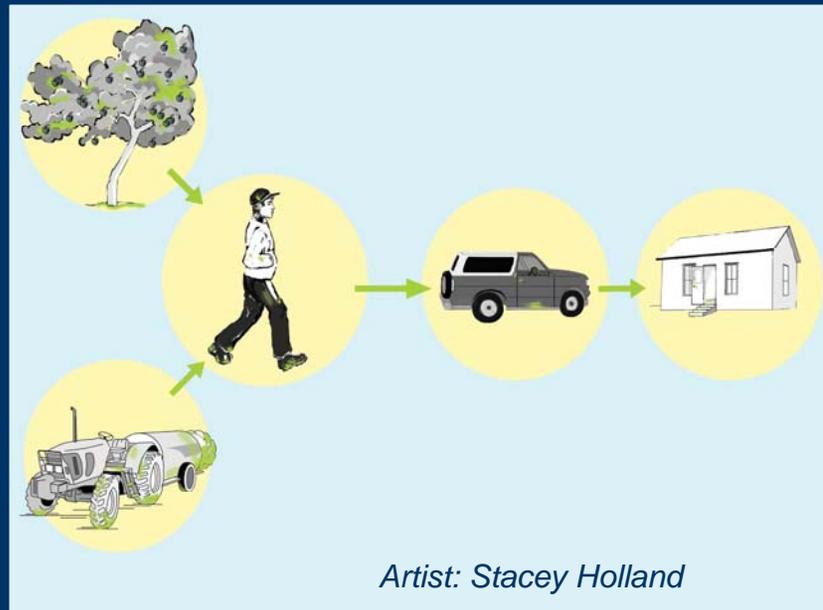


The Work to Home Pesticide Exposure Pathway

How to Protect Pregnant Women And Children



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Pacific Northwest Agricultural Safety and Health Center (PNASH)



Topics

- ✓ Work to Home Exposures
- ✓ Children's Vulnerability
- ✓ Prevention

Work to Home Studies

- Pesticide residues in yard soil and house dust significantly higher in homes of agriculture worker. (*Simcox et al., 1995*)
- Pesticide by-products in urine higher in children of agriculture workers. (*Loewenherz et al., 1997*)
- House pesticide dust levels 7x higher (*Lu et al., 2000*)
- Residues in house dust and vehicle dust of agricultural workers were significantly correlated. (*Curl et al., 2002*)
- Metabolites for agricultural workers and their children were significantly correlated. (*Curl et al., 2002*).

Yard and House Dust Residues

- Dust and soil samples tested for pesticide residues in play areas
- Farming (within 200 meters of an orchard vs. non-farming ($> \frac{1}{4}$ mile from a farm))
- Residues in house dust $>$ soil in all homes
- Residues in farming $>$ Non farming households



Profession and proximity to orchards are related to pesticide residues in homes

Pesticide By Products in Farm Children's Urines

- Children of applicators compared to non agricultural children
- Living close (200') compared to ($> \frac{1}{4}$ miles) from orchard
- Applicator children had 4 x more pesticide by-products in urine.
- The younger the child the more by-products
- The closer to the orchard greater chance of detecting pesticide by-product in urine

(Loewenherz et al., 1997)

Pesticide Residues in Urine, Dust and Vehicles

- 109 children & their homes
- Classified by occupation & distance from orchard
- Hand & surface wipes
- Dust & urine samples



