is why it is important to take proper steps when taking a bathroom break to avoid pesticide contamination.
 - How can people get exposed to pesticides when going to the bathroom?***
 - Bare hands touch dirty sides of gloves and PPE.
 - Clothes worn under PPE get contaminated.
 - When you apply pesticides while wearing full PPE, what makes it difficult to decontaminate before going to the bathroom?***

These real problems can include:

 - Not having decontamination supplies immediately available.
 - It takes time.
 - Need to urinate right away.
 - How can you plan ahead so you will not need to go to the bathroom when you are not near a decontamination station?***

Recommended solutions include:

 - Don't wait. Urinate before it is urgent.
 - Always urinate at the end of breaks and lunch.
 - Urinate before starting to spray.
 - Drink fluids without caffeine.

DEMONSTRATION – VOLUNTEER 2

—————→ 10 minutes

1. Tell participants Volunteer 2 will demonstrate the best possible way to partially remove PPE before urinating; he will be at a decontamination site where soap, water, and towels are immediately available.
2. Tell participants to think “Clean to Clean; Dirty to Dirty” to help them remember that clean gloves should only touch clean areas and dirty gloves should only touch dirty areas of outside PPE.
3. Instruct Volunteer 2 to demonstrate each step in the box as you clearly explain to participants how it relates to the principle of “Clean to Clean; Dirty to Dirty.”

BEFORE

- | | |
|------------------------------------------------------------|--------------------------------------|
| (1) Rinse PPE with water while still worn. | |
| (2) Remove hood or hat from outside. | dirty gloves ⇔ dirty hood |
| (3) Unsnap or unzip jacket. | dirty gloves ⇔ dirty jacket |
| (4) Wash gloves with soap and water. | |
| (5) Remove jacket. | clean gloves ⇔ clean inside jacket |
| - Be careful to not touch clothes underneath. | |
| - Lay jacket on ground or table with dirty side face down. | dirty outside jacket ⇔ dirty surface |
| (6) Remove both gloves. | |
| (7) Wash hands with soap and water. | |
| (8) Undo bib straps and tie around neck. | clean hands ⇔ clean straps |
| (9) Roll front bib down. | clean hands ⇔ clean bib |

DURING

- | | |
|----------------------------------|---------------------------|
| (10) Undo and redo belt and fly. | clean hands ⇔ clean pants |
|----------------------------------|---------------------------|

AFTER

- | | |
|--------------------------------------------------------------|------------------------------------|
| (11) Wash hands. | |
| (12) Attach straps to bib. | clean hands ⇔ clean straps |
| (13) Put gloves on. | clean hands ⇔ clean gloves |
| (14) Grab INSIDE jacket to put back on. | clean gloves ⇔ clean inside jacket |
| (15) Grab OUTSIDE hood or hat to put back on. | |
| (16) Snap or zip jacket without touching clothes underneath. | dirty gloves ⇔ dirty jacket |

DEMONSTRATION – VOLUNTEER 3

10 minutes

1. Tell participants Volunteer 3 will demonstrate a suggested way to partially remove PPE before urinating when decontamination supplies are not immediately available. Explain this procedure can work if PPE is not tightly worn and gloves are cuffed beforehand. Emphasize this procedure is suggested only as the last option for a pesticide handler. Remind participants to plan ahead to avoid this situation.
2. Instruct Volunteer 3 to demonstrate each step in the box as you clearly explain to participants how it relates to the principle of “Clean to Clean; Dirty to Dirty”.

BEFORE

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| (1) Remove hood or hat from outside. | dirty gloves ⇔ dirty hood |
| (2) Unsnap or unzip jacket. | dirty gloves ⇔ dirty jacket |
| (3) CAREFULLY remove both gloves. <ul style="list-style-type: none">- Remove the tape around both wrists.- Use first hand to pull glove partially off of second hand.- Use covered part of second hand to partially remove glove off of first hand.- Grab onto both cuffs to place gloves on a clean surface. | dirty glove ⇔ dirty glove
clean hand ⇔ clean inside glove |
| (4) Remove jacket from inside. <ul style="list-style-type: none">- Lay jacket on ground or table with dirty side face down. | clean hands ⇔ clean inside jacket
dirty outside jacket ⇔ dirty surface |
| (5) Undo bib straps and tie around neck. | clean hands ⇔ clean straps |
| (6) Roll front bib down. | clean hands ⇔ clean bib |

