# Pesticide Data Report Washington State

## *2010 – 2011 Agency Data*

*A report to the governor, agency directors, the legislature, and the public as required by Chapter 380, Laws of 1989, and RCW 70.104*

*June, 2013*

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For more information contact the Washington State Department of Health at www.doh.wa.gov/pesticidecontact.

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# Contents

# List of Tables

# List of Figures

# Introduction

*The Washington State Department of Health compiled this report on behalf of the Washington State Departments of Agriculture, Ecology, Health, and Labor and Industries. The content of this 2012 report differs slightly from previous reports and includes agency pesticide data for both 2010 and 2011 and contributions from Washington State University and the University of Washington.*

# Highlights and Trends

## Agriculture

The Washington State Department of Agriculture (Agriculture) investigated a total of 300 complaints, 162 in 2010 and 138 in 2011, which resulted in 184 violations. This continues a trend in the last few years of Agriculture receiving fewer pesticide-related complaints.

Complaints about pesticide applications in 2010 and 2011 continue to show a greater variety of pesticides than in previous reports.

Pesticide drift, misuse, and use of pesticides by neighbors remain the most common complaints involving pesticide applications. Pesticide misuse includes applying the wrong product to control pests.

The greatest number of application complaints was due to herbicide drift. Ingredients in two herbicides – 2,4-D and glyphosate – were again the most frequent in reported complaints. This is consistent with previous years, and probably reflects use by unlicensed and untrained applicators. It's also easy to visually notice the results of misusing these products.

## Ecology

The Washington State Department of Ecology (Ecology), with Agriculture, began studies in 2003 to identify the amount of pesticides found in salmon-bearing streams during certain pesticide application periods. Monitoring was performed in two urban basins and four agricultural basins.

During the 2009-2011 monitoring period, surface water samples were analyzed for more than 170 pesticides and pesticide break down products. Over the three years, 74 pesticides and pesticide degredates were detected. Of these detections, the pesticides that did not meet water quality standards or assessment criterion included the insecticides bifenthrin, chlorpyrifos, DDVP, diazinon, endosulfan, ethoprop, malathion, methiocarb, and methomyl; the herbicide metolachlor; the insecticide degradate endosulfan sulfate, and the legacy pesticide DDT.

Trend analysis of previous year's data was conducted at sites that met trend analysis model requirements. Decreasing trends in pesticide concentrations were seen for 16

select pesticides, and increasing trends in concentrations were seen for 10 pesticides. Decreasing trends in insecticide concentrations were seen for the insecticide azinphos-methyl in the lower Yakima basin, chlorpyrifos in Marion Drain, diazinon in Thornton Creek, and endosulfan in Brender Creek. In Marion Drain there were increasing trends in concentrations for the insecticide ethoprop.

## Health

The Washington State Department of Health (Health) converted to a new data system in 2010. The agency now uses the National Institute for Occupational Safety and Health (NIOSH) SENSOR Pesticide Incident Data & Reporting (SPIDER) system. As a result, some data sets of this report are for only 2010 and 2011.

For 2010-2011, the Department of Health investigated 161 non-agricultural cases and 131 agricultural cases. Drift was implicated in 67 of the 131 cases of illnesses from agricultural applications.

The drift exposures occurred when pesticides were applied to agricultural commodities like fruit and field crops, nursery, livestock, and forest operations. In these incidents, the pesticides moved from the intended target to other locations where people were present. Drift events continue to be a troublesome source of pesticide exposure for farmworkers and bystanders.

Because drift events often affect a large number of people, small reductions in the number of drift events can result in larger reductions in illnesses caused by pesticides in Washington.

## Labor and Industries

The Washington State Department of Labor and Industries (Labor and Industries) reported that 315 agricultural operations participated in cholinesterase testing in 2010, and 1,989 pesticide handlers submitted baseline testing results for cholinesterase. In 2011, 318 agricultural operations participated in testing and 2,017 handlers submitted cholinesterase baseline tests.

Cholinesterase is an enzyme that is essential to the normal function of the nervous system. Exposure to organophosphate or N-methyl-carbamate pesticides may lower the level of available cholinesterase. Monitoring cholinesterase levels in the blood through simple laboratory tests can detect cholinesterase depression prior to the onset of illness.

Among 1,989 pesticide handlers tested in 2010, eight had depressed cholinesterase levels. In 2011, six of 2,017 pesticide handlers tested had depressed levels of cholinesterase. Since monitoring began in 2004, these numbers reflect a steady decline in the number of pesticide handlers tested that have decreased levels of cholinesterase.

Labor and Industries carried out 49 workplace safety and health inspections in 2010 and 2011.

Labor and Industries received 82 workers claims initially related to pesticides in 2010. This was about a 6 percent increase from 2009. In 2011, 38 workers claims were received. This was about a 54 percent decrease from 2010.

# Agency Roles

*In February of 2010, the Washington State Departments of Agriculture, Labor and Industries, and Health updated an existing Memorandum of Understanding that describes the cooperative efforts of the three parties relative to Agricultural Pesticide Worker Protection Standards and their respective roles and responsibilities. These efforts include notification of worker complaints and collaboration during investigations and compliance actions, and sharing of findings. Additional agency activities are described below.*

## Agriculture

Agriculture's Pesticide Management Division protects human health and the environment by ensuring the safe and legal distribution, use, and disposal of pesticides in Washington.

The division investigates complaints concerning possible pesticide misuse, storage, sales, distribution, applicator licensing, and building structure inspections for wood-destroying organisms. The division also inspects marketplaces, importers, manufacturers, and pesticide application sites for compliance with state and federal laws and regulations on a non-complaint basis, and provides training and education through their Farmworker Education Program.

## Ecology

Ecology has several programs involved in pesticide permitting, monitoring, and cleanup of contaminated sites including Spills Prevention, Preparedness and Response, Toxics Cleanup, Water Quality, and Environmental Assessment. Each program has a separate area of responsibility and each track data related to the area of pesticide use they oversee.

## Health

Health's Pesticide Illness Monitoring and Prevention Program investigates both worker and non-worker pesticide related illnesses. Data from these investigations is used to identify public health problems and develop strategies to prevent human exposure and illnesses related to pesticides. Federal, state, and local governments, advocacy groups, and legislators use the data for similar purposes.

## Labor and Industries

Labor and Industries' Division of Occupational Safety and Health administers the Washington Industrial Safety and Health Act of 1973, Chapter 49.17 RCW by developing and enforcing rules that protect workers from hazardous job conditions. Labor and Industries also conducts research into workplace health and safety, which focuses on promoting healthy work environments and preventing workplace injuries and illnesses.

# Pesticide Complaints, Events, and Illness

## Agriculture

Agriculture investigated 162 complaints in 2010 and 138 complaints in 2011 involving the following program areas: pesticide use, sales, and distribution, pesticide licensing, and building inspections for wood-destroying organisms.

Agriculture is required to respond to cases of human exposure within one working day of receiving the case. In 2010, 26 of the 162 complaints investigated involved human exposure and in 2011, 32 of the 138 complaints investigated involved human exposure. It is important to note that not all human exposure complaints result in sufficient evidence to prove a violation occurred.

### Drift and Human Exposure

In 2010, Agriculture received 69 general complaints about drift with 23 of those involving possible human exposure. Of the 23 drift complaints with possible human exposure, there was some evidence of exposure in 11 cases that resulted in an action. Of the 23 human exposures, 15 were from a ground apparatus, four were from entering a treated field prior to the expiration of reentry times, and four were from an aerial apparatus.

In 2011, Agriculture received 48 general complaints about pesticide drift with 26 of those involving possible human exposure. Of the 26 drift complaints with possible human exposure, there was some evidence of exposure in three cases that resulted in an action. Of the 26 human exposures, 18 were from a ground apparatus, three were from entering a treated field prior to the expiration of reentry times, and five were from an aerial apparatus.

Table 1 provides drift event and enforcement information from 2007-2011.

**Table 1. Drift Events, 2007-2011**

| Year | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **Total Complaints** | 177 | 172 | 148 | 162 | 138 |
| **Total Drift Complaints** | 62 | 79 | 56 | 69 | 48 |
| **Total Drift Complaints Involving Human Health** | 24 | 27 | 25 | 23 | 26 |
| **Aerial Drift (Human Health)** | 7 | 4 | 3 | 4 | 5 |
| **Ground Drift (Human Health)** | 17 | 23 | 22 | 19 | 21 |
| **Aerial, All** | 18 | 22 | 11 | 16 | 13 |
| **Ground, All** | 44 | 57 | 45 | 53 | 29 |

# Ecology

The Spills Prevention, Preparedness, and Response Program responds to pesticide-related complaints and makes sure that the damage from a spill is contained and cleaned up as quickly as possible. Ecology uses the data from these spills and complaints to provide additional information on ways to reduce the impact of pesticides on people and the environment.

Ecology may follow-up by phone, request a voluntary cleanup, require a cleanup, or refer the case to another agency. Cases that require field work, research, input from other agencies, or technical assistance are investigated.

After Ecology staff respond, they determine if there are any long-term impacts. The case is closed if there are no long-term impacts. If there are long-term impacts, the case is referred to another program within the agency, and if necessary to other local and state agencies.

In 2010 and 2011 there were 58 pesticide-related complaints involving threats to air, water, or soil. All 58 complaints received a response within 24 hours.

Of the 58 complaints received:

- Four occurred in the agricultural environment.
- 10 involved commercial or industrial activities.
- 48 were reported by private residents.

Table 2 lists the types of pesticide-related complaints received from 2007 through 2011.

**Table 2. Ecology Pesticide-Related Complaints, 2007- 2011**

| Type of Complaint* | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Pesticides threatening ground or surface water | 8 | 1 | 3 | 14 | 12 |
| Pesticide disposal or waste concern | 6 | 4 | 4 | 0 | 0 |
| Spills and fires | 9 | 3 | 4 | 0 | 0 |
| Unsafe pesticide storage or handling | 3 | 3 | 8 | 1 | 1 |

* Complaints may involve more than one category

# Health

## Sources of Case Reports

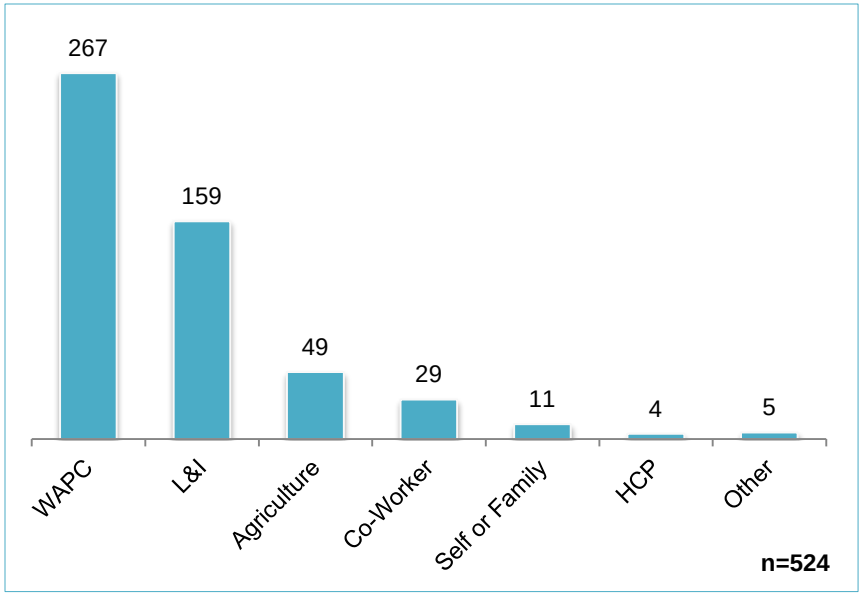
Pesticide-related illnesses are a notifiable condition in Washington under Chapter 246-101-101 of the Washington Administrative Code (WAC). Under this rule, health care providers are required to report cases of pesticide-related illness to the state Department of Health immediately in the case of hospitalization, fatality, or cluster; and within three business days for all other cases. Health receives reports of suspected pesticide illness events from multiple sources including the Washington Poison Center (WPC), Department of Labor and Industries, Department of

Agriculture, health care providers, and others. More than one agency may report the same illness event. The source is recorded as the report of the first entity to provide the information to Health.