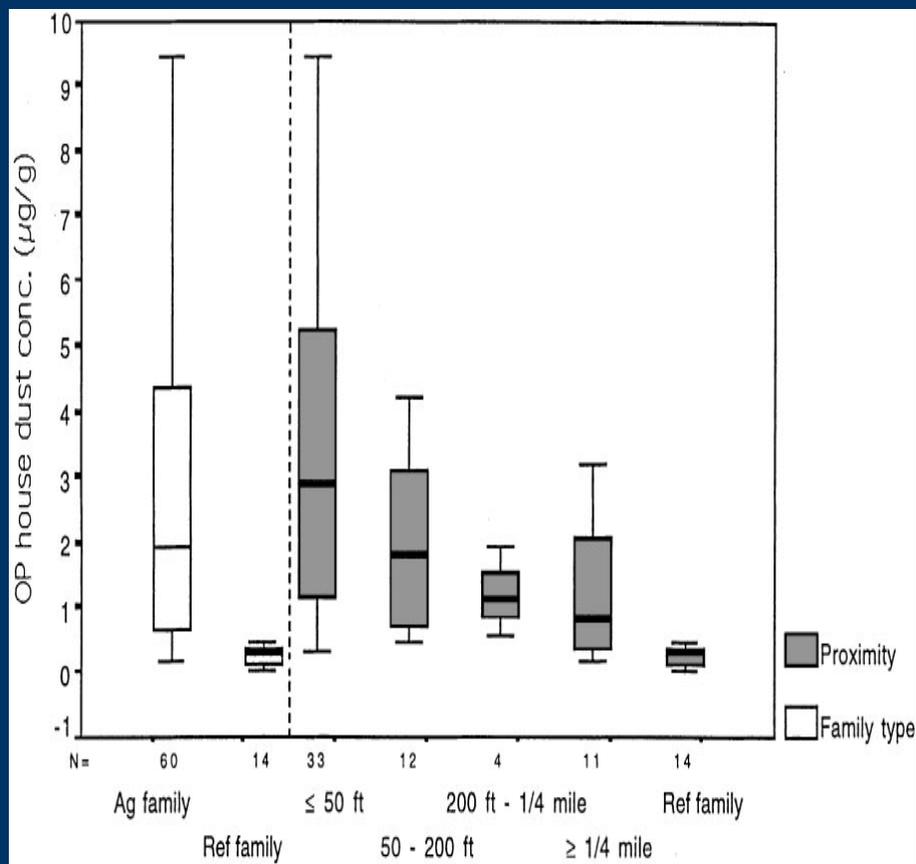
- AG homes 7 x more pesticide in dust
- AG children 5 x the pesticide metabolite load
- Living 200' from orchard more dust and urinary loads
- Evidence on some hands and steering wheels

(Lu et al. 2000)

