



Human Exposure to Pesticide Drift: Washington State Report

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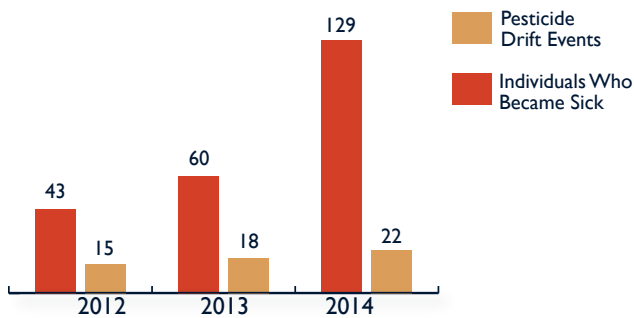
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Executive Summary

Human exposure to pesticide drift is on the rise in Washington State. Department of Health reports indicate 90% of the people exposed were not employed by the farm that applied the chemicals. Unfortunately, farm workers and their families – who have limited access to medical care – suffer disproportionate health impacts. Practical, common-sense measures that protect human health and farm worker communities from the harmful impacts of pesticide exposure must be implemented. This report includes personal stories of farm workers whose health has been negatively impacted by drift, background information on health risks associated with pesticides, and an overview of efforts to reduce exposure by drift.

Agricultural Drift Cases and Events Are Increasing, 2012–2014

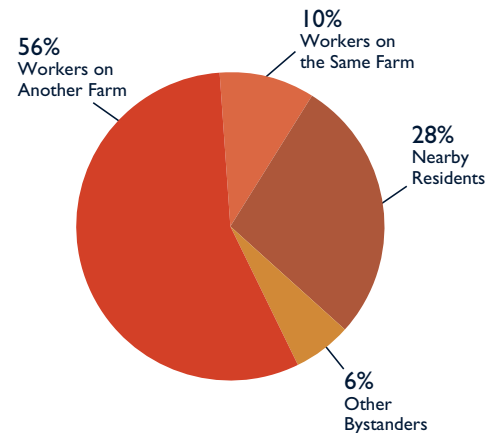
One pesticide drift event may result in multiple cases of pesticide illness



Source: Washington State Department of Health, "Washington State Data on Illness Related to Agricultural Pesticide Drift," July 2012

Who is Getting Sick from Pesticide Drift?

Department of Health averages based on data from 2005–2012



Source: Washington State Department of Health, "Agricultural Pesticide Drift and Farmworker Health," Farmworker Advisory Committee Meeting, 10/16/2014

Recommendations for Washington

1. Create and require systems for neighbor notification of pesticide application
2. Establish and enforce buffer zones around pesticide spraying
3. Increase penalties and remedies related to overspray or drift
4. Expand education for farm workers and applicators.

Recommendations for the EPA

1. Include direct drift and inhalation exposures in its risk assessments for pesticide label requirements
2. Address drift exposure under the standards required by Congress in the Food Quality Protection Act (FQPA).

Viviana Silva

“I’m thinking about everything that could happen because they were irresponsible. If I wanted to have another baby, I can’t just decide that so easily. Because of everything I know about the consequences – I have those in my mind.”

In April 2014, our crew boss sent us to work in a cherry orchard in Orondo, Washington, right next to a pear orchard. There were about 20 women in our crew. We were tying the cherry branches to a trellis wire when suddenly a tractor pulling an air-blast sprayer in the pear orchard turned around and started spraying right next to us. I could see the spray, and the wind was carrying it in our direction. The spray landed on my face and I inhaled it. It had a bitter taste.

I was afraid to leave without permission from the crew boss. Finally I heard someone shouting that the crew boss said we could leave and get away from the spray. I started

to feel tingling in my skin and my eyes burned. My vision was cloudy, and I vomited. All of my other co-workers began to feel ill as well. Someone called 911 and several of my co-workers were taken to emergency rooms by ambulance. The following day, I vomited again and went to the hospital as well. Sixteen of us had to seek medical care.

For a long time now, I have had lots of headaches. I didn’t have these headaches before the pesticides fell on me. I am concerned for women who are sprayed or drifted on because they may be pregnant or have children in the near future.



Background: Health Risks of Pesticides

Agriculture is the largest user of pesticides in the U.S. and the world.¹ The latest available data shows total U.S. pesticide expenditures were \$11.8 billion (1.127 million lbs.) in 2006 and \$12.5 billion (1.133 million lbs.) in 2007.²

Pesticides are used to increase crop production by eliminating insects or plant disease, removing competing plants, and cutting labor costs through chemical thinning. Early agriculturalists used sulfur and arsenic-containing compounds, including lead arsenic, to control insects and weeds. In the 1930s, organochlorines and organophosphates were discovered. During World War II, Germany and England further developed both of these as chemical warfare agents, some of which were later repurposed as insecticides.

Pesticides have also been developed from plant materials (pyrethrums). Other hormone-disrupting pesticides have been developed to interfere with plant and insect reproductive and other vital systems to kill or prevent the spread of pests. While many of these pesticides have been touted as “safe” or safer than arsenic and lead-based pesticides, human exposure still results in significant health risks.

Farm workers are at risk of health problems associated with pesticide exposure through acute and chronic occupational exposure. Workers and their families face additional risk due to residential and environmental exposure. Studies in the Eastern United States determined that farm workers suffer a disproportionate risk from health impacts of pesticides because of these social and environmental factors.³ Suggested or known risks of pesticide exposure include adverse

neurological, endocrinal and carcinogenic effects.

Synthetic pesticides can have systemic and long-lasting health impacts.

Neurodevelopmental Disabilities

Protecting farm workers and their families from pesticide exposure is crucial. Reported developmental, learning and behavioral disabilities resulting from exposure are increasing in prevalence.⁴ Pesticides are also known or suspected to have neurological, psychiatric, developmental, reproductive, and carcinogenic effects.⁵ For example, *chlorpyrifos*, an organophosphate insecticide, has been identified as a developmental neurotoxicant that injures the developing brain. Evidence suggests that this and other industrial chemicals cause neurodevelopmental disabilities, including autism, attention-deficit hyperactivity disorder, dyslexia, and other cognitive impairments which affect millions of children worldwide.⁶

Cancer

The 2008-09 Annual Report for the President’s Cancer Panel states that exposure to many EPA-approved chemical pesticides has been linked to breast and colon cancer, as well as Hodgkin and non-Hodgkin lymphoma, to name just a few. The President’s Cancer Panel also determined that regulation of chemicals could be improved.^{7 8}

Diabetes

Studies of pesticide applicators have found exposure to certain pesticides may be associated with increased risk of developing negative long-term health impacts, including diabetes. Applicators who previously used the organochlorine insecticides *heptachlor*, *aldrin*, and *chlordane* (now banned in the U.S.) had 51%, 63%, and 94% increased odds of diabetes, respectively. Exposure to other insecticides and herbicides also showed an increased risk of diabetes.⁹