A pesticide event may expose multiple people. Each individual exposure is an individual case and is treated as such when investigated. In 2010 and 2011, there were 524 cases — 230 in 2010 and 294 in 2011.

Figure 4 shows the number of investigated cases, and the source of the first report received on each case.

**Figure 1. Source of Case Reports, 2010- 2011**




Electronic reporting from the Washington Poison Center provided 51 percent of the total reports, more than any other source. Washington Poison Center reports are the primary way that Health learns of health care provider cases. The second highest report source is Labor and Industries, reporting 30 percent of the cases. Most of the work-related (occupational) cases come electronically through Labor and Industries claims data. Nine percent of 2010 and 2011 case reports were made by Agriculture.

Other report sources during this two-year period included the Whatcom County Health Department, Oregon Health Authority, and an article that appeared in the *Spokesman-Review* newspaper and reported to the Washington State Department of Health through the SENSOR[1] Listserv.

[1] SENSOR is a CDC sponsored program and stands for Sentinel Event Notification System for Occupational Risk. More information can be found online at http://www.cdc.gov/niosh/topics/pesticides/overview.html.

## Case Investigation Criteria

Any single event may involve more than one person who experiences pesticide illness. Health reviews all referred reports and investigates those that meet the following criteria:

- A pesticide exposure is reported.
- Symptoms are reported.
- At least one person involved saw a health care provider.
- The pesticide exposure occurred during the last three months.
- The pesticide exposure occurred in Washington.
- The pesticide exposure was neither a suicide nor homicide attempt.

Health occasionally investigates cases of special circumstance even if all criteria are not met. Examples include unusual exposures to children, incidents involving multiple ill people, moderate to severe illness or injuries for which the individual did not seek health care, and cases referred by another state agency for co-investigation.

In 2010 and 2011, Health adjusted the criteria for ascertaining reports of illness for investigation, and began to exclude non-occupational reports that: were of mild illness severity; involved adults only; and represented familiar products and well-known exposure scenarios. This screening enabled staff to focus on the highest priority cases.

Although disinfectants are classified as pesticides, Health does not typically investigate disinfectant-related illnesses. The number of cases associated with disinfectant exposure would overwhelm our current surveillance system. Health will begin to include higher-risk disinfectant reports for investigation in 2013.

## Classification of Investigated Cases

Health's investigators interview people who may have been exposed to pesticides, obtain and review pesticide application and medical records, and conduct field visits as needed. Investigators use these data to determine how likely it is that the symptoms reported are related to a pesticide exposure. Plausible pesticide-related illness cases are those that have sufficient evidence to support a causal relationship between pesticide exposure and health effects. Health uses the National Institute for Occupational Safety and Health (NIOSH) Case Classification System to categorize illness cases. Plausible illness cases must have symptoms that match known toxicological effects and time between exposure and symptom onset. All plausible illness cases are distinguished based on the level of evidence and identified as Definite, Probable, or Possible (DPP) cases (Table 3).

**Table 3. Classification Criteria of Plausible Illness Cases**

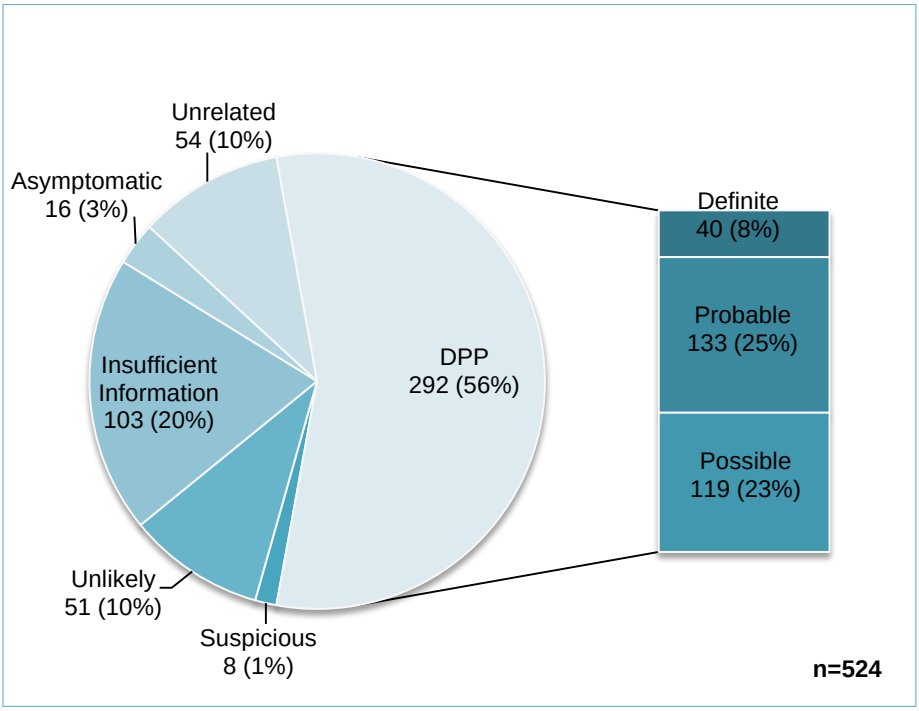
| | Plausible Evidence of Exposure | Plausible Evidence of Health Effects |
|---|---|---|
| **Definite** | Laboratory, clinical, or environmental evidence corroborates exposure. | Two or more post-exposure health effects (one a sign*) or lab findings are reported by a licensed health care provider. |
| **Probable** | Laboratory, clinical, or environmental evidence corroborates exposure. | Two or more post-exposure symptoms** are reported by the individual or a health care provider. |
| **Possible** | Evidence of exposure is based on report from case, witness, application, observation of residue, or contamination. | Two or more post-exposure health effects (one a sign*) or lab findings are reported by a licensed health care provider.<br>Two or more post-exposure symptoms** are reported by the individual or a health care provider. |

*Signs are considered objective evidence of illness and are observable on examination by a health care provider (for example, low heart rate, cough, rash, or depressed cholinesterase activity).

**Symptoms are considered subjective evidence of illness and may not be observable on examination by a health care provider (for example, headache, nausea, or dizziness).

Fifty-six percent of the 524 investigations completed during the two-year period were determined to be plausible illness cases, with 124 (54 percent) documented illnesses in 2010 and 168 (57 percent) in 2011. Figure 2 shows the classification of cases for 2010 and 2011 combined.

**Figure 2. Classification of Investigated Cases by Number and Percentage, 2010-2011**



## Number of Investigations

Figure 3 shows the number of events for each year of the five-year period from 2007 through 2011 versus the number of cases investigated during the same time.

**Figure 3. Health Events and Cases Investigated, 2007-2011**


During 2010 and 2011, Health investigated 384 events involving 524 cases (people). The number of events investigated in 2010 (177) was lower than the previous three years (247 in 2007, 213 in 2008, and 201 in 2009). The number of investigated events rose in 2011 to 207. Similarly, the number of cases also rose in 2011, to 294 people, up from 230 cases in 2010.

## Number of Plausible Illness Cases

Plausible Definite, Probable, or Possible (DPP) cases meet the threshold of evidence set by NIOSH. Health evaluates DPP cases for statistical purposes. Cases classified as “suspicious” are those that involve a pesticide that lacks human toxicological information, but includes documented exposure and symptoms. Health uploads de-identified data on all of our DPP and suspicious cases to NIOSH each year.

In 2010, there were 177 events that involved 124 DPP cases. In 2011, there were 207 events that involved 168 DPP cases. Of the combined years’ 384 events, 191 involved one case, nine involved two cases, three involved three cases, three involved four cases, two involved five cases, and one involved six cases. Four events in 2010 and 2011 involved more than six people. Each of these events occurred at the exposed people’s work-sites and resulted from agricultural pesticides drifting onto farm workers.

Numbers of Plausible DPP cases for the five years spanning from 2007 through 2011 are shown in Table 4.

**Table 4. Plausible Case Classification, 2007-2011**

| Classification | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **Definite** | 36 | 48 | 31 | 15 | 25 |
| **Probable** | 63 | 90 | 60 | 53 | 80 |
| **Possible** | 108 | 114 | 70 | 56 | 63 |
| **Total DPP Cases** | **207** | **252** | **161** | **124** | **168** |
| **Total Cases Investigated** | **310** | **310** | **232** | **230** | **294** |
| **Percent DPP** | 67% | 81% | 69% | 54% | 57% |

## Under-Reporting

The number of DPP cases documented by Health is an under-reporting of the actual number of pesticide-related illnesses that occur yearly in Washington. Health's surveillance system mainly captures cases that seek medical care where the health care provider either calls Washington Poison Center or files a Labor and Industries industrial insurance claim.

Many people with mild symptoms do not seek health care. Washington Poison Center data provides a limited measure of this. Most of the pesticide-related calls reported by Washington Poison Center are from people who did not seek health care. Since the individual did not seek health care, the event does not meet criteria for investigation. The most frequent medical outcome coding of these calls by Washington Poison Center were minor effect or not followed, minimal clinical effect possible.

Occupational cases in the data set may also be under-reported. Workplace exposures are generally reported through Labor and Industries, not the Washington Poison Center. During focus group meetings with farm workers in the Yakima area in 2001, workers explained that they were not likely to take time off from work to seek health care for mild to moderate symptoms. These workers were also unlikely to self-report to a government agency, voicing concerns about possible risks to their job security[2].

In addition, there is under-reporting from health care providers:

- Providers may not recognize the symptoms as being pesticide-related.
- Providers may not know to report.
- Providers may decide that other clinical responsibilities take precedent.
- The patient's employer may be self-insured so claims would not be submitted to Labor and Industries.

[2] See "Improving Data Quality in Pesticide Illness Surveillance," June 2004, at http://www.doh.wa.gov/Documents/Pubs/334-286.pdf.