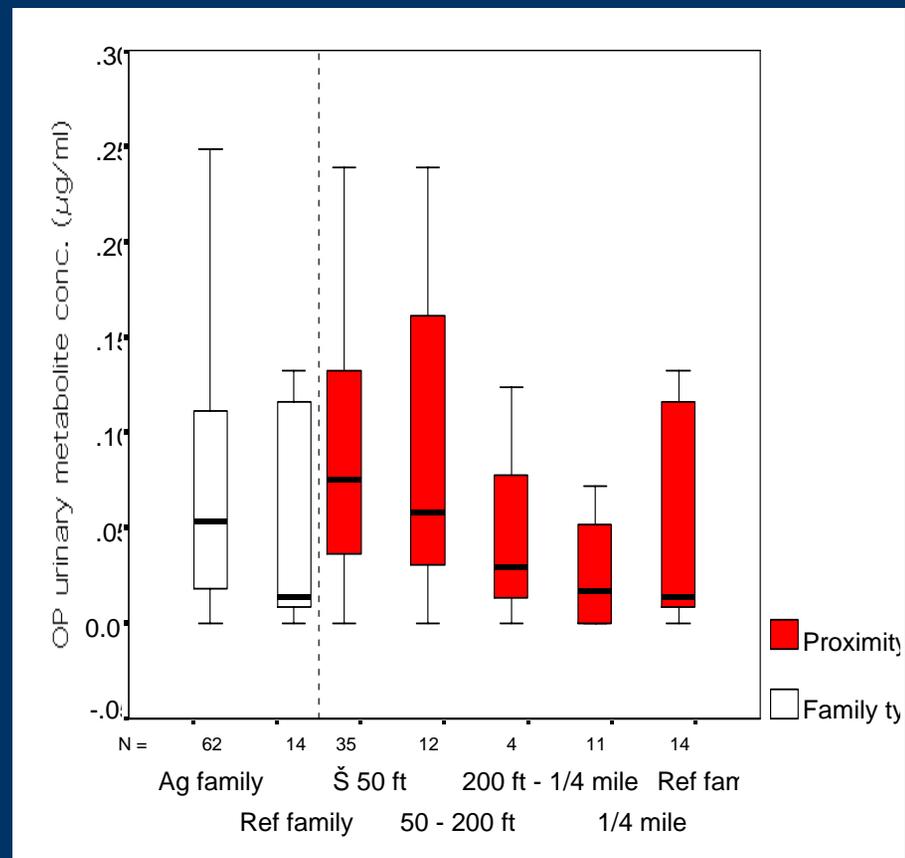
OP Dust & Urinary Concentrates

Family Status and Proximity

dust



urine



(Lu et al., 2000)

Children's Vulnerability

- Behavioral factors
- Biological factors
- Bigger doses
- Long term effects @ low level exposure

Behaviors

- ✓ *Hand to mouth:* Taste their environment
- ✓ *Near the ground:* Spend more time on the ground
- ✓ *Outdoors:* Spend more time outside
- ✓ *Diet:* consume more per weight (water and fruits)



Behavior: soil ingestion



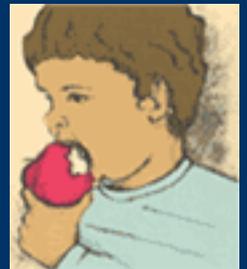
	2.5 year old	Adult
Soil ingestion		
Indoor	50mg	20mg
Outdoor	60mg	0.4mg

Diet

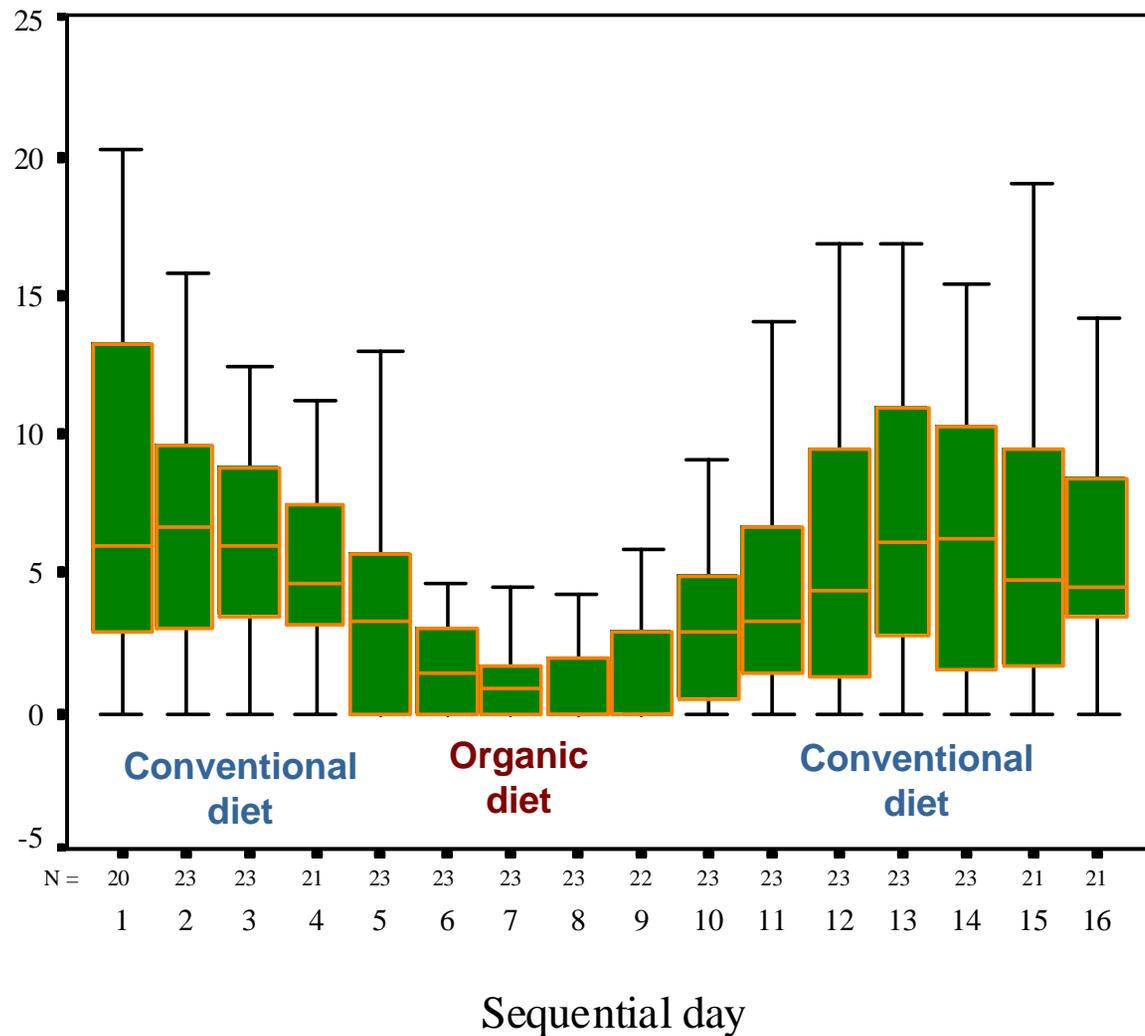
- Drinks 2 x more water per their weight than an adult