DURING

- | | |
|---------------------------------|---------------------------|
| (7) Undo and redo belt and fly. | clean hands ⇔ clean pants |
|---------------------------------|---------------------------|

AFTER

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| (8) Attach straps to bib. | clean hands ⇔ clean straps |
| (9) Grab INSIDE jacket to put back on. | clean hands ⇔ clean inside jacket |
| (10) Put gloves back on. <ul style="list-style-type: none">- Grab cuff of one glove to put back on first hand.- Use covered hand to put other glove back on second hand.- Retape sleeves around gloves. | clean hands ⇔ clean inside gloves |
| (11) Grab OUTSIDE hood or hat to put back on. | |
| (12) Snap or zip jacket without touching clothes underneath. | dirty gloves ⇔ dirty jacket |



DARK AREA

—————→ 5 minutes

1. Shine black light on volunteers and PPE to show comparison contamination on:
 - Hands and arms of volunteers
 - Shirt near bib buckles
 - Outside fly of shorts
 - Belt and fly of pants
2. Discuss the pros and cons of going to the bathroom with and without decontaminating gloves and hands beforehand.
 - Decontaminating beforehand is the best way to minimize pesticide contamination but may take longer, so it is important to plan ahead to avoid going to the bathroom without decontaminating.
 - Going to the bathroom without decontaminating beforehand will save time but you must partially remove PPE correctly to minimize pesticide contamination. Think **“Clean to Clean; Dirty to Dirty.”**



HOW TO ADAPT DEMONSTRATIONS FOR FEMALE VOLUNTEERS

Replace Steps 8-10 in Demonstration 2 or Steps 5-7 in Demonstration 3 with the following instructions:

- (a) Undo bib straps and tuck bib into pants.
- (b) Roll front bib down.
- (c) Grab inside of pants and pull down.
- (d) Pull black shorts down and back up.
- (e) Grab inside of pants and pull back up.

This may take some practice!



ACTIVITY 5

Backpack Spraying*

Srer Khmer NGO, Cambodia, PNASH

In role-play exercises, two volunteers will use a backpack sprayer to demonstrate spraying under conditions found in developing countries. Other participants will handle plants contaminated with tracer. Participants will observe and draw on body maps the tracer contamination on skin and clothes of volunteers. Participants will talk in small groups about safer pesticide handling practices. Overall, the activity will emphasize to participants the importance of using safer pesticide handling practices to protect their health. *Note: Activity can be modified for US conditions.*

**Estimated Total
Activity Time: 1 hour**

MESSAGE

Surprise! Pesticide gets on your skin more than you think.

LEARNING OBJECTIVES

Upon completing this lesson, participants will know:

- How wearing long-sleeved clothing and pants reduces skin contamination from pesticides
- Importance of washing immediately with soap and water after handling pesticides
- To not eat, drink, or smoke when mixing and applying pesticides
- How to choose safer pesticides

WHAT YOU NEED

Site Requirements

- Outdoors: field with tall vegetation
- Water source
- Dark area

Safety Materials

- UV-A safety glasses
- Emergency eyeflush water
- MSDS for Tinopal® CBS-X

Dark Area

- Black light
- Extension cord/batteries
(as needed)
- Flash light
- Dark fabric
- Duct tape
- Small body map handouts
- Markers, pens, or crayons

Discussion

- Flip chart paper for large body map
- Pesticide containers

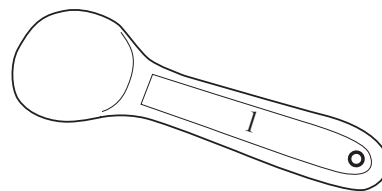
Tracer Recipe

- 1 teaspoon Tinopal® CBS-X
(add more if needed)
- 15 liters water in a backpack sprayer
- 18-liter backpack sprayer
- Measuring spoon or small plastic spoon

*Original developed by Helen Murphy for the IPM Field School Training, United Nations Food and Agriculture Organization.