An accurate estimate of the extent of health care provider under-reporting in Washington is currently unknown. In a Health study[3] completed in 2004, pesticide illness surveillance captured about 60 percent of occupational illness cases that sought medical care in the Yakima area and were given a pesticide-specific diagnosis. Farming employers are primarily insured through Labor and Industries, so the percentage of captured health care visits for occupational pesticide-related injuries may be relatively higher in this sector. No studies have been published that estimate the number of health care visits by Washington's urban populations for pesticide illnesses that go unreported.

Passive surveillance systems do not capture every case. This type of surveillance system's strength is in capturing enough cases to understand what problems are occurring and why. The focus of Health's pesticide illness monitoring is to collect data for targeted prevention. Although it is possible that this surveillance is missing significant cases, the agency is documenting sufficient problem areas in order to conduct prevention activities.

## Severity of Medical Outcome

Health uses the NIOSH Severity Index to classify signs and symptoms associated with pesticide illness cases. The "low" category includes symptoms such as nausea, vomiting, shortness of breath, headache, dizziness, and skin or eye irritation. With low-severity cases, duration is relatively short; time lost from work or normal activities is usually three days or less.

"Moderate" illness or injury includes signs and symptoms that are pronounced, prolonged, or both, and in most cases must be observed by a health care provider. These include second and third-degree skin burns, eye burns, systemic symptoms (such as altered heart rate), slurred speech, or asthma symptoms. For moderate cases, time lost from work or normal activities is usually three to five days.

Cases are classified as "high" severity when the illness or injury is considered life threatening. These cases typically require treatment or hospitalization to prevent death. Signs and symptoms may include coma, cardiac arrest, renal failure, or respiratory depression. The individual often sustains substantial loss of time (more than five days) from regular work.

"Death" classification indicates a fatality attributed to pesticide exposure. These are infrequently reported in the Health data set. Health surveillance excludes intentional pesticide exposures (suicide and homicide).

Table 5 lists severity of medical outcomes for DPP cases from 2007 through 2011. In 2010, 100 (81 percent) of the 124 DPP cases were classified as low. In 2011, 137 (82 percent) were classified as low. Twenty-three (18 percent) were classified as moderate illness in 2010 and 30 (18 percent) cases were classified as moderate in 2011. There was one high severity case in 2010 and one in 2011 (0.8 percent and

[3] *ibid*.

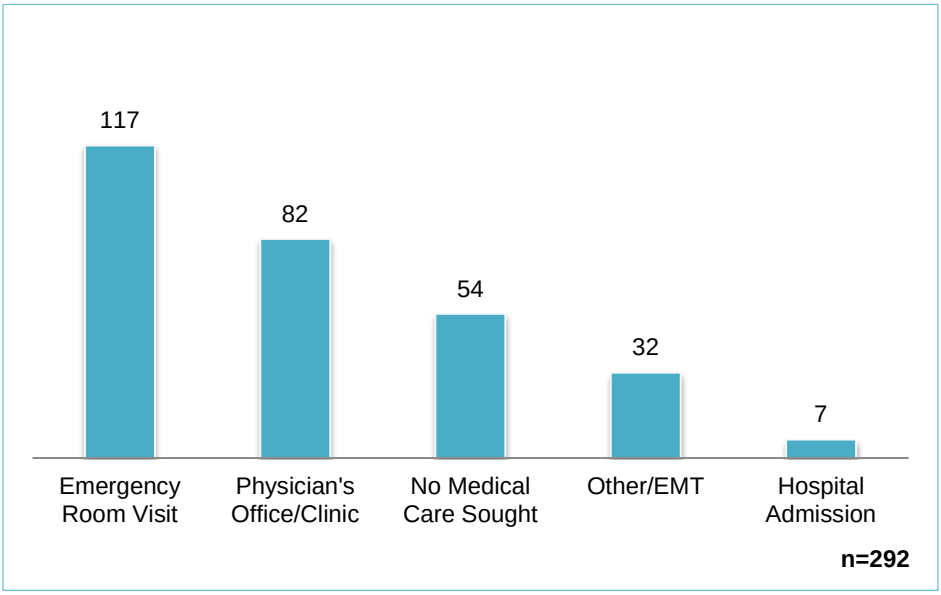
0.6 percent, respectively). No deaths plausibly due to pesticide exposure were documented in 2010 or 2011.

**Table 5. Severity of Medical Outcome in DPP Cases, 2007-2011**

| Severity | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **Low** | 181 (87%) | 227 (90%) | 145 (90%) | 100 (81%) | 137 (82%) |
| **Moderate** | 26 (13%) | 23 (9%) | 13 (8%) | 23 (18%) | 30 (18%) |
| **High** | 0 (0%) | 2 (1%) | 3 (2%) | 1 (0.8%) | 1 (0.6%) |
| **Death** | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| ***Total DPP Cases*** | ***207*** | ***252*** | ***161*** | ***124*** | ***168*** |

Figure 4 shows the type of medical care sought for 2010 and 2011 DPP cases. Of the 292 DPP cases, 238 (82 percent) received medical care for their symptoms. Most of these were seen in the emergency room or in a physician's office or clinic. Thirty-two cases (11 percent) received care from an emergency medical technician or other type of emergency health care professional. Seven cases (2 percent) were hospitalized. Most hospitalized cases also received care at the emergency room or by an emergency medical technician prior to hospitalization. Care prior to hospitalization is not reflected in Figure 4.

**Figure 4. Type of Medical Care Sought in DPP Cases, 2010-2011**




Most of the 54 cases (18 percent) that did not seek health care were referred to health care by the Washington Poison Center, or were part of a multi-case illness event. The reasons they did not seek medical care for their symptoms were often discussed with investigators during interviews. Many of them said that they did not have health insurance and the cost of care was prohibitive. Some also mentioned that the distance to the health care provider was too far and that they lacked transportation.

## Age and Sex

In 2010 and 2011, 26 of the DPP cases (9 percent) involved children younger than 18 years old. Twelve of the children were less than six years old, five were between ages 6 and 11, and nine were between 12 and 17. Table 6 lists the age and gender of 2010 and 2011 DPP cases.

**Table 6. DPP Cases by Age and Sex, 2010-2011**

| Age | Female | Male | Total |
|---|---|---|---|
| **0-5** | 6 | 6 | **12** |
| **6-11** | 1 | 4 | **5** |
| **12-17** | 5 | 4 | **9** |
| **18-29** | 28 | 46 | **74** |
| **30-49** | 39 | 81 | **120** |
| **50+** | 32 | 40 | **72** |
| ***Total*** | ***111*** | ***181*** | ***292*** |

Most of the DPP cases under 18 years of age involve toddlers – children 1-2 years of age. The main reason for exposure is that products in the home are stored within reach. Although the vast majority of toddler exposures to pesticides are from handling or tasting rodenticide products, Health rarely investigates these reports because they tend to not be symptomatic. The pesticides used in most consumer-purchased (over-the-counter) rodenticide products used in the home are not highly toxic to people. Nevertheless, care should be taken with all pesticide products to keep them away from a child's reach.

The major causes of DPP cases that involve children are:

- Products are located within reach of children under 5 years old.
- Excessive use or allergic reaction to creams to treat for lice and scabies.
- Mishaps that happen with unsupervised use by teenagers.

Children and other family members may also become ill after their home or apartment is treated for pests. Examples of childhood illness cases from Health's 2010 and 2011 investigations are below.

## Products Within Reach of Children

- **Event 100033**: A 22-month-old female developed eye and skin redness after she got into the kitchen cabinet and got an organophosphate flea and tick spray for cats on her. Paramedics responded.
- **Event 110200**: A three-year-old child accidentally sprayed herself with a dog repellent and complained about eye symptoms to her mother. The mother washed her face and noticed skin and eye symptoms, and took the child to the ER.

- **Event 110007**: A four-year-old male was sprayed by another child in the face and mouth with an insecticide while playing outside. He experienced eye, upper respiratory, and skin symptoms, including chemical burns. Symptoms lasted more than a week. The patient was seen at the ER and later by a dermatologist.
- **Event 110102**: A nine-month-old male became ill at his home after eating pyrethroid insecticide granules that were left near him. The infant developed cardiovascular, neurological, eye, and respiratory symptoms. EMT responded and transported. He was hospitalized for three days.

## Topical Treatments for Lice and Scabies

- **Event 110014**: A seven-week-old male became ill about four hours after his mother applied a topical permethrin cream to his face and head that had been prescribed by her physician for scabies. The infant experienced various neurological and respiratory symptoms that lasted about a day. The patient was seen at two medical facilities.
- **Event 110226**: A three-year-old female developed vomiting and fever three days after permethrin lotion was applied to her hair for lice. The lotion was kept on the child's hair for one week. The child was taken to the hospital.
- **Event 110217**: An 11-year-old female went to the doctor with dermatological health effects on her ear, after her mother applied a French product for lice to her hair. The product contained an organophosphate insecticide.

## Unsupervised Use by Adolescents

- **Event 110068**: Five male junior high school students were assigned by their science teacher the task of cleaning out a greenhouse that was scheduled for demolition. While cleaning, a container broke and the contents splashed on one of the student's jeans and shoes. The students reported headache, gastrointestinal, and upper respiratory effects. The Washington State Department of Agriculture investigated and oversaw proper cleanup and disposal of the pesticides in the greenhouse.
- **Event 100009**: A 14-year-old female sprayed ornamental plants inside her parents' home. She began to develop neurological, respiratory, and eye symptoms within one hour of application. She was transported by ambulance to an ER, where she was treated and discharged in stable condition.
- **Event 100172**: A 16-year-old male’s eye was splashed by weed killer when the product was released by its propellant. He experienced eye symptoms immediately and his friend called the Poison Control Center, which recommended he be taken for health care. He went to the medical center that afternoon and received follow-up care from an ophthalmologist for eye burn/chemical conjunctivitis and blunt trauma to right eye.

## Other Examples of Childhood Exposures and Illness

- **Event 110071**: A 17-month-old male was taken to the hospital after he suddenly stopped breathing. He had just eaten a cherry and returned from a 20-minute ride with his father on an all-terrain vehicle through nearby cherry orchards. The cherry orchards had been sprayed that morning and two days earlier with pyrethroid insecticide and a fungicide. The child was hospitalized in ICU with severe respiratory problems and neurological symptoms. Within 12 hours of symptom onset, he was asymptomatic and active. The child's presentation was not consistent with exposure to the pesticides applied to cherries. Health investigated and collected cherries and the child's clothing for lab testing. The child's father had thinned apples all morning before picking cherries with his son. Father and son had also used mosquito repellent that day. Department of Agriculture lab personnel tested cherries and the child's clothing for insecticides and mosquito repellent. Lab results identified mosquito repellent residue and N-methyl carbamate residue on the child's clothing. Many of the child's symptoms along with his rapid recovery are consistent with N-methyl carbamate poisoning. It is likely that the father's exposure while thinning apples was the source of N-methyl carbamate residue on the child's clothing.
- **Event 110219:** An eight-year-old child developed eye symptoms after playing with his dog and then rubbing his eyes. Symptom onset was about one hour and resolved later the same day. The dog had just been treated for fleas with a pyrethroid/pyridine insecticide. The patient was evaluated and treated at the ER, where he was diagnosed with chemical conjunctivitis.