- Eats 12x more apples per their weight than an adult



Pesticides in Urine of 22 Children Before, During, and After Organic Diet Intervention



Child's Biological Factors

- ✓ Body works **faster** (higher metabolic rate)
- ✓ More **skin** per body weight
- ✓ Developing **organs**

Biology- Higher Dose By:

1. Skin

- More permeable: highest at birth
- 2.7 x more skin surface/weight than adults

2. Lungs

- Inhales more per day (1.7x) than adult

Vulnerability to Health Effects: Organs Still Developing

❖ Nervous System	❖ Sex organs
❖ Lungs	❖ Kidneys
❖ Bones	❖ Immune
❖ Metabolism	❖ Digestive system

"A little kid goes from a single cell to a laughing, sociable, intelligent, friendly human being over the course of two years. That's dramatic growth and development!"

Kenneth Olden, PhD, former Director, National Institute of Environmental Health Sciences

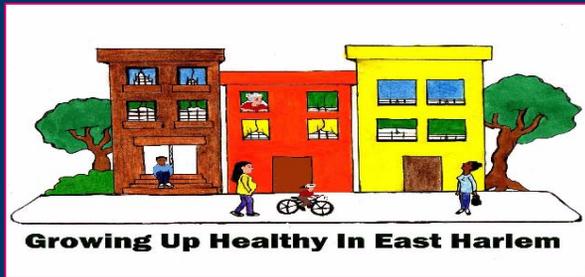
Impacts on Children

Studies on low level OP exposures among children

- ✓ The younger the child the greater consequences of OP exposure on development
 - Fetus
 - Soon after birth
- ✓ Nerve cells affected
- ✓ Levels so low that they do not affect the cholinesterase but still damage developing nerve cells.

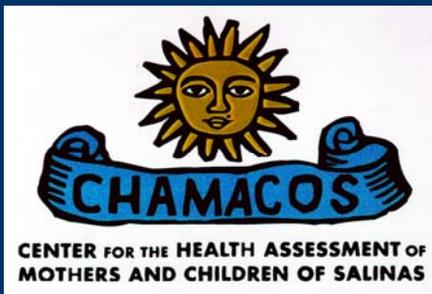
What is the Evidence?