Residential Exposure

Workers and their families need increased protection from the harmful complications of repeated exposure to pesticides. Not only are agricultural workers at risk, but so too are their families when exposed to chemicals on clothing, in the field, and through other channels.¹⁰ Take-home exposure and multiple pathways at work and at home result in compounding pesticide exposure for farm workers and members of their families. Studies have confirmed higher levels of *chlorpyrifos* and *azinphos-methyl* (both organophosphate pesticides) in the air and on surfaces of farm worker households demonstrating the significant potential for infiltration of toxic pesticides into indoor living environments.¹¹

In many cases, the homes of workers and their families are located within or very near the fields and orchards that are being treated with chemicals known to cause serious health problems. Cultural anthropologist Seth Holmes documented the compounding issues of health impacts of pesticides with his study of conditions that impact the lives of migrant

farm workers in Skagit County, Washington. The study identified health disparities and other compounding factors that exacerbate the health impacts of pesticide exposure. His work also illustrated the multiple paths of exposure to pesticides given the reality of living in close proximity to hazardous work environments.¹²

Children are especially susceptible and encounter a higher level of toxicants than adults due to “spatial ecology” (spending time on floors, exploring the environment, breathing in dust, and ingesting a higher ratio of pesticide residues in food and water relative to their body weight).¹³ In one Washington case, the toddler of a farm worker was hospitalized after eating fruit that contained insect repellent and agricultural pesticides.¹⁴ Children of mothers who live near agricultural areas, or who are otherwise exposed to certain pesticides during gestation, may also be at increased risk for neurodevelopmental disorders.¹⁵

Drift Exposure in Washington State

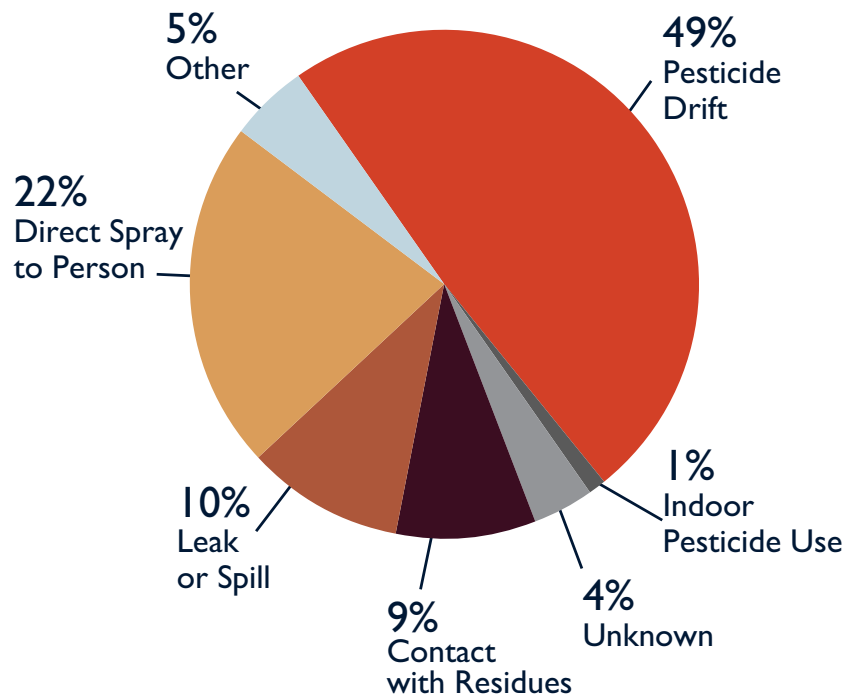
In Washington, drift is the most common source of acute illness related to agricultural pesticide use. The Environmental Protection Agency (EPA) defines pesticide spray drift as the movement of pesticide dust or droplets through the air to any site other than the area intended.¹⁶ Research conducted by the University of Washington found that pesticides do not stay where they are sprayed. The Washington Aerial Drift study found “spray drift occurring despite adherence to general precautionary pesticide application guidelines.”¹⁷

The acute illness that is publicly reported provides only a limited picture of the level of pesticide exposure in Washington. In 2001, DOH conducted six pesticide focus groups totaling 64 farm workers. More than 75% of the workers said that they, or someone close to them, had become ill due to pesticides at work. The workers’ most frequently reported symptoms were rash, dizziness, difficulty breathing, and coughing. Headache, eye and throat irritation, disorientation, and nausea were also mentioned.¹⁸ The

workers often did not seek medical care for pesticide-related illness because: (1) they could not afford to lose wages by taking time off work to seek care; (2) they feared seeking care could result in the loss of their jobs; (3) they didn’t know that worker’s compensation would pay for their medical treatment; and (4) they believed that health care providers were more sympathetic to their employers.

In Washington agriculture, the largest source of drift exposure is from air-blast sprayers. Air-blast sprayers blow pesticides up into and through the canopy of fruit trees, creating an opportunity that is ripe for drift. During 2012-2014, air-blast applications accounted

Figure 1: Source of Agricultural-Related Pesticide Illness DPP Cases, 2005–2009



Source: Washington State Department of Health, “Washington State Data on Illness Related to Agricultural Pesticide Drift,” July 2012

for 54% of drift illness cases while aerial applications comprised 31% (see Figure 4).

Reported drift illnesses in Washington agriculture increased dramatically from 43 in 2012 to 129 in 2014. During 2005-2012, farm workers suffered 66% of all illnesses from drift, and 56% of these illnesses were the result of off-target pesticide drift (see Figure 3). It is widely believed that drift incidents are significantly underreported due to worker fears concerning retaliation and intimidation.¹⁹

Figure 2: Who is Getting Sick from Pesticide Drift?