## Occupational Cases of Pesticide-Related Illness

Table 7 lists the age and sex of combined DPP occupational and non-occupational cases for 2010 and 2011. During this two-year period, as in previous years, almost twice as many males (119) experienced illness resulting from pesticide exposures at work than did females (60). A total of 61 males were represented in non-occupational cases compared to 52 females.

**Table 7. Occupational and Non-Occupational DPP Cases by Age and Sex, 2010-2011**

| Age | Occupational | | Non-Occupational | | Total |
|---|---|---|---|---|---|
| | Female | Male | Female | Male | |
| **0-5** | 0 | 0 | 6 | 6 | **12** |
| **6-11** | 0 | 0 | 1 | 4 | **5** |
| **12-17** | 0 | 0 | 5 | 4 | **9** |
| **18-29** | 22 | 36 | 6 | 8 | **72** |
| **30-49** | 29 | 63 | 11 | 18 | **121** |
| **50+** | 9 | 20 | 23 | 21 | **73** |
| ***Total*** | ***60*** | ***119*** | ***52*** | ***61*** | ***292*** |

Table 8 shows that 179 DPP cases involved a pesticide-illness resulting from exposures while on the job in 2010 and 2011. This represents 61 percent of all DPP cases investigated during this two-year period.

**Table 8. Annual Occupational and Non-Occupational DPP Cases, 2007-2011**

| Year | Occupational | Non-Occupational | Total DPP Cases |
|---|---|---|---|
| **2007** | 88 (43%) | 119 (57%) | 207 |
| **2008** | 130 (52%) | 122 (48%) | 252 |
| **2009** | 71 (44%) | 90 (56%) | 161 |
| **2010** | 78 (63%) | 46 (37%) | 124 |
| **2011** | 101 (60%) | 67 (40%) | 168 |

Health began focusing on occupational cases and assigning fewer non-occupational cases for investigation in January 2010. Non-occupational cases, therefore, appear less frequently in the data after this time, not due to reduction in occurrence or reporting, but because the shift in case ascertainment implemented in 2010 prefers occupational reports.

Table 8 represents the slight change in weight between the occupational and non-occupational cases beginning in 2010 and continuing in 2011. Sixty three percent of occupational DPP cases are documented in 2010, and 60 percent in 2011, compared to an average of 47 percent for the preceding three years (2007-2009). Fewer residential bug-bomb cases and fewer moss-out exposures and eye injury cases were investigated during these last two years than in the previous years, although the reporting of these types of cases has not changed.

Pesticide types are defined by the functional classes of pesticide products. Pesticide types involved in plausible cases of occupational illness are presented in Table 9.

**Table 9. Pesticide Type, Occupational DPP Cases, 2010-2011**

| Pesticide Type | 2010 | Percent | 2011 | Percent |
|---|---|---|---|---|
| **Insecticide** | 98 | 40.2% | 58 | 40.0% |
| **Herbicide** | 32 | 13.1% | 19 | 13.1% |
| **Fungicide** | 45 | 18.4% | 36 | 24.8% |
| **Fumigant** | 6 | 2.5% | 3 | 2.1% |
| **Rodenticide** | 1 | 0.4% | 1 | 0.7% |
| **Disinfectant/broad spectrum for water sanitation** | 2 | 0.8% | 0 | 0.0% |
| **Insect repellent** | 2 | 0.8% | 2 | 1.4% |
| **Insecticide & other** | 24 | 9.9% | 9 | 6.2% |
| **Other** | 7 | 2.9% | 2 | 1.4% |
| **Unknown** | 27 | 11.1% | 15 | 10.3% |
| **Total** | **244** | **100.0%** | **145** | **100.0%** |

As in previous years, insecticide exposures account for most documented pesticide-illness cases among workers during this two-year reporting period. Forty percent of DPP cases involved insecticides, alone or in combination with another pesticide. Twenty-one percent of these involved a cholinesterase-inhibiting insecticide.

Exposure to fungicides averaged slightly less than 22 percent of DPP cases, with about 18 percent in 2010 and 25 percent in 2011. Herbicide exposure was slightly over 13 percent in both 2010 and 2011. Fumigant cases averaged 2.3 percent of occupational exposures for this two-year period. Though not numerous compared to other pesticide types, illnesses resulting from exposure to fumigants can be severe. Most of the cases involving fumigants are associated with pesticide drift.

Pesticides may also be classified according to their chemical class. Table 10 presents the chemical classes of pesticides involved in occupational illnesses in 2010 and 2011.

**Table 10. Occupational Cases by Chemical Class, 2010-2011**

| Chemical Class | 2010 | Percent | 2011 | Percent |
|---|---|---|---|---|
| **Organochlorine compounds** | 2 | 0.8% | 2 | 1.3% |
| **Organophosphorus compounds (AChE Inhibitor)** | 27 | 10.7% | 7 | 4.6% |
| **N-methyl carbamates (AChE Inhibitor)** | 7 | 2.8% | 6 | 3.9% |
| **Pyrethrins** | 1 | 0.4% | 0 | 0.0% |
| **Pyrethroids** | 43 | 17.0% | 33 | 21.6% |
| **Dipyridyl compounds** | 9 | 3.6% | 5 | 3.3% |
| **Chlorophenoxy compounds** | 9 | 3.6% | 6 | 3.9% |
| **Organo-metallic compounds** | 2 | 0.8% | 0 | 0.0% |
| **Inorganic compounds** | 23 | 9.1% | 15 | 9.8% |
| **Indandiones** | 1 | 0.4% | 0 | 0.0% |
| **Microbial** | 1 | 0.4% | 0 | 0.0% |
| **Dithiocarbamates** | 6 | 2.4% | 3 | 2.0% |
| **AChE Inhibitor, with compounds NOS*** | 3 | 1.2% | 0 | 0.0% |
| **Pyrethrin plus pyrethroid + other compounds NOS** | 1 | 0.4% | 0 | 0.0% |
| **Other, including multiple classes NOS** | 113 | 44.7% | 73 | 47.7% |
| **Multiple ingredients and grouped class codes NOS** | 5 | 2.0% | 3 | 2.0% |
| **Total** | **253** | **100.0%** | **153** | **100.0%** |

*Not otherwise specified (NOS)

More than one pesticide may be associated with a single case, and more than one chemical class or ingredient can be in a single pesticide product. That is why the total numbers are more than the total number of occupational DPP cases.

Table 11 indicates that the most plausible illness cases resulting from pesticide exposure in the workplace occur in agricultural occupations. During the combined 2010 and 2011 reporting period, 91 of all cases (51 percent) investigated by Health were on farms, 38 at nurseries (11 percent), and eight at farm product warehouse or

storage facilities (4 percent). Less than 1 percent of illnesses investigated occurred in livestock and animal production businesses.

**Table 11. Occupational Exposure Location of All Investigated Cases, 2010-2011**

| Location | 2010 | 2011 | Total | Percent |
|---|---|---|---|---|
| **Farm** | 42 | 49 | 91 | 51% |
| **Nursery** | 0 | 19 | 19 | 11% |
| **Office or business** | 5 | 4 | 9 | 5% |
| **Retail** | 6 | 2 | 8 | 4% |
| **Farm product warehouse or storage** | 4 | 4 | 8 | 4% |
| **Single family home** | 2 | 4 | 6 | 3% |
| **Multi-unit housing** | 2 | 4 | 6 | 3% |
| **Park** | 5 | 0 | 5 | 3% |
| **Private residence-type unknown** | 1 | 2 | 3 | 2% |
| **Service establishment** | 0 | 3 | 3 | 2% |
| **School** | 1 | 1 | 2 | 1% |
| **Other institution** | 1 | 1 | 2 | 1% |
| **Road/rail** | 1 | 1 | 2 | 1% |
| **Livestock and animal production** | 0 | 1 | 1 | 0.5% |
| **Residential institution** | 1 | 0 | 1 | 0.5% |
| **Hospital** | 0 | 1 | 1 | 0.5% |
| **Food processing mfg facility** | 1 | 0 | 1 | 0.5% |
| **Pet care and veterinary services** | 0 | 1 | 1 | 0.5% |
| **Public transportation** | 0 | 1 | 1 | 0.5% |
| **Private vehicle** | 1 | 0 | 1 | 0.5% |
| **Other** | 2 | 1 | 1 | 0.5% |
| **Unknown** | 3 | 2 | 7 | 4% |
| **Total** | **78** | **101** | **179** | **99%** |

## Agricultural vs. Non-Agricultural Cases

Table 12 displays the distribution of cases categorized as DPP by agricultural and non-agricultural application sites, for five years (2007 through 2011).

**Table 12. Annual Agricultural and Non-Agricultural DPP Cases, 2007-2011**

| Year | Agricultural | Non-Agricultural | Total Cases |
|---|---|---|---|
| **2007** | 60 (29%) | 147 (71%) | **207** |
| **2008** | 123 (49%) | 129 (51%) | **252** |
| **2009** | 58 (36%) | 101 (63%) | **161*** |
| **2010** | 52 (42%) | 72 (58%) | **124** |
| **2011** | 79 (47%) | 89 (53%) | **168** |

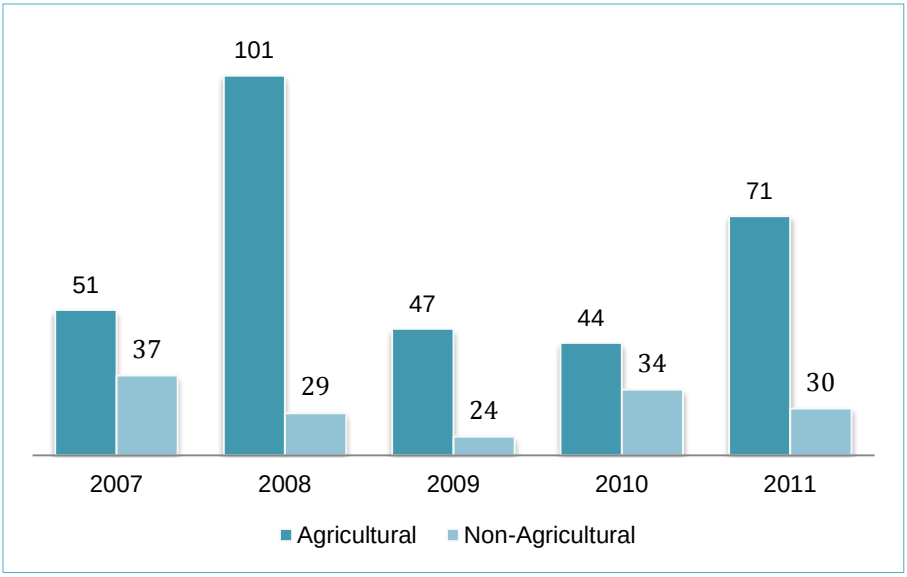
*The site of application was unknown in two of the total 161 cases.

Agricultural cases occur when the pesticide application is intended for agricultural commodities such as fruit and field crops, nursery, livestock, and forest operations. They are classified as either “occupational” (cases that occur to employees at work) or “non-occupational” (when people are not at work at the time of exposure). Agricultural cases include exposure during pesticide handling, contact with drift or leaf residues from an agricultural application, and drift of pesticides from the intended target of application.