Three Studies of Mother-Baby Pairs



Mary Wolff, Stephanie Engel, Gertrud Berkowitz
Mount Sinai School of Medicine

Virginia Rauh, Robin Wyatt, Frederica Perera
Columbia University



Brenda Eskenazi, Kim Harley, Asa Bradman, Amy Marks
University of California, Berkeley

New York Studies



Following 700
mother/baby pairs
for 7 years.

- ✓ Mother's air intake
for pesticides
- ✓ Mother's blood
- ✓ Umbilical cord
blood of baby

Followed 409
mother/baby pairs for
3 years.

- ✓ Mother's urine
- ✓ Birth outcomes
- ✓ Development to age 2

California Studies



600 pregnant Latina women farm working families living in Salinas, a heavy agriculture area.

- ✓ OP by-products in urine during pregnancy and after delivery
- ✓ Birth outcomes

Biomarkers of Prenatal OP Pesticide Exposures

In Urine

In Blood

OP by products
(Dialkyl Phosphates)

Chlorpyrifos

Berkeley X

Mt. Sinai X

Columbia X

Early Childhood Neurodevelopmental Outcome Measurements

	Behavioral Assessment	Infant Development*				Pre-school Intelligence**	
	Neonatal	6M	1Y	2Y	3Y	3.5Y	5Y
Berkeley	X	X	X	X		X	X ****
Mt. Sinai	X		X	X			
Columbia			X	X	X		X

* Baley: Tests motor, cognitive, language development

*** Brazelton

**Wechsler Preschool and Primary Scale of Intelligence (WPPSI)

**** Verbal IQ assessed with PPVT

Source: Kim Harley, PhD UC Berkeley Center for Children's Environmental Health Research

Early Childhood Behavioral Outcome Measurements

Child Behavior Checklist

2Y

3Y

3.5Y

Berkeley

X

X

Mt. Sinai

Columbia

X

AGRICULTURAL CALIFORNIA



URBAN NEW YORK

Characteristics of Study Populations

	Berkeley (%)	Mt. Sinai (%)	Columbia (%)
Race/Ethnicity			
Non-Hispanic White	1	20	--
African-American	--	27	35
Hispanic	Mexican 97	Mex, PR 51	Dominican 65
Other	2	1	--
Married	82	29	29
< High school	81	32	35

Source: Kim Harley, PhD UC Berkeley Center for Children's Environmental Health Research

In summary...

- Three scientifically-rigorous, cohort studies
 - Different populations
 - Different exposure levels and sources
 - Exposure measured using biomarkers in urine (metabolites) and blood (parent compound)
- Despite these differences, some patterns emerge...

Prenatal OP exposure associated with

- ✓ Increased odds of abnormal reflexes in neonates
- ✓ Poorer mental development in 2 and 3 year olds
- ✓ Poorer verbal IQ in 3½ and 5 year olds
- ✓ Increased odds of pervasive developmental disorder

Home Based Intervention

- ❑ Storing and washing work clothes
- ❑ Personal hygiene
- ❑ Effectiveness of home cleaning (McCauley)
- ❑ Community based: behavioral changes

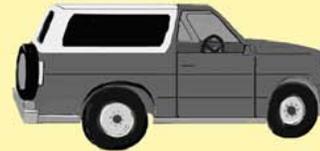
Work Based Interventions

- Personal car vacuuming
 - ↓ Family exposure
 - Cherry harvesters

- Tracer-in-the-Tank
 - ↓ Handler exposure
 - ↓ Family exposure
 - Pesticide handlers