PREPARE

- Make tracer recipe:
 - Fill 18-liter backpack spray tank with water.
 - Add 1 teaspoon Tinopal® CBS-X into spray tank.
- Construct a dark area:
 - Use dark fabric to block out light and cover bright objects.
 - Check to make sure area is dark enough to view tracer under black light.
 - Turn on the blacklights to be sure the gloves do not glow.



INTRODUCTION

5 minutes

1. Introduce yourself, review learning objectives, and tell participants you need their active participation. As the instructor, you will not lecture but lead a discussion; **ask participants direct questions and let participants spend a few minutes talking about their answers.**
2. Inform participants this activity uses a black light and fluorescent tracer to see contamination. For the short duration of this training, both are safe to use. Black lights can be found in dance clubs and fluorescent tracers are common ingredients in laundry detergents, soaps, and paper. Advise participants not to look directly into the black lights because that may cause discomfort. See **Health and Safety Instructions** (p. 7).
3. Using labels on available pesticide containers, ask participants:
What is this pesticide by brand and common name?
What is the color of the band on the label? What does this mean?
 - Internationally, the World Health Organization (WHO) recommends that pesticide labels have a color code to let you know the level of danger this pesticide presents to human health. This is a color band found near the bottom of the pesticide container. Instead of color band, US EPA requires signal words on pesticide labels.

PESTICIDE CLASSIFICATION

World Health Organization Color Code	US Environmental Protection Agency Signal Word	What It Means?
Class IA & IB red	Category 1 Danger	- extremely hazardous to health
Class II yellow	Category 2 Warning	- moderately hazardous to health
Class III blue	Category 3 Caution	- slightly hazardous to health
Class IV green	Category 4 Caution	- unlikely to be hazardous when used under normal conditions

ROLE-PLAY EXERCISE - BACKPACK SPRAYING

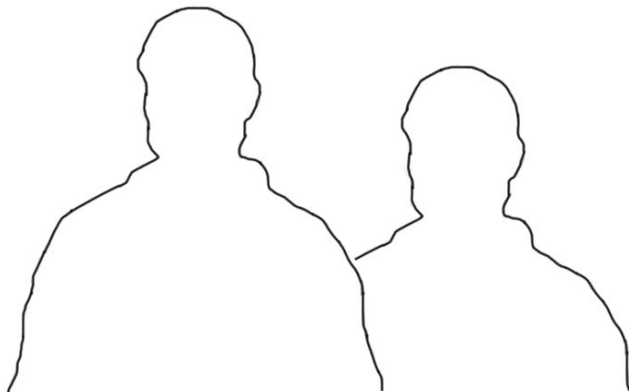
—————→ *20 minutes*

1. Ask for two volunteers to spray tracer mixture using a backpack sprayer. Volunteers can wear clothing that is normally worn in that country. Have Volunteer 1 wear clothes that cover more of his or her skin than Volunteer 2.
2. Find a nearby outdoor field with tall vegetation and/or overhanging plants. It is not necessary to have volunteers spray on actual crops.
3. Instruct each volunteer to spray the tracer for about 10 minutes on the plants. Tell volunteers to imagine this site was their own vegetable plot.
4. Instruct volunteers to **NOT** be careful when they spray. Ask other participants to observe and direct the volunteers on careless ways farmers may spray. Suggestions can include:
 - Spray into the wind.
 - Spray high as if applying pesticides to high growing crops.
 - Spray low as if applying pesticides to low growing crops.
 - Walk through sprayed crops.
 - Smoke (an unlit cigarette).
 - Clean out clogged spray wand.
5. Ask volunteers to **NOT** wash hands or feet after spraying the tracer.

ROLE-PLAY EXERCISE – HANDLING CONTAMINATED VEGETABLES

—————→ *10 minutes*

1. Tell participants to imagine they are harvesting vegetables soon after the volunteers applied pesticides. Ask for a few participants to pick some plants to pass around to the other participants. Ask each participant to imagine he or she is inspecting the vegetables at a local open-air market.
2. Ask participants to **NOT** wash their hands after handling the plants.