Non-agricultural cases typically involve commercial and residential use of pesticides. These cases may include spills or splashes while opening and pouring pesticides, or pesticide drifting off target (such as being carried by wind out doors or seeping through living spaces indoors). Problems with fogger use occur due to mishaps during application, overuse, or drift of product to unintended areas of the residence or worksite.

For 2010 and 2011, 179 (61 percent) of DPP cases were experienced by workers from on-the-job exposure to pesticides. Of the 179 occupational DPP cases, 115 were agriculture workers and 64 were from other occupations. Figure 5 shows occupational cases for agricultural and non-agricultural workers for the years 2007 through 2011.

**Figure 5. Agricultural and Non-Agricultural Occupational DPP Cases, 2007-2011**




The lowest number of agricultural worker DPP cases during this five year period occurred in 2010, when there were 44 cases. The number of agricultural DPP cases has increased since 2001, when there were 34 agricultural DPP cases. Since then, there was a gradual increase in cases peaking in 2008 (101 cases) when drift events resulted in a greater number of cases compared to prior years. This increase in agricultural cases since 2001 coincides with increase in cases overall, and is most likely due to improved reporting relationships with Labor and Industries and the Washington Poison Center. A decline in the number of agricultural cases classified as DPP occurred in 2009 and continued through 2010. A similar dip was seen in

2006, when there were 37 agricultural worker DPP cases, down substantially from previous years.

The active pesticide ingredient involved in plausible cases of applications occurring in agriculture are provided in Table 13. More than one ingredient may be present in any one product, and more than one product may be implicated in any illness case.

**Table 13. Pesticide Ingredients in Agricultural Applications DPP Cases, 2010-2011**

| Active Ingredient | 2010 | 2011 | Total |
|---|---|---|---|
| **Cholinesterase Inhibitors** | | | |
| **Aldicarb** | 0 | 1 | 1 |
| **Azinphos-Methyl** | 1 | 1 | 2 |
| **Carbaryl** | 3 | 0 | 3 |
| **Chloropyrifos** | 1 | 11 | 12 |
| **Diazinon** | 1 | 0 | 1 |
| **Dimethoate** | 1 | 0 | 1 |
| **Malathion** | 2 | 2 | 4 |
| **Other Insecticides (acaracides)** | | | |
| **Acetamiprid** | 1 | 1 | 2 |
| **Bifenthrin** | 0 | 1 | 1 |
| **Bifenazate** | 2 | 1 | 3 |
| **Imidacloprid** | 3 | 1 | 4 |
| **Lambda-cyhalothrin** | 1 | 23 | 24 |
| **Propargite** | 0 | 1 | 1 |
| **Thiacloprid** | 0 | 1 | 1 |
| **Spinetoram** | 2 | 12 | 14 |
| **Spirotetramat** | 0 | 12 | 12 |
| **Herbicides** | | | |
| **Glyphosate** | 3 | 4 | 7 |
| **Paraquat dichloride** | 4 | 3 | 7 |
| **2,4-D** | 0 | 4 | 4 |
| **MCPA, 2-ethylhexyl ester** | 1 | 1 | 2 |
| **Fungicides** | | | |
| **Mancozeb** | 1 | 0 | 1 |
| **Metam-Sodium** | 6 | 0 | 6 |
| **Sulfur compounds** | 3 | 6 | 9 |
| **Chlorothalonil** | 0 | 4 | 4 |
| **Propiconazole** | 0 | 19 | 19 |
| **Myclobutanil** | 2 | 4 | 6 |
| **Pyraclostrobin** | 2 | 2 | 4 |
| **Trifloxystrobin** | 3 | 1 | 4 |
| **Triflumizole** | 1 | 2 | 3 |
| **Thiophanate-methyl** | 0 | 2 | 2 |
| **Ziram** | 0 | 1 | 1 |
| **Other** | | | |
| **Aluminum phosphide** | 1 | 1 | 2 |
| **Benzyladenine** | 2 | 0 | 2 |
| **Deet** | 0 | 1 | 1 |
| **Ethephon** | 1 | 3 | 4 |
| **Kaolin** | 2 | 0 | 2 |
| **Metaldehyde** | 1 | 0 | 1 |

## Exposure Event Type

The nature of the exposure is characterized in five types: drift, targeted, indoor air, leak/spill, and surface. The exposure type for all plausible cases is presented in Table 14. The differences between the types of exposures common to agricultural and those common to non-agricultural applications are reflected.

**Table 14. Type of Exposure by Agricultural or Non-Agricultural Application Site, DPP Cases, 2010-2011**

| Type of Pesticide Exposure | Agricultural Applications | Non-Agricultural Applications | Total |
|---|---|---|---|
| **Drift** | 67 | 20 | 87 |
| **Targeted** | 34 | 49 | 83 |
| **Indoor air** | 1 | 56 | 57 |
| **Leak/spill** | 10 | 25 | 35 |
| **Surface** | 19 | 11 | 30 |
| **Total DPP Cases** | **131** | **161** | **292** |

The most prevalent type of application implicated in exposures in agricultural applications is drift (67 cases). Drift exposures happen when pesticides move away from the target treatment site through the air.

Targeted exposures (34 cases) happen when a person is exposed to a pesticide released at the target site, and the pesticide is not carried from the target site by air. These are the second greatest agricultural application exposure type. The pesticide may be any formulation type (granular dust, aerosol, liquid, or other). The definition of "Targeted" was expanded in 2006 to include exposure types previously referred to as "Spray" and "Contact."

Surface exposures (30 cases) happen when a person is exposed through contact with pesticide residues on a treated surface (plant material, carpets, and treated animal). Surface exposure is the third most common exposure type for agricultural applications.

Application types classified as "Indoor Air" are the leading type of non-agricultural cases (35 percent). Here's an example of an indoor air residential case:

- **Event 110009**: A 41-year-old male reported a headache and respiratory difficulty after completing a task in his closed garage where four bottles of 9-year-old herbicides were stored. He could smell the herbicides while in the space.

The second most common type of non-agricultural case for 2010 to 2011 is "Targeted" (30 percent). Here's an example of a targeted occupational pesticide illness case:

- **Event 100087**: A 38-year-old male warehouse worker was hit with herbicide. He felt the spray on his face and eyes after a pressure hose dislodged and propelled the herbicide to his face. He was wearing safety glasses, but the herbicide still hit his eyes. He sought medical attention the same day.

Pesticide drift is a major contributor to illnesses resulting from agricultural applications. For 2010 through 2011, drift exposures comprised 67 (23 percent) of the 292 total DPP illness cases. Pesticide drift comprised more than half (51 percent) of all DPP cases within agricultural applications and 12 percent (20 out of 161) of the DPP cases among non-agricultural applications.

## Agricultural Pesticide Drift Events

Table 15 shows the number of drift events and cases associated with agricultural applications for 2007 through 2011. The annual number of drift cases tends to vary each year because a single event can affect multiple people. Drift to workers usually, but not always, involves agricultural workers. Drift to non-workers generally involves people in their homes, driving on roads, visiting parks, or at schools.

**Table 15. DPP Cases of Agricultural Drift to Workers and Others, 2007-2011**

| Year | Events | DPP Cases | Occupational Cases | Non-Occupational Cases |
|---|---|---|---|---|
| **2007** | 13 | 21 | 12 | 9 |
| **2008** | 13 | 83 | 62 | 21 |
| **2009** | 16 | 28 | 16 | 12 |
| **2010** | 9 | 22 | 19 | 3 |
| **2011** | 15 | 45 | 41 | 4 |
| **Total DPP Cases** | **66** | **199** | **150** | **49** |

## Examples of Drift Cases

- **Event 100027**: Seven female and three male farm workers ages 24 to 53 sought medical care after receiving drift from a pesticide application in a neighboring orchard. None of the workers reported feeling the spray but all reported breathing or smelling it. Workers reported gastrointestinal symptoms minutes after smelling the spray. Department of Agriculture tests were positive for organophosphate residues on the clothing of two workers. Samples were positive for areas where workers were gathered when they smelled the spray.

  *Contributing cause in addition to drift*: Workers were not asked to decontaminate after they smelled the pesticide. There was no notification of application in neighboring orchard and one worker was told that the pesticide was not toxic.

- **Event 110154**: A 24-year-old male farm worker was irrigating a corn field when he received drift from an aerial application. He felt the spray on his face and developed gastrointestinal and eye symptoms. He continued working and decontaminated at home four hours after the exposure. He sought

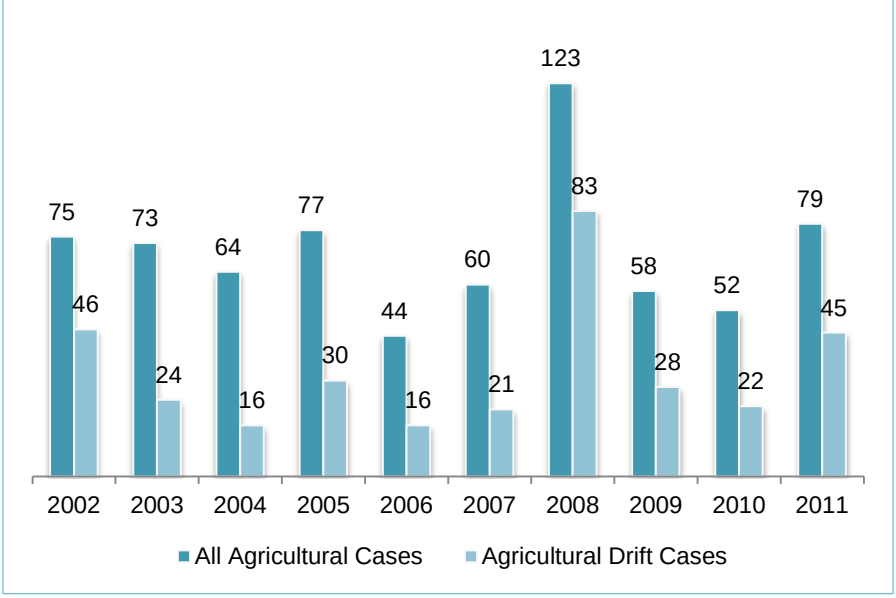
medical care the same day. No one at the ranch notified the irrigator of the 13-day re-entry interval and he entered the field the next day to change the water.

*Contributing cause in addition to drift*: There was no oral notification of the application nor were any signs posted. After the drift incident, the worker continued to be exposed by re-entering the treated field. There were no instructions from employers regarding re-entry interval restrictions, nor did the irrigator see any signs.

## Drift DPP Cases

Agricultural pesticide drift onto workers and other bystanders has been documented in Washington for many years. Figure 6 illustrates 10 years of pesticide drift data from 2002 to 2011.

**Figure 6. Agricultural Pesticide DPP Cases and Agricultural Pesticide Drift DPP Cases, 2002-2011**




The number of people involved in agricultural drift events has fluctuated over the past 10 years, between a low of 16 in 2004 and 2006, to a high of 83 cases in 2008. There were 22 plausible agricultural drift cases documented 2010 and 45 in 2011. The number of drift events dropped to nine in 2010, but rose again to 15 in 2011.