Minimizing work to home pesticide exposure



Reduciendo exposición de
pesticidas del trabajo a la casa

Artist: Stacey Holland

Personal Car Vacuuming Cherry Harvesters

- Central location
- Check out system
- \$5 coupon
- 1-2x/week



OP* Load After Vehicle Vacuuming

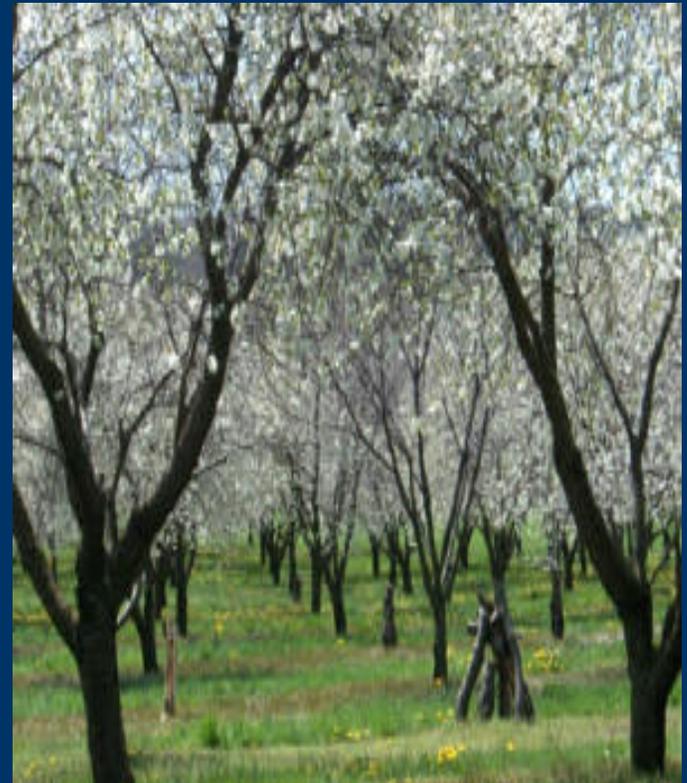
		control	vacuum 1-4 times	frequency 5-8 times	p-value
<i>House</i>	n	27	8	8	
$\mu\text{g}/\text{m}^2$	mean	0.22	0.10	0.02	0.038
	95% CI	0.10-0.48	0.02-0.42	0.01-0.11	
	SD	7.7	7.8	7.9	

* Azinphos methyl (Guthion)

Conclusions

- Vehicle loadings higher than house loadings
- Vehicle vacuuming significantly reduced OP* load in homes
- Increased vacuuming frequency decreased OP load in homes

* Azinphos methyl (Guthion)



http://www.hartfordmi.com/hartfordhistory/Scenic/HPI/M2378sm_small1.jpg

Tracer-in-the-Tank



Source: K Galvin PNASH

Fluorescent Tracers

- Not visible in daylight
- Visible under UVA light
- Evaluation tool
 - Dermal exposure
 - Contamination
 - PPE Failure
- Educational tool

Study Design

- "Tracer-in-the-Tank"
- Mixing, loading, & applying
- Observed handling activity
- Photographed FT
- Participatory Education