DARK AREA

10 minutes

1. Ask participants to create a circle around you. Shine the black light on hands of participants who touched the vegetables.
2. Give each participant, except for the two volunteer sprayers, an individual body map and a marker. Ask them to mark on the body map where they see the tracer on the volunteers during or after viewing the volunteer sprayers under the black light.
3. Examine one volunteer sprayer at a time in the circle. Shine the black light on:
 - Face (*volunteer must close eyes or wear UV-shielding goggles*)
 - Arms and hands
 - Torso (*chest and back*)
 - Legs
 - Feet
 - Clothing



DISCUSSIONS

15 minutes

1. Break participants into two small groups, by gender if appropriate. Provide one blank flip chart page to each group.
2. On the flip-chart page, ask the group to:
 - Draw large body map and mark contamination seen on one of the volunteers
 - Write the percentage of contamination seen on the entire body of the volunteer
 - Write the signs and symptoms of pesticide poisonings with arrows pointing to the relevant body parts
 - List the four ways pesticide can get into the body: eye, skin, inhalation, and ingestion
 - Creatively come up with ways to protect their health from pesticides
3. Ask for one representative from the group to discuss their body map with everyone together.

How to Adapt Role-Play for US Conditions

- Wear PPE required by pesticide label or used on farm
- Discuss US EPA warning labeling criteria

PART 2

ADDITIONAL INFORMATION

Helpful Hints	63
US Worker Protection Standard	64
Where to Obtain Supplies	66



HELPFUL HINTS

When choosing black lights:

- Make sure you use only the safe UV-A bulbs. Do not use the dangerous UV-B and UV-C bulbs. Also, standard fluorescent lights won't light up the fluorescent tracer.
- If possible use AC-powered black lights. These lights are stronger and the fluorescent tracer will shine more brightly.

Don't forget to bring to training:

- A large dark cloth to shield out normal light or cover bright objects.
- Extra batteries or extension cords for black lights.

Make the tracer work for you:

- When liquid tracer mixture soaks into fabric and doesn't fluoresce well, apply a light coat of Scotchgard™ to the fabric beforehand.
- When liquid tracer mixture dries and does not transfer easily from surfaces, add rubbing alcohol (70% isopropanol) to the mixture.

When the dark area is not dark enough:

- View the tracer contamination at night.
- To help you see the glow better, add more tracer into the mixture, use a brighter fluorescent tracer, or use stronger black lights.
- Use black cloth or cardboard to block out light. Tape to hold in place.

To make sure training goes smoothly:

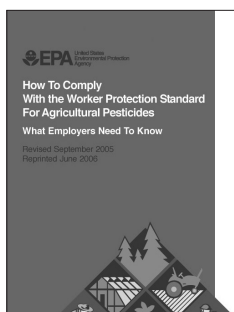
- Establish and practice the procedure ahead of time.
- Dispel concerns about using fluorescent tracers and black lights. Inform participants that tracers are nontoxic chemicals.
- Use scripted role-plays or perform worst-case scenario to ensure tracer contamination occurs and demonstrates the problem.

Other fun ideas:

- Wipe contaminated surfaces such as furniture or tractor with a small dark cloth or towel to view under black light.
- Use your imagination to adapt activities and demonstrations in this manual for your workplace or training.
- Ask for participants' creative ideas on how to use the tracers.

US WORKER PROTECTION STANDARD (WPS)

Relevant information on the US Worker Protection Standard (WPS) requirements can be incorporated into discussions in US based hands-on activities. Excerpts from US Environmental Protection Agency's "How to Comply with the Worker Protection Standard for Agricultural Pesticides: What Employers Need to Know" are shown below. For more information on US WPS, see (<http://www.epa.gov/oecaagct/htc.html>).



Note: Individual states may have additional requirements. Check with your local jurisdiction to assure you have complete regulatory requirements.

ACTIVITY 1 Application Equipment Safety [WPS 2005 p. 61]

Equipment Inspection

Inspect pesticide handling equipment before each day of use for leaks, clogging, and worn or damaged parts. Repair or replace any damaged equipment.

Protections for Persons Maintaining Equipment

Remove pesticide residues from pesticide handling equipment before anyone other than an appropriately trained and equipped handler is allowed to repair, clean, or adjust it.