Table 16 illustrates that although the number of plausible illness cases documented in Health's pesticide illness surveillance system may shift from year to year, agricultural drift remains a continuing public health problem.

The number of events versus the number of total plausible cases is illustrated in

Table 16. Ten years (2002 to 2011) of agricultural pesticide drift data are included.

**Table 16. Events and DPP Cases Involving Agricultural Pesticide Drift, 2002-2011**

| Year | Events | Cases |
|---|---|---|
| **2002** | 26 | 46 |
| **2003** | 14 | 24 |
| **2004** | 13 | 16 |
| **2005** | 13 | 30 |
| **2006** | 12 | 16 |
| **2007** | 13 | 21 |
| **2008** | 13 | 83 |
| **2009** | 16 | 28 |
| **2010** | 09 | 22 |
| **2011** | 15 | 45 |
| **Total** | **144** | **331** |

Figure 7 and Figure 8 provide relevant features of agricultural drift cases that help design effective prevention activities. Figure 7 represents the drift DPP cases.

**Figure 7. People Affected by Agricultural Pesticide Drift, DPP Cases, 2010-2011**

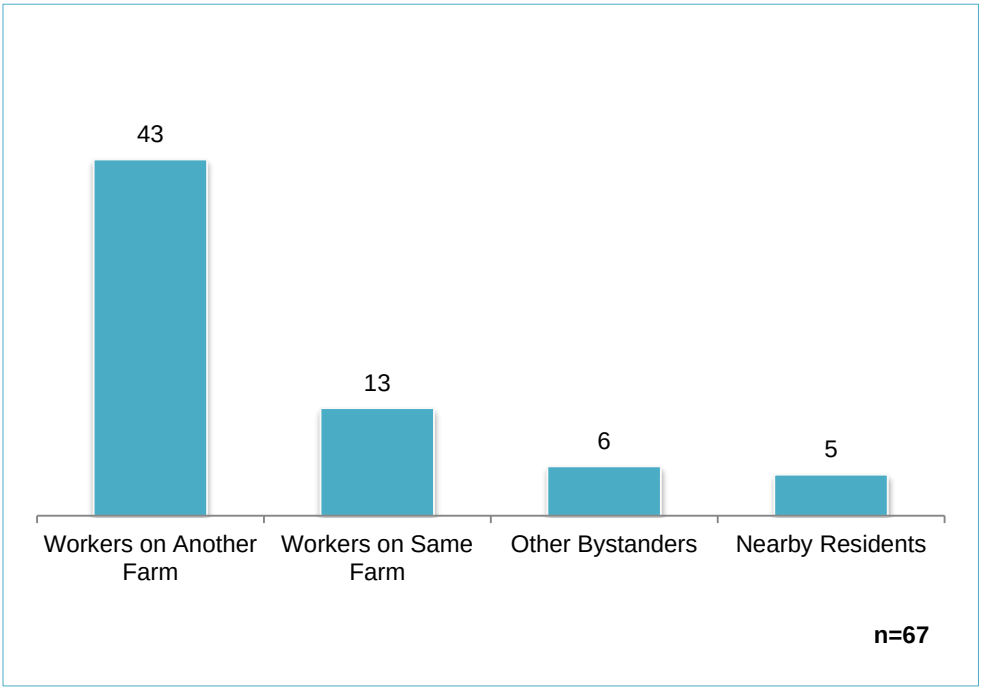
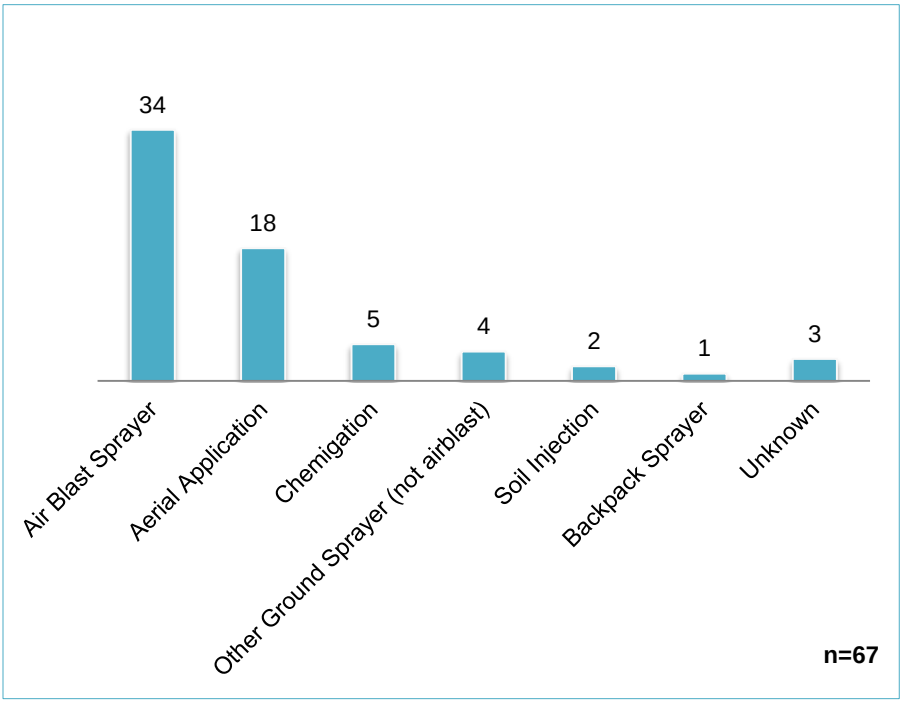


Figure 7 illustrates that agricultural drift is primarily a health issue for agricultural workers. Drift also impacts people who live, work, or study near the field where the application occurs. Other bystanders include people traveling on roads in cars, on motorcycles, or on foot, and other non-agricultural workers in the area. Agricultural workers on other farms appear more than three times more frequently in the data than do workers on the same farm, (43/13). There may be additional barriers to an employee reporting illness when their employer is responsible for the exposure.

Figure 8 shows the types of application equipment associated with agricultural pesticide drift cases from 2010 to 2011. This data shows that air blast sprayers and aerial application is involved in most (78 percent) drift cases.

**Figure 8. Type of Application Equipment Associated with Agricultural Pesticide Drift, DPP Cases, 2010-2011**




The orchard air blast sprayer produces a high-pressure fan-shaped spray that is prone to drift. This continues to be an application method associated with most agricultural drift events and was responsible for half of all drift cases in this two-year reporting period. Aerial applications also contributed a substantial proportion (27 percent) of agricultural drift DPP cases during the 2010 and 2011 period.

The proximity of workers to spray equipment is an important contributing factor in most of the drift incidents. Most of the workers were nearby and could see or hear the sprayer. During interviews, some workers reported they could feel the droplets of spray on their face and arms. In most of the events, the distance between the worker and the sprayer was less than 50 meters. Frequently, workers who experience pesticide drift are located in the same or adjacent block or field being treated.

## Non-Agricultural DPP Cases

An analysis of the person's location when they were exposed is also important for preventing pesticide exposure in non-agricultural cases. Both occupational and non-occupational cases are presented in Table 17

**Table 17. Exposure Site for Non-Agricultural, Occupational, and Non-Occupational DPP Cases, 2010-2011**

| Exposure Site | Occupational | Non-Occupational | Total |
|---|---|---|---|
| **Manufacturing and other industrial facilities** | 1 | 0 | **1** |
| **Office, retail, or service business** | 20 | 0 | **20** |
| **Park, camp, golf course** | 6 | 2 | **8** |
| **Residential building or grounds** | 15 | 84 | **99** |
| **Road, right-of-way or vehicle** | 2 | 2 | **4** |
| **School, prison, hospital/clinic, institutions** | 6 | 5 | **11** |
| **Other** | 8 | 10 | **18** |
| **Total Cases** | **58** | **103** | **161** |

## Non-Occupational Exposures in Single-Family Homes

- **Event 100246**: A father of two boys, ages 6 and 8, set off five bed bug foggers in his 2,100 square foot home to control bug problems. One fogger was placed in the boys' large bedroom. The children were away during fogging and returned 24 hours later, after the father had ventilated the home for several hours. Bedding was not changed after the fogging. Both children awoke several hours after going to bed with gastrointestinal symptoms and headache. They were taken to the emergency room.
- **Event 110045**: A 59-year-old female wore nitrile gloves as she dipped a rag in diluted moss-cleaning concentrate to remove moss from home siding. She worked quickly and only had a small area to clean. She felt her fingers getting wet but continued several more dips to complete the task. Her skin stung and she rinsed her hands under cold water. Her skin then developed ulcers and intense swelling of fingers and hand. She went to the ER. The product is not a registered pesticide, but contains trisodium phosphate and an antimicrobial pesticide.
- **Event 110178**: A 35-year-old female developed respiratory and neurological symptoms when a pest control operator applied herbicide outside her home, next to her open window where a fan drew in outside air. She asked to be notified before application to protect her health, yet she found the notification paper in her yard afterward. She lives on a military base and the herbicide was applied by a landscape contractor. Swab samples taken by the Department of Agriculture were positive for residue on the window and the fan.

## Non-Occupational Exposures in Multi-Unit Housing (apartments)

- **Event 100050**: A 21-year-old woman in her first trimester of pregnancy reported that her landlords applied an organophosphate pesticide to the attic space of her home and to an ant hill outside. Four people (two adults and two children ages 3 years and 5 years) share the duplex rental home. She reported smelling the product and experiencing neurologic, respiratory, and gastrointestinal symptoms within 30 minutes of the application. The second adult also reported smelling the product and experiencing symptoms after returning home from work later that evening. The two children experienced neurologic and respiratory symptoms and had difficulty sleeping that night. She contacted her health care provider by phone, and took the two children to medical care the next day. A second family of two adults and one 3-year-old child, living in the duplex next door, also reported symptoms. A total of seven residents were exposed.
- **Event 110002**: Seven people comprising two families, the youngest member less than one month old, were exposed to vapors from mothballs that their landlord placed in the crawlspace of the two-story duplex they rented. The four adults reported respiratory, neurologic, and gastrointestinal health effects. A 31-year-old female, 40-year-old male and 5-year-old female noticed the mothball smell several days before the family living in the downstairs unit. Windows were closed and the furnace was running, which draws air from under the duplex. The family developed symptoms and notified property management. They questioned the family downstairs, who did not notice the smell at the time.

  In the downstairs unit, the 22-year-old female and male and their 2-week-old and 3-year-old daughters spent the night away from home on the evening that the mothballs were detected and confirmed in the crawl space. These spaces were accessible from the home by way of a storage closet. The landlord removed the mothballs after the family downstairs contacted him. The property management company reportedly did not respond to complaints from the upstairs tenants who detected vapors several days earlier.