Data Collection



Source: K Galvin PNASH

Hood



Source: K Galvin PNASH

Hood



Source: K Galvin PNASH

Neck



Source: K Galvin PNASH

Neck



Jacket Back



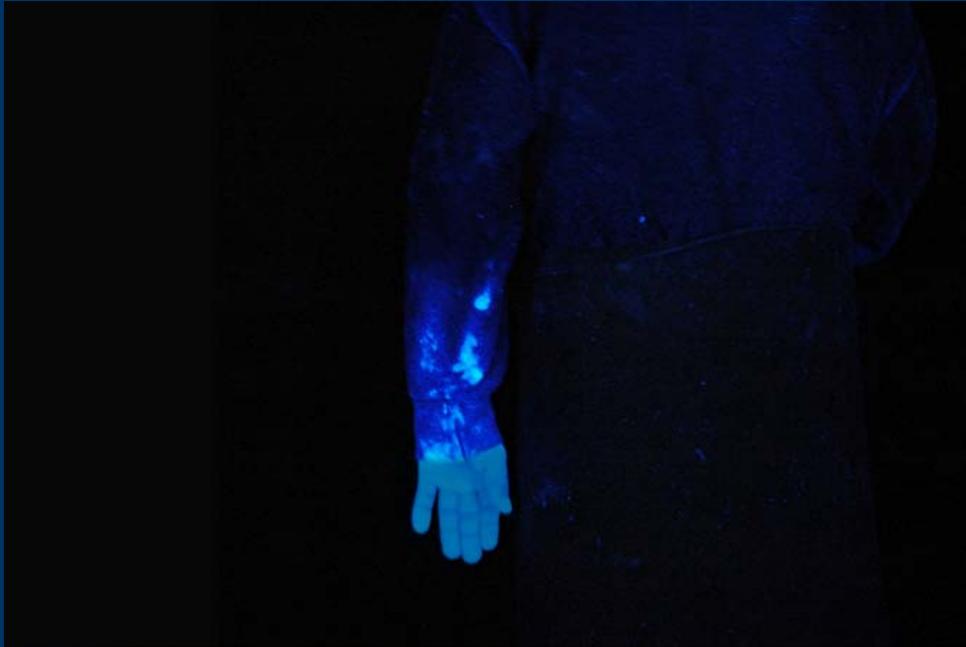
Source: K Galvin PNASH

Jacket Back



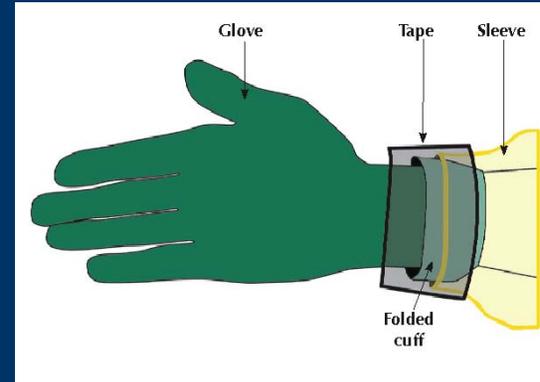
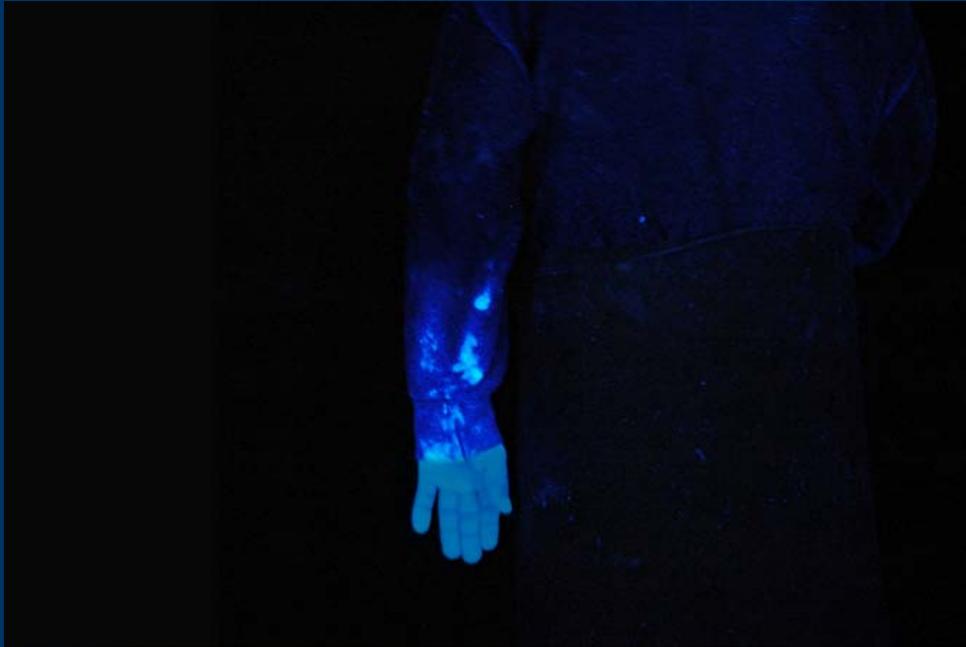
Source: K Galvin PNASH