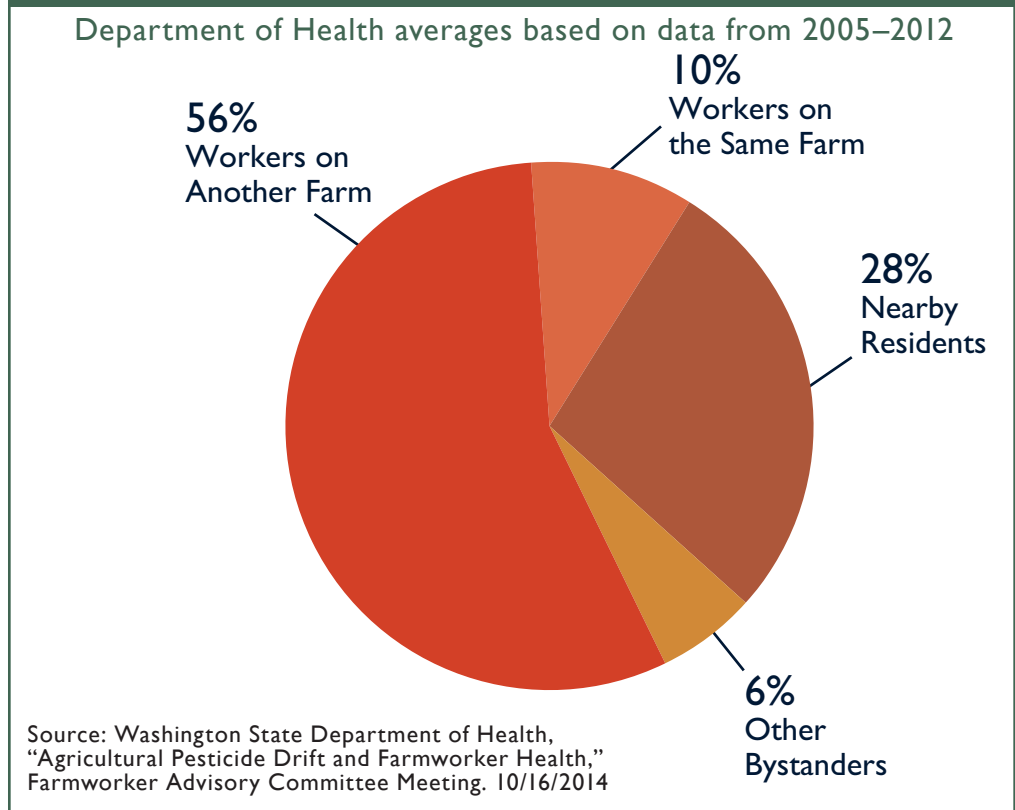
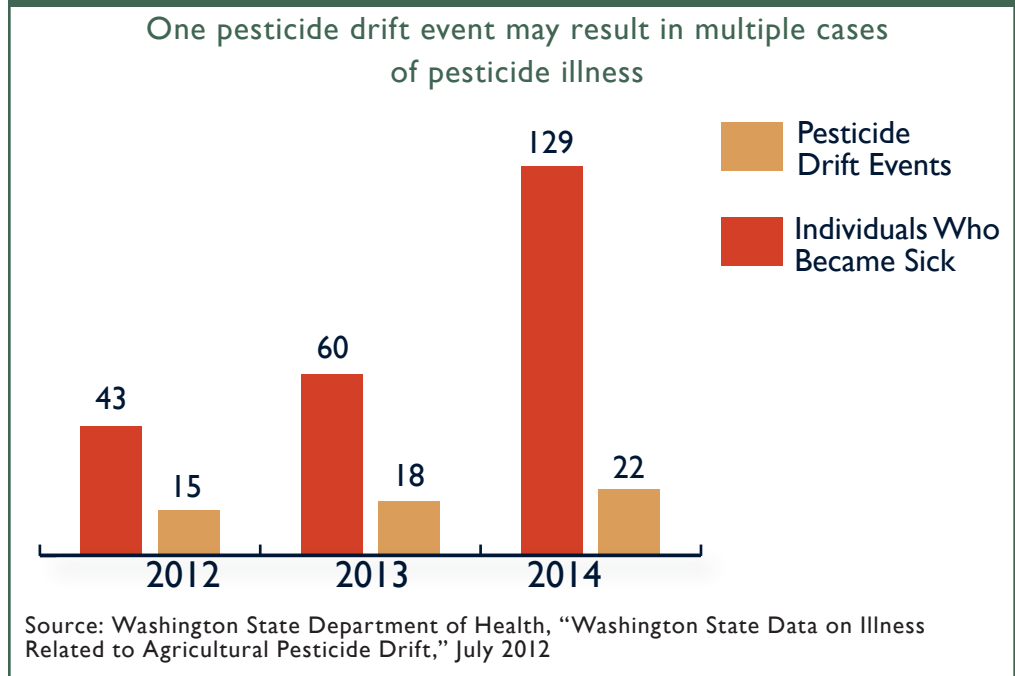


Figure 3: Agricultural Drift Cases and Events Are Increasing, 2012–2014



Angélica Blanco*

“Every time they spray, they should notify those around them that they are going to spray, so that one has a chance to prevent this kind of spray that can endanger us.”

I have lived in Mattawa, Washington for 14 years. I’ve worked in thinning, pruning and picking fruit trees.

On August 27, 2014, I was tying the branches of small apple trees to a trellis wire. We were two crews - about 65 farm workers altogether. The weather was calm. While I was working, a plane come by once, but I did not pay much attention. We learned later that he was spraying a neighboring potato field. The plane came by a second time, and a third time. When it passed by, there was a strong, bad smell that penetrated my nose. Even when we covered our faces with our handkerchiefs, I could still smell it.

A short time after that the workers began coughing and sneezing. They said they were

feeling sick. I kept sneezing and coughing, and felt my face going numb. A man came by and took us to the shop to get away from the chemical. We were there for a long time; then the manager sent us home to shower and change our clothes so the pesticide would not be on them.

I came back to the orchard around 11 am. I told the manager that I still felt bad, with a stomach ache and diarrhea. Also my face was stinging and my throat was hurting. The manager said he would take us workers to the doctor, and we went to the Mattawa clinic. I told the doctor how I felt, and the clinic gave me some medicine. I went to the doctor three more times.



*Pseudonym

Viviana Silva Exposure: Investigation Report

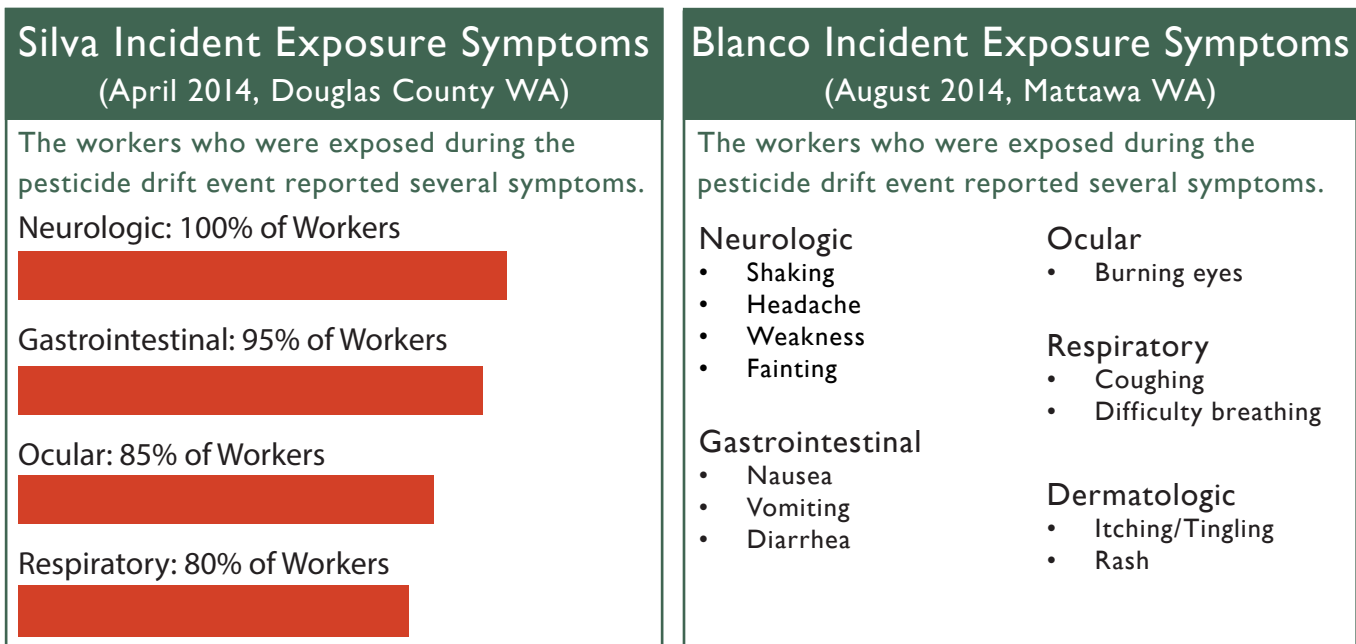
The need to protect human health from drift is well documented. There are multiple cases in Washington where drift caused acute health impacts on farm workers. In the April 2014 case involving Viviana Silva, 20 farm workers in Douglas County, Washington were exposed to drift from a neighboring farm resulting in serious health effects.