ACTIVITY 2 Personal Protective Equipment (PPE) Clean-Up and Maintenance

[WPS 2005 p. 62-63]

Duties related to Personal Protective Equipment

Employers must:

1. Provide handlers with the appropriate PPE in clean and operating condition.
2. Make sure the handlers wear the PPE correctly and use it according to the manufacturer's instructions. If a handler wears a respirator, make sure that it fits the wearer correctly.
3. Inspect all PPE before each day of use for leaks, holes, tears, or worn places, and repair or discard any damaged equipment.
4. Provide handlers with clean places away from pesticide storage and pesticide use areas to:
 - store personal clothing not in use
 - put on PPE at the start of any exposure period
 - take off PPE at the end of any exposure period
5. Take any necessary steps to prevent heat illness (too much heat stress) while PPE is being worn.
6. Do not allow any handler to wear home or take home PPE contaminated with pesticides.

Cleaning and Maintaining PPE

Employers must:

1. Keep pesticide-contaminated PPE away from other clothing or laundry, and wash it separately.
2. If PPE will be reused, clean it before each day of reuse according to the instructions from the PPE unless the pesticide labeling specifies other requirements. If there are no such instructions or requirements, wash PPE thoroughly in detergent and hot water.
3. Thoroughly dry the clean PPE before it is stored, or put it in a well-ventilated place to dry.
4. Store clean PPE separately from personal clothing and away from pesticide-contaminated areas.

ACTIVITY 2 & 4

Decontamination Site

[WPS 2005 p. 24-25]

Location

1. All decontamination supplies for workers must be located together and all decontamination supplies for handlers must be located together. Decontamination supplies must be reasonably accessible to the workers and handlers. Handlers mixing pesticides must have decontamination supplies at the mixing area.

Exceptions:

- For a pilot who is applying pesticides aerially, the decontamination supplies must be at the aircraft's loading site or in the aircraft.
 - For tasks performed more than 1/4 mile from the nearest point reachable by vehicles (cars, trucks, or tractors), the decontamination supplies may be at the access point.
2. Worker decontamination supplies must not be in an area being treated with pesticides or in an area under a restricted-entry interval.
 3. Handler decontamination supplies may be located in an area being treated with pesticides (or an area that has a restricted-entry interval in effect), only if:
 - They are in the area where the handler is doing handling tasks, and
 - The soap, single-use towels, and clean change of clothing are in closed containers, and
 - The water is running tap water or is in a closed container.

Supplies

Provide workers and handlers with:

1. Water – enough for:
 - routine washing, and
 - emergency eyeflushing.
2. Soap and single-use towels
3. For handlers, also provide:
 - enough water for washing entire body in case of emergency, and
 - clean change of clothes, such as one-size-fits-all coveralls, to put on if the handler's garments are contaminated and need to be removed right away.

Emergency Eyeflushing

Provide each handler with at least 1 pint of emergency eyeflush water when the pesticide labeling requires protective eyewear for the handling task being performed. The emergency eyeflush water must be immediately accessible. For example, it could be carried by the handler or be on a vehicle the handler is using. The water is supplied for general decontamination may also be used as eyeflush water, if it is immediately accessible.



WSDA

WHERE TO OBTAIN SUPPLIES

Disclaimer: Mention of any company or product does not constitute endorsement by the University of Washington PNASH, the WSDA Farmworker Education Program, or the WSU Extension. Contact the companies for current pricing.

Water-Soluble Tracers

Water-soluble tracers can easily dissolve in water and can be used to simulate mixing, loading, and applying a liquid pesticide formulation. Generally, the simulated liquid pesticide mixture with a water-soluble tracer is easily transferred when wet and more difficult to transfer after the mixture has dried. Rubbing alcohol (70% isopropanol) can be added to help with transfer.

Fluorescent Tracer	Supplier/Manufacturer
Tinopal® CBS-X powder*	Ciba™ Additives Tilley Chemical Company
Tinopal® SFP powder	Ciba™ Additives MF Cachat Company
Tinopal® 5BM-GX powder	Ciba™ Additives Tilley Chemical Company
DayGlo® UV Blue (D-282) powder	Day-Glo™ Color Corporation

*Tracer has been tested for activities in this manual.

Oil-Soluble Tracers

Oil-soluble tracers do not easily dissolve in water unless a surfactant such as vegetable crop oil is added to the mixture. An oil-soluble powder can dissolve in oil-soluble pesticide formulation for use in workplace applications. In the original formulation (powder, oil, or gel), oil-soluble tracers can be used to show transfer.