Sleeve



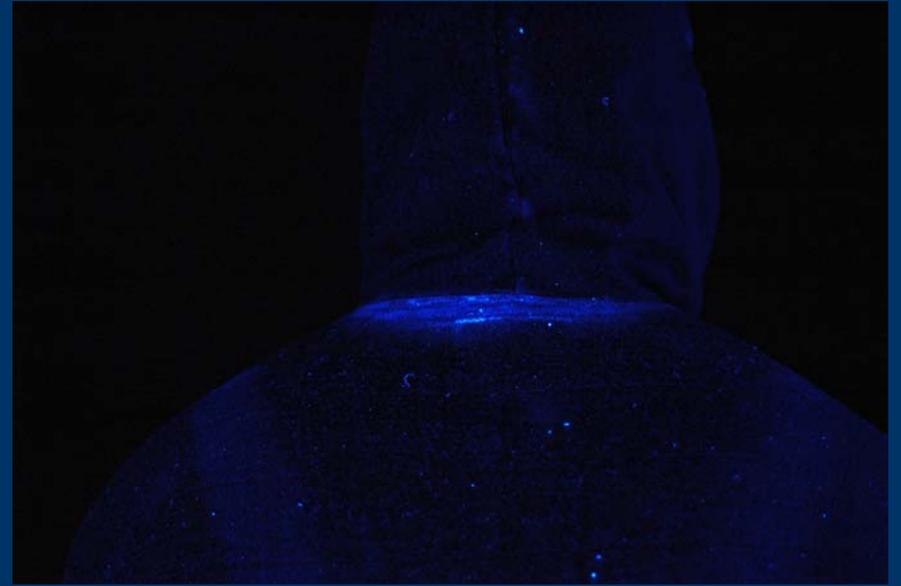
Source: K Galvin PNASH

Sleeve



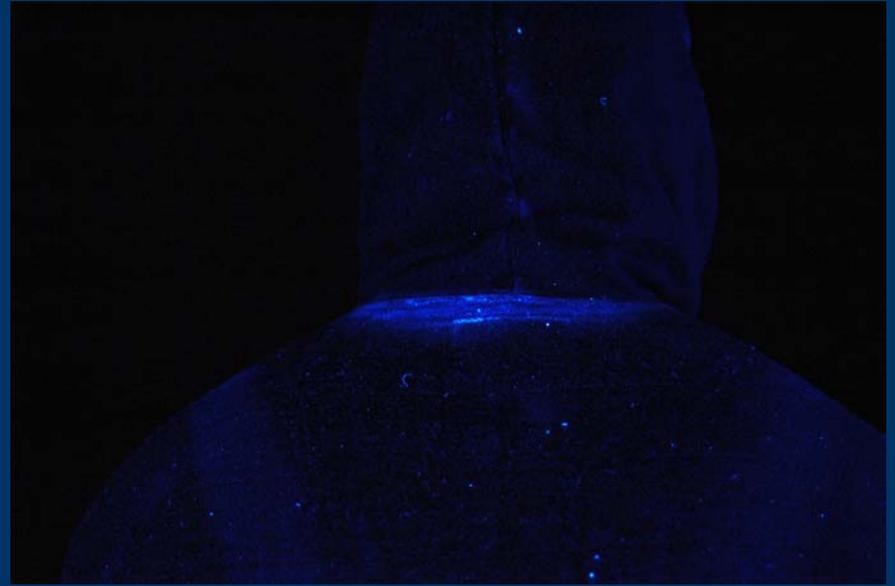
Source: K Galvin PNASH

Hood Neck



Source: K Galvin PNASH

Hood Neck



Source: K Galvin PNASH



Source: K Galvin PNASH

Tracer in Tank Conclusions

- Demonstrated T-n-T method in fruit orchards during application
 - Exposure & contamination
 - PPE limitations & failures
- Handlers & managers benefited
 - Educational impact
 - Handlers participation/interaction
 - Problems were resolved promptly



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