“All of the workers reported two or more symptoms consistent with those caused by the pesticides applied to the [neighboring] pear orchard.” Sixteen workers sought medical care.

Of the eight workers who were contacted again after the incident, six (75%) had symptoms that persisted for at least two weeks. The illnesses were caused by the three pesticides applied together (*pyridaben*, *novaluron*, and *triflumizole*). If the workers’ employer had been provided with prior notification of the pesticide application, the workers could have been kept out of harm’s way and illnesses would have been prevented.²⁰

Angélica Blanco Exposure: Investigation Report

On August 27, 2014, a crop duster on contract sprayed a potato field in Mattawa, Washington, with an insecticide called Silencer. Sixty-eight farm workers were tying tree limbs in a nearby apple orchard. Silencer is a restricted-use insecticide in the pyrethrum family. Pyrethrums disrupt the normal functioning of the nervous system. Silencer’s federally-mandated label states that it may not be used in a way that contacts people, either directly or through drift. The 68 orchard workers were alerted to drift from the spray application by its smell. The Washington Department of Health investigated and ultimately made a finding that virtually all of the workers in the orchard suffered a probable pesticide illness as a result of spray drift.



Though the Washington State Department of Agriculture found that the crop duster violated state laws and assessed a civil fine of \$7,500 and a 90-day license suspension, an administrative law judge reduced the penalty to only \$550 and a 9-day license suspension, believing that was the maximum amount allowed for first-time offenders based on the Department’s regulations.²¹

Other Drift Incidents

In Washington, drift has affected not only farm workers in the fields, but also adjacent landowners, residents and even schools.²²

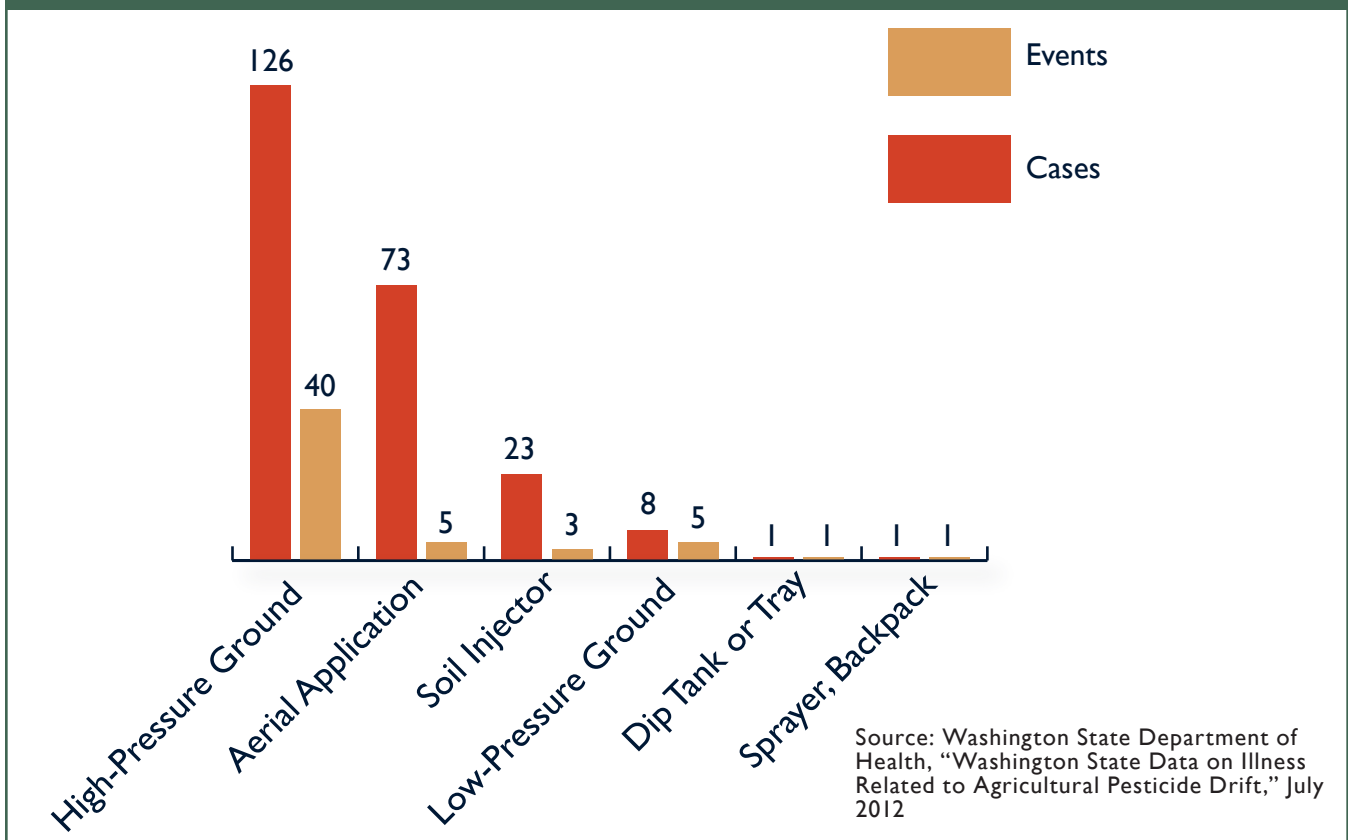
In March of 2015, a school campus in Grant County, Washington reported strong odor and drift from a neighboring field. Emergency services were called.²³ The air-blast pesticide application to an apple orchard drifted onto

four different school properties (high school, middle school and two elementary schools) including sport fields, tennis courts, and school district offices. This incident resulted in a \$7,500 fine, the maximum authorized by Washington law.²⁴

There were three reported cases of drift to non-target crops in 2014 and 2015.²⁵ Drift can adversely impact organic crops and beehives and economically impact farmers who could lose organic certification.

Direct pesticide applications and drift impact wildlife, water quality and habitat.²⁶ Highly toxic insecticides (either applied to or allowed to drift onto blooming crops or broadleaf weeds) are responsible for the majority of the bee kills reported in the state of Washington.²⁷

Figure 4: Agricultural Drift Cases and Events by Application Type 2012–2014



Socorro Díaz

“Before they sprayed me, I was fine. Afterward, I felt pressure in my head and it hurt. I didn’t have much energy to do house work or leave the house. Now, five years later, I still have bad headaches that can last for weeks. When they don’t hurt very badly, I still have a mild headache.”