Fluorescent Tracer	Supplier/Manufacturer
Uvitex OB powder*	Ciba™ Additives MF Cachat Company
GloGerm™ Oil	Glo-Germ™ Company
GloGerm™ Gel*	Glo-Germ™ Company
GloGerm™ Powder*	Glo-Germ™ Company
DayGlo Invisible Blue (A-594-5)* powder	Day-Glo® Color Corporation

*Tracer has been tested for activities in this manual.

Ultraviolet Black lights

Ultraviolet black lights come in different shapes and sizes. Some are portable (hand-held and battery-operated) and others require a power outlet.

Description	Power source	Supplier
4-watt Handheld Black light (DG1HHBL)	4 AA batteries	Day-Glo® Color Corporation
15-watt 801 Light Stick	110V AC	Glo-Germ™ Company
9-watt 901 Lamp	10V AC	Glo-Germ™ Company
8-watt 1005 Dual Power Light Stick	110V AC 8 AA batteries	Glo-Germ™ Company
UVSL-26P Rechargeable UV Lamp	Internal rechargeable battery with 12V adapter	UVP® (Ultra-Violet Products)
6-watt ML-49 Portable UV Lamp	2 6-volt batteries (standard or rechargeable with 12V adapter)	UVP® (Ultra-Violet Products)
Mini-UV Lamps	4 AA batteries	UVP® (Ultra-Violet Products)

Suppliers/manufacturers

Ciba™ Additives

(800) 474-4731

<http://www.cibasc.com/>

International distributors:

http://www.cibasc.com/talk/ttu_01.asp

Day-Glo® Color Corporation

(216) 391-7070

www.dayglo.com

Catalog: http://www.dayglo.com/products_optical_brighteners.asp

International distributors:

<http://www.dayglo.com/distributors.asp>

Fisher Scientific (*laboratory supplies*)

(800) 640-0640

<http://www.fisherscientific.com/>

International distributors:

<http://www.fisherscientific.com/index.cfm?fuseaction=order.map>

MF Cachat Company

(800) 729-8900

<http://www.mfcachat.com/contact/>

Tilley Chemical Company

(800) 638-6968

<http://tilleychem.com/>

UVP® (Ultra-Violet Products)

(800) 452-6788

<http://www.uvp.com/>

International distributors: <http://uvp.com/new/index.php?module=ContentExpress&func=display&ceid=91>

VWR International (*laboratory supplies*)

(800) 932-5000

<http://www.vwr.com/index.htm>

Catalog: http://www.vwrsp.com/programs/safety/page.cgi?tmpl=browse_catalog#personal

Glo-Germ™ Company

(800) 842-6622

<http://www.glogerm.com/>

Catalog: <http://www.hdd.net/cgi-bin/glogerm/hazel.cgi#Anchor-55666>

“[The research] was seven years ago. But what I remember from [the participants] was that some of them really didn’t believe they could get that contaminated and said the hands were the most contaminated. One month ago, I went to visit two farms because they were in their study and they still remember and they said the guy demonstrated [with FT] how difficult it is to escape from pesticides. So it creates an impact.

~ Aurora Aragon
University of Leon, Nicaragua



This manual was developed through a University of Washington research project. We would appreciate your feedback. Please bi-fold with address on the outside and return to PNASH postage paid (US only). You can also fax it to PNASH (206) 616-2817 or fill it out online at http://depts.washington.edu/pnash/FT_manual.php

Please tell us a little about yourself.

1. Residence: Country _____ State _____ 2. Today's date ___/___/___ (dd/mm/yy)
3. Where do you work?(One best answer)
- Farm
 - Orchard
 - Nursery
 - Agricultural extension
 - University or college
 - Consulting firm
 - Government agency
 - Not for profit agency
 - Producer organization
 - Farmworker organization or union
 - Other _____
4. What is your position?(One best answer)
- Pesticide safety educator or trainer
 - Health and Safety professional
 - Owner of a farm, orchard, or nursery
 - Manager or supervisor of a farm, orchard, or nursery
 - Pesticide handler
 - Farm industry representative
 - Farm worker representative
 - Consultant
 - Other _____