  Both families took their children for health care evaluation. The adults in the downstairs unit had respiratory and gastrointestinal symptoms. Their newborn was crying more than normal. The mothball odor lingered in both homes for weeks after the landlord had reportedly removed the mothballs. The Department of Agriculture investigated and detected broken mothballs in the crawl space three weeks after they were reported removed by the landlord.
- **Event 110012**: A family of four rented an apartment that was infested with bed bugs. All family members developed symptoms after treatments were applied by a pest control company. The couple, ages 35 and 39, and their male children, ages 5 and 10, developed respiratory and neurological

symptoms after crack and crevice applications were conducted inside the apartment. The tenants were informed of the applications and left the premises during the applications. They re-entered the unit approximately eight and 10 hours after applications. They could still smell the pesticide inside the apartment. The child, who had a history of asthma, reported that his condition worsened after the first application. He was seen and treated at a health care facility two days after the first application. This case was referred to the Department of Agriculture for compliance evaluation of the pesticide applications. Agriculture collected physical evidence in the form of residue samples. The samples were positive for pesticide residues inside the apartment. Their investigation concluded that the pesticide applicators followed all pesticide label directions.

### Office Buildings

Although most acute occupational pesticide-related illnesses ascertained by Health are related to agricultural exposures, in 2010 and 2011 there were 20 people who were made ill by pesticide exposures in office buildings or retail and service establishments. Most of these cases were low severity illnesses. Eleven percent of the 179 acute occupational pesticide-related illnesses identified during this two year time period were from office-based exposures.

## Labor and Industries

### Division of Occupational Safety and Health Cholinesterase Monitoring Program

Agricultural employers are required to offer each employee who may handle cholinesterase-inhibiting pesticides for 30 or more hours in any consecutive 30-day period the opportunity to participate in the cholinesterase (ChE) blood-monitoring program. Monitoring of cholinesterase levels in both red blood cells and blood serum can detect cholinesterase depression before the onset of illness. Employees are provided an annual baseline test prior to use of targeted pesticides. Cholinesterase activity levels are determined periodically during the application season and are compared to baseline levels. A decrease from baseline of 20 percent or more indicates potential pesticide over-exposure. Although by itself a cholinesterase level depression is not a violation of the standard, it is an indicator of exposure and initiates a review and possible investigation by Labor and Industries of pesticide handling practices.

### Cholinesterase Monitoring Results

During the 2010 cholinesterase testing season (January – October), around 315 growing operations participated in testing and 1,989 handlers submitted cholinesterase baseline tests. Baseline submissions decreased from 2009. In the 2011 cholinesterase testing season (January – October), 388 growing operations

participated in testing and 2,017 handlers submitted cholinesterase baseline tests. Baseline submissions increased slightly from 2010.

Of the 257 handlers who received at least one periodic test in 2010, eight (3 percent) received at least one periodic test result with a >20 percent cholinesterase depression from baseline (action level cholinesterase depression) requiring the employer to evaluate pesticide handling practices for possible problems. In 2011, 186 handlers who received at least one periodic test, six (3 percent) received at least one periodic test result with a >20 percent cholinesterase depression from baseline (action level cholinesterase depression) requiring the employer to evaluate pesticide handling practices for possible deficiencies. The ChE summary information above is from the Labor and Industries report titled, *Cholinesterase Monitoring of Pesticide Handlers in Agriculture: 2010 and 2011 Report*. The full reports posted on the Labor and Industries cholinesterase monitoring website, along with the cholinesterase monitoring data.

Table 18 shows the number of employer and handler ChE testing and ChE Depressions from 2007 to 2011.

**Table 18. Employer and Handler ChE Testing and ChE Depressions, 2007-2011**

| Years | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **Employers participating in testing** | 226 | 218 | 217 | 315 | 388 |
| **Handlers submitting baseline tests** | 1857 | 2013 | 2060 | 1989 | 2017 |
| **Handlers with at least one periodic test** | 386 | 314 | 249 | 257 | 186 |
| **Periodic tests** | 532 | 495 | 286 | 316 | 202 |
| **Handlers with ChE depression to work evaluation level** | 49 (12.6%) | 21 (6.7%) | 15 (6.1%) | 8 (3.1%) | 6 (3.2%) |
| **Handlers with ChE depression to exposure removal level** | 18 (4.6%) | 1 (0.1%) | 7 (2.8%) | 0 | 0 |
| **Total number of handlers with ChE AL depression** | **67 (17.3%)** | **22 (7.0%)** | **22 (8.8%)** | **8 (3.1%)** | **6 (3.2%)** |

## Claims Insurance Services Division, Claims Administration Program

The Insurances Services Division, Claims Administration Program, processes workers' compensation claims initiated by on-the-job injuries and illnesses. In 2010, Labor and Industries received 82 claims in which the injury or illness initially appeared to be related to pesticide exposure (Table 19). The number of pesticide-related claims decreased in 2011 by about 54 percent from 2010.

Labor and Industries accepts or rejects claims based on whether or not a work-related injury or illness is diagnosed. Compensation is determined in accordance with specific definitions:

- Medical Only/Non-Compensable Claim: A worker experiences symptoms that he/she believes occurred from exposure on-the-job and seeks medical evaluation. When a physician finds that the symptoms are related to the exposure and there is objective evidence of injury, the claim is allowed. The medical evaluation and any follow-up medical care/treatment costs are paid. In this type of claim, the employee misses less than three days of work. These lost workdays are not reimbursed to the employee.
- Time Loss/Compensable Claim: A worker has an allowable claim and misses more than three days of work immediately following an exposure on the job. The worker is paid a portion of salary while unable to work. All related medical costs are covered.
- Rejected Claims: Initial diagnostic and medical evaluation costs are covered but the claim is rejected because objective evidence is lacking to relate symptoms to the workplace exposure. Claims may be rejected because symptoms have resolved by the time treatment is obtained, there is no objective evidence of injury, the worker may not yet have symptoms of illness from the exposure, or exposure cannot be confirmed or documented. A rejected status can be appealed and is often re-evaluated, but, once final, the worker can no longer reopen a claim based on original symptoms. Illness claims may be either opened or re-opened up to two years after the identification of the onset of delayed symptoms. Costs of initial medical visits are usually paid.
- Pending: Additional information is being collected on the claim before a determination can be made.
- Kept on Salary: The employer elects to pay the claimant's salary instead of Labor and Industries paying time loss payments while the employee is recovering from an injury or illness.

**Table 19. Status of Labor and Industries Claims Initially Related to Pesticides, 2006-2011**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| **Medical Only Non-compensable** | 68 | 82 | 108 | 53 | 57 | 29 |
| **Time Loss/ Compensable** | 4 | 2 | 5 | 1 | 1 | 0 |
| **Rejected** | 36 | 20 | 24 | 23 | 22 | 9 |
| **Pending/Unknown** | **1** | **0** | **0** | **0** | **0** | **0** |
| **Kept on Salary** | 1 | 1 | 1 | 0 | 2 | 0 |
| **Total** | **110** | **105** | **138** | **77** | **82** | **38** |

Claims categorized as *Medical Only* and *Time Loss* are compensated as work-related injuries. Of the 82 claims in 2010, 57 (70 percent) were compensated by Labor and Industries as being work-related injuries. Labor and Industries paid either time-loss or medical benefits for a total of $59,991 in 2010. Of the 38 claims in 2011, 29 (76 percent) were compensated by Labor and Industries as being work-related. The total paid out benefits for time-loss or medical benefits in 2011 was a $29,235.

As noted in the Rejected Claims definition above, most rejected claims were compensated for initial diagnostic and medical evaluation costs even if a determination could not be made to relate the symptoms to the work place.

# Compliance Activities

## Agriculture

Agriculture investigates all complaints it receives concerning possible pesticide misuse, storage, sales, distribution, applicator licensing, and building structure inspections for wood-destroying organisms. The division also inspects marketplaces, importers, manufacturers, and pesticide application sites for compliance with state and federal laws and regulations on a non-complaint basis.

### Complaints and Investigations

In 2010 and 2011, Agriculture investigated 300 complaints involving pesticide use, sales, and distribution; pesticide licensing; and building inspections for wood-destroying organisms.

Herbicides were involved much more than insecticides in 2010 and 2011 complaints, accounting for approximately 60 percent of all 2010 complaints and approximately 45 percent of all 2011 complaints.

Table 20 provides the number of complaints (cases) investigated from 2007 through 2011 and the number of resulting violations.

**Table 20. Agriculture Complaints and Violations, 2007-2011**

| Year | Complaints | Resulting Violations * |
|---|---|---|
| 2007 | 177 | 101 (57%) |
| 2008 | 171 | 88 (51%) |
| 2009 | 148 | 84(57%) |
| 2010 | 162 | 124 (77%) |
| 2011 | 138 | 72 (52%) |

*Some of the percentages have changed from previous publications due to case completions and amendments outside of the original reporting periods.

Complaints are classified by Agriculture according to definitions of the type of activity:

- **Agricultural**: Incidents occur in an agricultural environment such as farming, greenhouses, or Christmas tree farming.
- **Commercial/Industrial**: Incidents involving applications by licensed operators to offices, restaurants, and landscapes.
- **Pest Control Operator (PCO)**: Incidents involving a subset of individuals licensed to make applications to control structural pest.
- **Wood-Destroying Organism (WDO)**: Incidents involving inspections of structures for fungi, insects, and conditions that lead to pest infestations.
- **Residential**: Includes any application of a pesticide in a residential environment by homeowner, resident, or neighbor.

- **Right-of-way**: Applications made on public land such as roadways, electric lines, and irrigation canal banks.

Table 21 shows complaints with violations by type of activity from 2007 to 2011.

**Table 21. WSDA Violations by Type of Activity, 2007-2011**

| Type of Activity | 2007 | 2008* | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Agricultural | 24 | 15 | 25 | 27 | 15 |
| Commercial/ Industrial | 16 | 29 | 15 | 47 | 30 |
| PCO/WDO | 36 | 21 | 22 | 19 | 21 |
| Residential (non-commercial) | 12 | 18 | 7 | 15 | 7 |
| Right-of Way | 13 | 5 | 13 | 16 | 13 |
| **Total Violations** | **101** | **88** | **84** | **124** | **86** |

*Some of the violation numbers have changed from previous publications due to case completions and amendments outside of the original reporting periods.

### Other Agencies Involved

Agriculture works in cooperation with other state and local agencies in collecting evidence and testimony. Cooperating agencies may independently report their involvement in these cases or they may do no further independent investigation.

In 2010 and 2011, Agriculture consulted with other state, federal, and local agencies in 39 investigations. The agencies most frequently consulted were Department of Health, Department of Ecology, Yakama Nation, Department of Agriculture's Food Safety Program, and the U.S. EPA.

### Type of Pesticide Involved

In 2010 and 2011, herbicides were involved much more than insecticides. In 2010 approximately 60 percent of all complaints involved an herbicide and in 2011 approximately 45 percent of all complaints involved herbicides.

In both 2010 and 2011, herbicide drift constitutes the greatest number of complaints. Two herbicides — 2, 4-D (21 complaints) and glyphosate (23 complaints) — were the most frequently reported active ingredients. This is consistent with previous years' numbers and reflects the frequency of use by all applicators and the misuse of these products.

Table 22 shows the frequency of active ingredients most commonly involved in Agriculture's complaints.