I am a mother of five children, including two small girls. I live in Quincy, Washington.

In May 2011, I was working at a nursery near Quincy with nine co-workers. We were removing suckers (small shoots) from baby trees. There was a wheat field next to us.

We had our eyes on the ground, so we didn’t see how close an airplane was coming to us. Then we smelled a strong chemical odor, and we felt something falling on us like drizzle. When we looked up, we saw the plane on the edge of the wheat field, very close to the ground -- lower than a telephone line.

Right after that, I got a headache and felt like I was going to vomit. I also felt faint and

weak. My lips started to swell and then to burn and tingle. Then I started shaking like I had the chills, and I was very sleepy. People told me that my skin looked yellow. I didn’t know what the plane had sprayed on me.

They sent me to the hospital, where I had to wait a long time to be seen. The nurses said they were afraid to touch me because of the chemical that had fallen on me. They washed me with cold water outside of the hospital, and took me inside to give me some fluids in an I.V. Others who were working with me also got sick. They had problems such as nausea, headache, eye irritation, and fatigue.

I still have headaches, and periods of time when I am very tired.



Gaps in State and Federal Laws Leave Workers Vulnerable to Drift

No federal or state law requires pesticide applicators to provide general notice to neighboring farms and properties prior to commencing a spray application. Washington law requires notice be given to individuals who have self-registered as chemically-sensitive and to parents prior to application at K-12 schools, but is otherwise silent. The EPA relies on a general pesticide label direction directing applicators not to allow contact with workers or other persons and does not consider drift or inhalation exposure as a basis for other label safeguards. Under the Food Quality Protection Act, the EPA refused to consider drift exposure to children living in farm worker communities when modeling potential harm to children from pesticide exposure. The EPA's 2016 application exclusion zone requirements, not yet fully implemented, provide insufficient protection from pesticide drift to workers at neighboring farms. In this era of "constant communication" there are convenient means of supplying adequate notice to neighboring farms and properties which federal and state law should require.

Gaps in Washington State Requirements

Notification Laws Exclude Farm Workers

Washington has several regulations that require prior notice for schools and chemically-sensitive persons living in residential areas, but nothing for farm workers working on neighboring farms despite being at the highest risk for drift exposure.

In 1992, the Washington Legislature required the Washington State Department of Agriculture (WSDA) to establish a registry of pesticide-sensitive individuals.²⁸ Individuals asking to be included on the list must annually submit to the WSDA a "Pesticide Sensitive Individual Application" form. At least two hours before performing a pesticide application to a landscape or right-of-way abutting the principal place of residence of a listed individual, pesticide applicators must notify the sensitive individual in person, by mail, or by telephone, of the date and time that the application will take place. If the applicator is unable to make contact with the sensitive individual, written notice must be left at the individual's residence at the time of the application. This law does not protect farm workers since it does not apply to agricultural applications.

Washington also requires schools, upon request by parents or guardians of students, to provide written notification of its pest control methods.²⁹ The school must establish a notification system to inform parents at least 48 hours in advance of pesticide applications.

Washington law also requires landscape or right-of-way applicators when spraying with a powered apparatus to display the applicator's or her employer's name and phone number on any powered application apparatus.³⁰ The applicator must also carry a safety data information sheet (SDS) or a WSDA-approved pesticide fact sheet for each pesticide being applied, and supply the

chemical names and data sheets upon request.

Department of Agriculture's Penalty Structure is Inadequate to Deter Drift

WSDA is the lead state agency tasked with protecting the public from exposure to chemical applications and enforcing the state Pesticide Application Act.³¹ When WSDA finds pesticide misuse, it may issue civil penalties of up to \$7500 and revoke or suspend a pesticide applicator license.³² For less-serious infractions, the agency may issue a notice of correction, which is a form of technical assistance.

By far, agriculture is the largest source of WSDA investigations; approximately 50% of all investigations in fiscal year 2015.³³ In 2015, WSDA conducted 61 agricultural investigations, 47 of them involving allegations of drift. Twenty-eight of the drift investigations involved human exposure.

In Angélica's August 2014 case, where 65 people experienced health impacts from drift, the pilot was fined only \$550 (less than \$10 per person) and his license was suspended for 9 days.³⁴ The employer whose applicator drifted onto Viviana Silva and her 20 co-workers, was fined the maximum \$7,500 penalty, but the applicator's license was not suspended. Both of these cases, along with the alarming increase in documented drift exposure cases, demonstrate that the WSDA's administrative penalties do not sufficiently deter applicators from risking exposure to nearby workers. WSDA's legislative authority and internal policies do not adequately incentivize employers or provide real deterrence for violators to avoid drift onto bystanders.

EPA Does Not Consider Drift and Inhalation Exposure for Label Safeguards

Pesticide applicators must follow the directions on the EPA-approved pesticide labels. Virtually all such labels include an instruction similar to the following:

“Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.”³⁵

Labels often list additional precautions, such as directions not to spray above certain wind speeds. However, the labels do not contain affirmative directions instructing the applicator on how to avoid drift onto people.

Indeed, the EPA does not include drift and inhalation exposures in the risk assessment studies that form the basis for pesticide label safeguards, citing label prohibitions on drifting onto people.³⁶ It reasons that since drift is already prohibited, any drift incidents are an enforcement issue and do not require a risk assessment. Given that in Washington, human drift exposure is on the rise, label prohibitions are clearly inadequate to prevent drift onto humans. Farm workers therefore have been advocating for the EPA to account for drift in its risk assessments, and to require additional prescriptive measures on its labels to prevent drift onto humans.

The federal Food Quality Protection Act (FQPA) requires the EPA to bring pesticide authorizations into compliance with new standards to protect people (particularly children) from all types of exposure to pesticides. The EPA modeled potential harm

to children from exposure to pesticides in and around the home, and accordingly phased out many pesticides. However, the EPA refused to consider additional drift exposure experienced by children living in farm worker communities, reasoning that: (1) the FQPA excludes occupational exposures from consideration, (2) generalized drift in farm worker communities is a form of occupational exposure, (3) children of farm workers are extensions of their parents, and (4) children's exposure to generalized drift in a community is also an occupational exposure excluded by the FQPA.