Fold Here

74-5702



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 429 SEATTLE WA

POSTAGE WILL BE PAID BY ADDRESSEE

PACIFIC NORTHWEST AGRICULTURAL SAFETY AND HEALTH CENTER
BOX 357234
UNIVERSITY OF WASHINGTON
SEATTLE WA 98105-9950



Fold Here

Tell us about the Fluorescent Tracer Manual

5. When did you first get the manual? ___/___/___ (dd/mm/yy)
6. How did you find out about the manual?
- From a colleague or coworker. _____
 - At a conference or trade show. Which one? _____
 - At a workshop or class. Which one? _____
 - In a newsletter or publication. Which one? _____
 - On the internet. PNASH WSDA WSU other _____



7. Rate the manual on the items below 0 (not at all) to 5 (very much)
- | | | | | | | |
|----------------------------------------------------------|---|---|---|---|---|---|
| Instructions are easy to follow. | 0 | 1 | 2 | 3 | 4 | 5 |
| Technical information is accurate. | 0 | 1 | 2 | 3 | 4 | 5 |
| Layout and graphics are clear. | 0 | 1 | 2 | 3 | 4 | 5 |
| My likelihood of using the fluorescent tracer technique. | 0 | 1 | 2 | 3 | 4 | 5 |
| My likelihood of recommending the manual to others. | 0 | 1 | 2 | 3 | 4 | 5 |
| The manual enhanced my pesticide safety knowledge. | 0 | 1 | 2 | 3 | 4 | 5 |

8. Did you use or do you plan to use any of the below:
- | | used | plan to use |
|---------------------------------------------------|--------------------------|--------------------------|
| A quick demonstration: Light up your discussion | <input type="checkbox"/> | <input type="checkbox"/> |
| Workplace Application: Tracer in the Tank | <input type="checkbox"/> | <input type="checkbox"/> |
| Activity #1 Application Equipment Decontamination | <input type="checkbox"/> | <input type="checkbox"/> |
| Activity #2: PPE Decontamination | <input type="checkbox"/> | <input type="checkbox"/> |
| Activity #3: Unplugging a Spray Nozzle | <input type="checkbox"/> | <input type="checkbox"/> |
| Activity #4: Taking a Bathroom Break | <input type="checkbox"/> | <input type="checkbox"/> |
| Activity #5: Backpack Spraying | <input type="checkbox"/> | <input type="checkbox"/> |
| My own FT activity _____ | <input type="checkbox"/> | <input type="checkbox"/> |

9. In what language did you or will you be providing the training? Check all that apply.
- English Spanish other _____

10. How many people did you train or do you plan to train in the next year: Trained ___ Plan to train ___

11. Did using FT help stimulate class participation? yes somewhat no

12. Did using FT help students learn the course materials? yes somewhat no

13. What are the strengths of the manual or using FT? _____

14. What are the weaknesses of the manual or using FT that we should change? _____

15. Tell us other creative ways you have used fluorescent tracers. _____

Thank you for filling out the evaluation and sending us your answers. We would like to hear more about your experience using fluorescent tracers. Can we contact you? yes no

Would you like to receive other agricultural safety education information? yes no

If yes,
Name _____ Organization _____

Address _____

Phone number _____ email _____

Your responses to this evaluation are confidential. If you choose not to provide your name and contact information, your responses will also be anonymous. We only share combined results that do not identify individuals.

Permission is granted to reprint and distribute *Fluorescent Tracer Manual: An Educational Tool for Pesticide Safety Educators*, provided that this copyright notice and permission statement is retained. © 2007 University of Washington

This manual was created by the University of Washington (UW) Pacific Northwest Agricultural Safety and Health Center, a component of the Agricultural Centers Program of the National Institute for Occupational Safety and Health. Please attribute UW appropriately.

We would appreciate your providing a copy of reprinted materials and the feedback form.

ORDERING INFORMATION

To receive this manual or other information about northwest agricultural safety and health, contact the PNASH Center at:



PNASH

Department of Environmental and
Occupational Health Sciences
School of Public Health and Community Medicine
University of Washington
Box 357234
Seattle, WA 98195-7234 USA

Telephone: (800) 330-0827
Fax: (206) 616-2687
E-mail: pnash@u.washington.edu

Please indicate Spanish or English

Copies are available for download at PNASH website:
http://depts.washington.edu/pnash/FT_manual.php