Workers and advocates brought lawsuits and filed petitions with the EPA which eventually recognized its legal obligation to protect children and other bystanders from pesticide drift. However, rather than implementing across-the-board protections the EPA opted to review each pesticide individually in a lengthy review process. Meanwhile, children and bystanders remain at risk from pesticide drift because the EPA limits its focus to exposure from post-spray residues on treated crops, and excludes inhalation exposure from drift that occurs during the application process.³⁷

The EPA does promote some awareness of drift through its Worker Protection Standards (WPS). The WPS requires employers to offer training on hazards from drift³⁸ and to provide emergency transportation to a medical facility if a worker has been poisoned by drift.³⁹

Beginning in 2017, the EPA added a requirement for "application exclusion zones" (AEZ) to the WPS. The employer must not direct or allow anyone other than the applicator in the AEZ.⁴⁰ Currently, the AEZ is

limited to the boundaries of the farm where application is being made and does not extend to adjacent properties where drift most often occurs.⁴¹ When the application is made aerially or by air-blast sprayers, the AEZ is 100 feet from the applicator. Applications by other methods are limited to 25 feet, or there is no AEZ at all. After January 1, 2018, a pesticide applicator must immediately suspend a pesticide application if any worker or other person enters the AEZ, including areas that are outside the boundaries of the farm.⁴²

The AEZ requirement will have very limited impact because it covers such a limited area, and it does nothing to protect workers in neighboring farms until 2018. In Washington, only 10% of drift illness involves workers on the same farm. The majority of drift illnesses (56%) involve workers employed at neighboring farms. Given that the goal implementing an AEZ is the protection of human health, the AEZ requirement is very limited. In contrast, Washington laws protecting specialty crops, water and wildlife forbid aerial use of restricted herbicides within between a half-mile or a mile of commercial vineyards.⁴³ Even the EPA (per a court order) requires buffer zones of 100 yards of salmon-supporting waters for aerial applications, and 20 yards of salmon-supporting waters for broadcast spraying.⁴⁴

Available Solutions to Reduce Pesticide Drift Exposure in Washington

Department of Health Recommends Additional Notification

The Washington Department of Health (DOH) investigates all suspected human cases of pesticide poisoning.⁴⁵ From the investigations, DOH identifies public health problems and develops strategies to prevent exposure to pesticides.

DOH co-authored a scholarly article with the Centers for Disease Prevention and Control about the pesticide drift exposure incident involving Viviana Silva.⁴⁶ The article (summarized below) found that lack of a notification of pesticide applications to a neighboring farm is frequently a contributing factor to acute pesticide-related illness.

After numerous drift illnesses in 2014, DOH issued a warning to the agriculture industry concerning the drift hazards. The agency recommended that farm owners and operators notify nearby neighbors about upcoming pesticide applications and stop application if they see people near the treatment area.⁴⁷

In the 2009 Pesticide Incident and Tracking Report, DOH noted key causes of drift-related illness:

- The acute toxicity of the pesticides applied
- The high-pressure fan-shaped spray produced by typical orchard “air-blast” sprayers
- Proximity of workers to spray equipment
- Windy conditions
- **Inadequate communication; workers were not notified about the sprayer and were not sure they were permitted to leave their work when the drift reached them.**⁴⁸

DOH concluded that nearby farms should notify each other when treating their perimeter fields in order to keep workers at a safe distance. However, this is purely a recommendation and does not have the effect of law.

Washington State Department of Health Findings

Factors that Increase the Risk of Pesticide Drift and Illness

Poor communication

Worker proximity to spray equipment

Weather conditions

- Windy
- Air inversions

Application Method

- Air blast sprayer
- Aerial application
- Fumigator

Notification System Models

In 2014, researchers at the University of Washington (UW) undertook a survey of pesticide spray notification systems around the world. Given that DOH identified neighbor notification as a key measure to prevent drift-related illness, systems or technology to facilitate notification is a high priority for illness prevention. UW researchers found that notification systems have been used in New Zealand, the United Kingdom, China, Canada, and the United States. They also found that direct notification methods such as sign posting, phone calls, and personal visits have long been used in agriculture.⁴⁹

The UW review identified a New Zealand notification system called SprayWatch, which is used to meet legal notification requirements.⁵⁰ After agricultural land and neighbor contacts are entered into the system, SprayWatch automatically sends a message to each contact number at a time and in a format – voicemail, text, or email – that has been specified by the neighbor of the pesticide user. The cost for the system is a \$6.00 one-time fee per new farm and \$32 per farm for 7-8 notifications each year.

A chart comparing six notification systems is attached as Appendix A. With advances in computer and mobile technology, remote notification is becoming more user-friendly.

Washington Legislation

The first legislation specifically addressing drift hazards for Washington farm workers was introduced in 2012.⁵¹ That bill sought to require one-half mile buffer zones between applications and workers, as well as neighbor notification. Advocates for the bill pointed

out that state law protects grapes in wine country by banning aerial application of herbicides with a one-mile buffer zone.⁵²

State law provides a one-half mile buffer for aerial application near commercial greenhouses, unless prior notice is given.⁵³ Nevertheless, the bill did not pass out of the Washington House of Representatives.

In 2015, farm worker advocates proposed a budget proviso to develop pilot systems to: (1) notify neighbors of pesticide applications; and (2) collect and make available pesticide application data that is already maintained by applicators pursuant to Washington law (pesticide-use reporting). The collection and distribution of pesticide-use data would facilitate understanding of pesticide use and related health effects. The budget proviso was adopted by the House of Representatives, but did not pass the Senate.

In 2016, advocates again supported pesticide drift notification legislation, along with provisions to require pesticide-use reporting. That bill did not pass out of the House committee to which it was assigned. The House subsequently adopted a budget proviso to pilot neighbor-notification and pesticide-use reporting, but the Senate did not accept the proviso.

Recommendations to Protect Human Health from Drift

Pesticide drift is the greatest source of reported illness cases in agriculture; and farm workers suffer most (66%) of the drift-related illness.

Acute poisoning symptoms observed and reported by workers do not show the full extent of harm from pesticide exposure. As discussed previously, pesticide exposure also can have neurological, psychiatric, developmental, reproductive, and carcinogenic effects. Common-sense prevention measures can largely mitigate exposure and harm. We make the following recommendations to state and federal governments to protect workers from drift.

I. Washington State should create and require systems for neighbor notification of pesticide applications.

The UW survey of notification systems shows that this measure is feasible and is in practice in other places. Advances in computer and mobile technology make remote notification user-friendly and effective. Washington law already requires notification for pesticide-sensitive individuals, landscape and right of way applications, and pesticide use in the schools.

Neighbor notification addresses two primary causes of drift illness identified by DOH: (1) poor communication and awareness and (2) proximity of workers to spray equipment. House Bill 2392 (2016 session) addressed applications using drift-prone methods –air-

blast, aerial, and fumigant applications. The proposed bill required notice of application to adjacent neighbors between 2 and 48 hours prior to spraying, either in person, by mail, by text message, or by other means approved by DOH. Notice would include: (1) the time, date, and location of the application; (2) name, address, and phone of the applicator; (3) a list of the pesticides to be applied; (4) the phone numbers of the DOH pesticide program and the Poison Control Center; (5) a list of precautions related to drift that appear on the pesticide label; and (6) a statement in English and Spanish that the applicator can be reached for further information.

2. Washington State should establish buffer zones around pesticide spraying

Washington law recognizes buffer zones as an effective means for preventing unwanted exposure to crops, establishing buffer zones for greenhouses and wine grapes. A federal court has required buffers for salmon bearing streams for some pesticides.⁵⁴ Farm workers deserve equal protection. Establishing buffers addresses a major factor that DOH identified in drift poisoning incidents – worker proximity to the pesticide application area. Based on the buffers provided for Washington crops, the buffer around the area to which pesticides are applied should be no less than one-half mile from the application.

3. Washington State should increase penalties and remedies

The current penalty structure enforced by WSDA is grossly inadequate. The maximum penalty, no matter how many workers are poisoned and no matter how severely, is \$7,500. In Viviana Silva's case, 20 workers were poisoned, with some requiring transport to the hospital. The maximum fine imposed amounted to \$375 per worker. Only \$550 – less than \$9 per worker – was levied in Angélica's case despite the fact that 65 workers were poisoned.

The legislature and WSDA should adopt a revised penalty structure that provides genuine deterrence for negligent or reckless behavior resulting in serious and/or widespread drift exposure. For example, Department of Labor and Industries occupational safety and health rules authorize penalties up to \$70,000 for violations of occupational safety and health rules.⁵⁵

The law should also provide for a private right to sue with minimum statutory damages of \$5,000 for each worker and the option to pursue actual damages if a worker chooses to do so. The right to sue should include a prevailing plaintiff's right to collect attorney fees to create an incentive for private enforcement action through the civil courts. This enhanced penalty structure and a private remedy for statutory damages would deter applications within the buffer zone and encourage participation in notification system.

4. Washington State should expand education

DOH should expand its efforts to educate pesticide users about the effects of drift, its causes, and ways to prevent it. That information should be included in the WSDA applicator training. Ways to prevent drift exposure include better communication with neighbors and workers; ensuring that workers are a safe distance away from pesticide applications; refraining from applications in windy conditions, inversions and other adverse weather conditions; awareness of new technology, to replace or reduce the use of air-blast sprayers and aerial applications that are prone to produce drift; and implementing safer pest management methods that include cultural, mechanical and biological methods in place of harmful synthetic pesticides.

5. The EPA should include direct drift and inhalation exposures in its risk assessments for pesticide label requirements.

The EPA should look at all types of pesticide exposure when establishing safeguards protecting human health. Currently, the EPA ignores exposure occurring from drift falling directly onto people, as well as inhalation exposure, when it develops the risk assessments underlying pesticide label safeguards. Because the EPA-required label is the law, adequate labeling is critical to preventing dangerous exposures.

6. The EPA should address drift exposure under the standards required by Congress in the Food Quality Protection Act (FQPA).

The EPA should adopt a process to comprehensively protect farm worker children across the board. The FQPA required the EPA to increase protection for children exposed to pesticides in 2006. The agency

still has not met this obligation. It protected most children from some kinds of exposure in and around the home, but did not take into account additional exposure from drift affecting children in farm worker communities. The EPA changed its policy and improved the standard for protection after legal action on behalf of farm worker children; but it is using an unnecessarily lengthy process under which it reviews each pesticide one-by-one.

Conclusion

Farm workers and others are exposed to immediate harm and serious long-term health effects from pesticides. Agency data show that drift exposure is continuing and even growing. The identification of the problem and development of common-sense steps for prevention have not been met with action needed to prevent the unacceptable poisoning

of those who live and work near agricultural operations. Lawmakers, agencies, the scientific community, and the public need to respond to widespread poisoning of workers by developing and adopting neighbor notification for pesticide applications and other measures necessary to protect human health.

¹ Reporting on pesticide expenditures is not released and summarized until several years after. This data is from 2006 from a summary published in 2011. Updated information was not available for this report.

² Grube, A., Donaldson, D., Kiely, T., & Wu, L. (2011). Pesticide Industry Sales and Usage: 2006 and 2007 Market Estimates. U.S. Environmental Protection Agency, Office of Chemical Safety and Pollution Prevention. Washington, DC: Office of Pesticide Programs.

³ Arcury, T., & Quandt, S. (2009). Chapter 5-Pesticide Exposure among Farm Workers and their Families in the Eastern United States: Matters of Social and Environmental Justice. In T. Arcury, & S. Quandt, Latino Farmworkers in Eastern United States (pp. 103-129). New York: Springer and Science + Business Media.

⁴ Kroger, S., Schettler, T., & Weiss, B. (2005, April). Environmental Toxicants and Developmental Disabilities: A Challenge for Psychologists. *American Psychologist*, 243-255.

⁵ Kerry, L., & Kroger, S. (2012). Toxicants and Environmental Health: A Psychological Issue. *Journal of Student Research*, 2, 19-30.

⁶ Grandjean, P., & Landrigan, P. J. (2014). Neurobehavioural Effects of Developmental Toxicity. *The Lancet Neurology*, 13, 330-338.

⁷ Reuben, S. (2008-2009). Reducing Environmental Cancer Risk. US Department of Health and Human Services, President's Cancer Panel. Washington, DC.: President's Cancer Panel.

⁸ The Cancer Panel found, "Weak laws and regulations, inefficient enforcement, regulatory complexity, and fragmented authority allow avoidable exposures to known or suspected cancer-causing and cancer-promoting agents to continue and proliferate in the workplace and the community. (page 99)"

⁹ Montgomery, M., Kamel, S., & Sandler, A. (2008). Incident Diabetes and Pesticide Exposure among Licensed Pesticide Applicators: Agricultural Health Study, 1993-2003. *American Journal of Epidemiology*, 167 (10), 1235-1246.

¹⁰ Arcury, T., & Quandt, S. (2009). Chapter 5-Pesticide Exposure among Farm Workers and their Families in the Eastern United States: Matters of Social and Environmental Justice. In T. Arcury, & S. Quandt, Latino Farmworkers in Eastern United States (pp. 103-129). New York: Springer and Science + Business Media.

¹¹ Gibbs JL, Yost MG, Negrete M, Fenske RA. Passive Sampling for Indoor and Outdoor Exposures to Chlorpyrifos, Azinphos-Methyl, and Oxygen Analogs in a Rural Agricultural Community. *Environ Health Perspect*;

- ¹² Holmes, S. (2013). *Fresh Fruit, Broken Bodies: Migrant Farmworkers in the United States*. Berkeley: University of California Press.
- ¹³ Kroger, S., Schettler, T., & Weiss, B. (2005, April). Environmental Toxicants and Developmental Disabilities: A Challenge for Psychologists. *American Psychologist*, 243-255.
- ¹⁴ Sievert, J., Morrissey, B., & Calvert, G. (2013). Severe Acute Illness in a Toddler Exposed to Multiple Agricultural Pesticides and Insect Repellent. *Journal of Agromedicine*, 18 (4), 285-292.
- ¹⁵ Shelton JF, et al. (2016) Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: the CHARGE Study. *Environ Health Perspect* 122(10):1103–1109 (2014); doi: 10.1289/ehp.1307044.
- ¹⁶ 40 C.F.R. § 156.206.
- ¹⁷ Tsai, M.-Y., Elgethun, K., Ramaprasad, J., Yost, M. G., Felsot, A. S., Hebert, V. R., et al. (2005). The Washington Aerial Spray Drift Study: Modeling pesticide spray drift deposition from an aerial application. *Atmospheric Environment*, 39 (33), 6194-6203.
- ¹⁸ Washington State Department of Health, *Learning from Listening: Results of Yakima Farmworker Focus Groups about Pesticides and Health Care* (2004).
- ¹⁹ Holmes, S. (2013). *Fresh Fruit, Broken Bodies*.
- ²⁰ Calvert, G. M., Rodriguez, L., & Prado, J. B. (2015, January 23). Worker Illness Related to Newly Marketed Pesticides — Douglas County, Washington, 2014. *Morbidity and Mortality Weekly Report (MMWR)*.
- ²¹ In re: Lenard Beierle/ Ag Air Flying Services, Docket No. 07-2015-AGR-0004, Initial Order (2016). (“The maximum penalty for a first time violation where probable adverse effects are present with one or more aggravating factors is a \$550.00 civil penalty and a nine (9) day license suspension per violation.” WAC 16-228-1130)
- ²² Washington State Department of Agriculture. (2015, August 26). Pesticide Enforcement Actions. Retrieved December 21, 2015, from Washington State Department of Agriculture: <http://agr.wa.gov/pestfert/enforcementactions.aspx>
- ²³ Jenkins, D. (2015, July 23). WSDA Levies Maximum Fine for Pesticides Drifting over School. Capital Press.
- ²⁴ (Washington State Department of Agriculture, 2015)
- ²⁵ (Washington State Department of Agriculture, 2015)
- ²⁶ Department of Ecology State of Washington. *Control of Toxic Chemicals in Puget Sound: Assessment of Selected Toxic Chemicals in the Puget Sound Basin, 2007-2011*. Seattle: Department of Ecology.
- ²⁷ <http://agr.wa.gov/PestFert/Pesticides/docs/PollinatorSLNSect18.pdf>
- ²⁸ RCW 17.21.420 -430.
- ²⁹ RCW 17.21.415.
- ³⁰ RCW 17.21.400.
- ³¹ Chapter 17.21 RCW.
- ³² RCW 17.21.350.
- ³³ Washington State Department of Agriculture, 2015 Annual Report to the Legislature (2016).
- ³⁴ The workers are appealing this decision to the Superior Court.
- ³⁵ 40 CFR § 156.26.
- ³⁶ United States Environmental Protection Agency. (2016, August 5). Technical Overview of Ecological Risk Assessment - Analysis Phase: Exposure Characterization. Retrieved September 20, 2016, from EPA: <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-1>
- ³⁷ (United States Environmental Protection Agency, 2016)
- ³⁸ 40 CFR § 170.130.
- ³⁹ 40 CFR § 170.160.
- ⁴⁰ 40 CFR § 170.405.
- ⁴¹ 40 CFR § 170.405
- ⁴² 40 CFR § 170.505(b). See also EPA’s WPS FAQs, pg 20
- ⁴³ Chapter 16-230 to 232 WAC.
- ⁴⁴ Washington Toxics Coalition v. EPA, No COI-0132C (January 22, 2004).

⁴⁵ RCW 70.104.030.

⁴⁶ Calvert, G et. al., “Worker Illness Related to Newly Marketed Pesticides – Douglas County Washington, 2014, Morbidity and Mortality Weekly Report, Centers for Disease Control and Prevention 2014).

⁴⁷ Washington Department of Health, Advisory to Farm Owners and Operators re: Take Precautions to Avoid Pesticide Drift (March 16, 2015).

⁴⁸ Washington State Department of Health, 2009 Annual Report, Pesticide Incident Reporting and Tracking Review Panel (2010) at 67.

⁴⁹ Kasner, E. J., Fenske, R.A., Galvin, K., Yost, M. G., & Palmandez, P. (2016). Review of Agricultural Spray Notification Systems. University of Washington School of Public Health, Department of Environmental and Occupational Health Sciences. Seattle: Pacific Northwest Agricultural Safety and Health Center.

⁵⁰ Rule 13 in New Zealand’s Bay of Plenty Regional Air Plan requires that “the owner/occupier or agent must notify the occupier of any adjoining properties with 50 [meters] of that agrichemical use.” (Environment Bay of Plenty 2003)

⁵¹ House Bill 2413 (2012).

⁵² WAC 16-230-665(1)

⁵³ WAC 16-230-460

⁵⁴ The court ruled that these buffers are required as interim protections while the EPA is bringing its pesticide authorizations into compliance with the Endangered Species Act. The buffers are 60 feet for ground spraying and 300 feet for aerial spraying. Biological opinions have found that larger buffers are required for some pesticides, but those buffers have not been imposed. Citation: National Research Council. Assessing Risks to Endangered and Threatened Species from Pesticides. Washington, DC: The National Academies Press, 2013. doi:10.17226/18344.

⁵⁵ WAC 296-900-14020.

Appendix A: Table from Review of Agricultural Spray Notification Systems

Table 1. Review of existing pesticide spray notification systems

System	Basic information				Worker Notification Categories					
	Year of origin	Currently in use	Location	Model type ¹	Flexibility of method	Minimum lead time	Between-party range	Message content about pesticides	Mobile friendliness ²	Estimated cost per year
WA Sensitive Persons	1994	Yes	Washington, United States	Applicator-to-resident	Phone call In person In writing	2 hours	Within 0.5 miles; Shared border	Undefined	Possible	Undefined
SprayWatch	2002	Yes	New Zealand	Applicator-to-resident	Phone call SMS/text Email	12 hours	Within 50 meters	Pesticide name	Yes	One-time NZ\$ 8.00 (US\$ 6) fee per new farm plus NZ\$ 47.00 (US\$ 32) per farm for 7-8 notifications each year
Spraydays	2005	No	United Kingdom	Applicator-to-resident	Phone call SMS/text Email Posting Flagging In writing	Varies	Within 25 meters	Pesticide name Target pest Mixing tank contents	Yes	£ 1.07 (US\$ 143) per farm for SMS/text or email
DriftWatch	2008	Yes	United States and Canada	Registry	Email Posting	Undefined	Custom area	Undefined	Yes	Varies by membership level: Individual: US\$ 0 - 500 Group: US\$ 6,500 - 50,000
PEAC	2009	Yes	China	Registry	SMS/text	Undefined	Undefined	Undefined	Yes	Annual fee charged based on number of successfully transmitted messages
WA Schools	2009	Yes	Washington, United States	Applicator-to-resident	Posting In writing	48 hours	On-site only	Pesticide name Target pest	Possible	Undefined

1. **Applicator-to-farmer:** notification between neighboring farms (e.g. orchard-to-orchard: from an orchard applicator to the manager of a neighboring orchard's work crew); **Applicator-to-resident:** residential bystander receives notification from an applicator (e.g. from an applicator to a residential bystander); **Registry:** applicator receives notification based on a list of sensitive individuals or crops nearby

2. For **mobile friendliness**, "Yes" means that the system is currently usable via SMS/text or email on a mobile device and "possible" means that the system uses only calls or other non-mobile forms of communication.

Source: Kasner, E. J., Fenske, R. A., Galvin, K., Yost, M. G., & Palmandez, P. (2016). Review of Agricultural Spray Notification Systems. University of Washington School of Public Health, Department of Environmental and Occupational Health Sciences. Seattle: Pacific Northwest Agricultural Safety and Health Center.