**Table 22. Active Ingredients Most Commonly Involved in Department of Agriculture Complaints, 2011**

| Active Ingredient | 2011 |
|---|---|
| Glyphosate | 23 |
| 2,4-D | 21 |
| Triclopyr | 5 |
| Dicamba | 13 |
| Endosulfan | 1 |
| Chlorpyrifos | 5 |
| Diuron | 6 |
| Propicozanole | 6 |

## Enforcement Actions

Agriculture can take a range of actions on determination of a violation. The only formal enforcement action under the Administrative Procedures Act (RCW 34.05) is the Notice of Intent (NOI). This document that represents Agriculture's intent to assess civil penalties to the alleged violator and/or to suspend, deny, or revoke the alleged violator's pesticide license.

Agriculture also takes informal enforcement actions. These include:

- **Verbal Warning**. A verbal warning administered oraally by a field investigator to an alleged infractor.
- **Advisory Letter**. An advisory letter with specific written advice to an alleged infractor on how to comply with the laws and rules related to pesticides.
- **Notice of Correction (NOC)**. A written document issued to an infractor when a minor violation has occurred. The NOC references the specific law or rule violated and provides information on how to correct the violation.

Complaints in a given year do not directly correlate with the enforcement actions in that same year. Enforcement actions are often completed in the year after the complaint is received. Also, some complaints result in action being taken against more than one person.

Complaint investigations may result in the determination that a violation of state or federal laws or rules has occurred. Generally, first offenders or minor infractions are given a NOC and a period of time to correct the problem.

Sometimes more than one corrective action is taken on a case. In this report, only one corrective action per category is identified. For example, if more than one NOC was issued, the action would be listed as one NOC. However, if more than one type of corrective action was taken, such as a NOC and a NOI (which could happen if several applicators were involved in the same investigation), both types are listed.

Table 23 summarizes the formal and informal enforcement actions completed in the last four years.

**Table 23. Agriculture Agency Actions, 2007-2011**

| Action Completed | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| ***Formal Enforcement Action*** | | | | | |
| Actions resulting from Notices of Intent (NOI) | 34 | 38 | 28 | 36 | 34 |
| License Suspension (days) | 110 | 106 | 274 | 212 | 69 |
| Civil penalties assessed | $25,175 | $34,636 | $36,275 | $77,800 | $24,975 |
| ***Non-Formal Enforcement Action*** | | | | | |
| Notices of Correction issued (NOC) | 101 | 102 | 86 | 83 | 65 |

### Severity of Reported Complaints

Agriculture rates the severity of a case after a complaint investigation is complete.

Of the 15 cases in 2010 with a severity rating of four, eight were issued a Notice of Intent (NOI). All eight were related to pesticide drift. For two cases, Notice of Correction (NOC) was issued for drift. No Action was taken on five cases because the applicator could not be determined, the problem was caused by the complainant, or it was a neighbor dispute with no violation proven. The three cases with a severity rating of five involved the overnight stay at a hospital for further evaluation.

Of the 10 cases in 2011 with a severity rating of four, three were issued NOIs. All 10 were related to pesticide drift. For two cases, NOCs were issued for pesticide drift. No Action was taken on five cases as the applicator could not be determined, the problem was caused by the complainant, or it was a neighbor dispute with no violation proven. The four cases with a severity rating of five involved the overnight stay at a hospital for further evaluation.

Table 24 gives a detailed description of each rating. As in previous years, most complaints (79 percent) received a severity rating of two or less.

**Table 24. Case Severity Ratings, 2007-2011**

| Rating | 2007 | 2008 | 2009 | 2010 | 2011 | Criteria |
|---|---|---|---|---|---|---|
| **0** | 29<br>16% | 18<br>11% | 25<br>17% | 30<br>19% | 22<br>16% | Problem not due to pesticides and/or no cause determined; Structural Pest Inspection with no violations. |
| **1** | 54<br>31% | 67<br>39% | 28<br>19% | 40<br>25% | 30<br>22% | Pesticides involved, no residue, no symptoms occurred; possible pesticide problem, not substantiated; issues involving records, registration, posting, notification (multiple chemical sensitivity) or licensing; DOH classified "unlikely" or "insufficient information". |
| **2** | 57<br>32% | 52<br>30% | 66<br>45% | 54<br>33% | 47<br>34% | Residue found, no health symptoms (human, animal); health symptoms not verified; multiple minor violations; off label use; worker protection violations; PPE violations with no health symptoms; plants with temporary or superficial damage only; Structural Pest Inspection faulty inspections; DOH classified "possible". |
| **3** | 25<br>14% | 21<br>12% | 15<br>10% | 20<br>12% | 25<br>18% | Minor short-term health symptoms (rash, eye irritation, shortness of breath, dizzy, nausea, vomiting); bee kills of less than 25 hives; minor fish kills; economic plant damage under $1000; evidence of deliberate economic fraud; DOH classified "probable". |
| **4** | 10<br>5% | 12<br>7% | 11<br>8% | 15<br>9% | 10<br>7% | Short-term veterinary or hospital care; bee kills of greater than 25 hives; significant fish kills; significant economic plant damage (over $1000); environmental damage; illness involving children; DOH classified "probable". |
| **5** | 2<br>1% | 1<br>1% | 2<br>1% | 3<br>2% | 4<br>3% | Veterinary or hospital care overnight or longer; physician diagnosed children's illness as caused by pesticides; animal death due to pesticides; significant environmental damage; DOH classified "definite". |
| **6** | 0 | 0 | 0 | 0 | 0 | Human death due to pesticides. |
| **Total** | **177** | **171** | **147*** | **162** | **138** | (* plus one case referred) |

## Penalties

Under Agriculture's pesticide violation penalty matrix, the maximum penalty Agriculture may assign is $7,500 per violation and/or 90 days license suspension, or license denial or revocation. The typical penalty for a non-serious, first-time violation is $200 to $500 and a license suspension of two to six days. A first-time violation would, in most cases, result in an NOC and not a civil penalty – unless a repeat violation was identified.

The typical penalty for a first-time human exposure violation is $350 to $550 and a license suspension of five to nine days. Cases with multiple violations or aggravating circumstances have resulted in fines averaging $1,000. Some first-time human exposure cases may proceed directly to civil penalty without an NOC. Agriculture may also refer appropriate cases to EPA for criminal prosecution or civil action.

For more serious infractions, Agriculture follows the penalty matrix for any legal actions as specified in WAC 16-228-1130. Beginning in 2009, violations of the Worker Protection Standards were classified as more serious offences and violators issued NOIs.

Cases that may be taken to court are listed as NOI. The violator may pay the penalty as stated, or the violator has the right to appeal and take the case to court. The court may impose the fine or license suspension given by the agency or it might dismiss the case.

Appeals may take several years to settle, so all cases are listed as NOI in order to complete this report. Final settlement of these cases can be determined by contacting the Department of Agriculture.

# Ecology

## Toxics Cleanup Program: Contaminated Sites Containing Pesticides

Sites can become contaminated from leaking underground petroleum tanks, historic or current pesticide use, spills, or industrial processes. Contaminated sites are placed on a cleanup list and remain on that list until the cleanup is completed, which may be longer than one year.

Six pesticide-contaminated sites in Benton, Chelan, Pierce, Skagit, and Yakima counties were added to the list in 2010. Two of the sites required no further action, three are awaiting cleanup, and one had cleanup started. Two pesticide-contaminated sites in Chelan and Yakima counties were added to the list in 2011. One site is awaiting cleanup and the other required no further action.

There were a total of 251 pesticide-contaminated sites in 2010 and 253 pesticide-contaminated sites in 2011. The status for all sites for 2010 and 2011 is summarized in Table 25.

**Table 25. Status of Pesticide-Contaminated Sites Statewide, 2010-2011**

| Pesticide Contaminated Sites | 2010 | 2011 |
|---|---|---|
| Sites undergoing cleanup at year's end | 112 | 112 |
| Sites with no further action needed | 96 | 97 |
| Sites awaiting further investigation | 43 | 44 |
| Total pesticide contaminated sites for the year | **251** | **253** |

## Water Quality Program: Aquatic Pesticide Permits

Ecology is the delegated Clean Water Act Authority in Washington. Ecology implements the Clean Water Act and associated regulations along with state water pollution control laws. Since 2002, the Water Quality Program at Ecology has regulated the discharge of pesticides to waters of the state through the use of National Pollutant Discharge Elimination System (NPDES) permits. These permits are designed to manage the impacts of pesticide discharge to the aquatic environment. Ecology must balance all beneficial uses of state waters when developing NPDES permits. The data below is collected by Ecology through permit reporting requirements.

## Aquatic Plant and Algae Management NPDES/State General Permit

The Aquatic Plant and Algae Management permit allows the in-water and riparian treatment of state listed noxious weeds, algae (including toxic algae blooms), nutrient inactivation (phosphorous), and native nuisance plants.

Table 26 contains the pesticide use reporting information for herbicides, algaecides, adjuvants, and biological water clarifiers applied in lakes, rivers, and ponds under Ecology's Aquatic Plant and Algae Management permit in 2010 and 2011.

**Table 26. Aquatic Plant and Algae Management Permit, 2010-2011**

| Product Active Ingredient | 2010 Pounds of Active Ingredient Applied | 2011 Pounds of Active Ingredient Applied |
|---|---|---|
| **2,4-D Amine** | 7,220 | 2,550 |
| **2,4-D Ester** | 185 | 152 |
| **Adjuvant** | 56 | 35 |
| **Biological Water Clarifiers** | 201 | 126 |
| **Diquat** | 6,272 | 4,667 |
| **Endothall (dipotassium salt)** | 670 | 69 |
| **Endothall (mono salt)** | 1,641 | 3,342 |
| **Fluridone** | 635 | 620 |
| **Glyphosate** | 1,051 | 140 |
| **Imazapyr** | 27 | 0 |
| **Marker Dyes** | 0 | 1 |
| **Shading Products** | 0 | 6 |
| **Sodium Carbonate Peroxyhydrate** | 480 | 2 |
| **Triclopyr TEA** | 5,582 | 41,301 |
| Total Pounds of Active Ingredient | **24,021** | **53,012** |

## Willapa Bay/Grays Harbor Oyster Growers Association NPDES/State Individual Permit

The Oyster Grower's Permit is an individual permit issued directly to the Willapa Bay/Grays Harbor Oyster Growers Association. It allows the use of carbaryl, an insecticide in the carbamate family, to control burrowing shrimp in oyster beds. The data for 2005 through 2011 are shown in Table 27.

**Table 27. Oyster Growers Permit, Carbaryl Usage, 2007-2011.**

| Year | Acres treated | Pounds of active ingredient used |
|---|---|---|
| **2007** | 555 | **4,438** |
| **2008** | 458 | **3,660** |
| **2009** | 559 | **4,472** |
| **2010** | 489 | **3,913** |
| **2011** | 559 | **4,470** |

From 2007-2011 the Department of Agriculture issued an experimental use permit for use of Imidacloprid. which is in a class of neuro-active insecticides that resembles nicotine. In 2010, 76 pounds of the active ingredient for Imidacloprid were applied experimentally to 65 acres in Willapa Bay. In 2011, 27 pounds of the active ingredient for Imidacloprid were applied experimentally to 51 acres in Willapa Bay.

## Aquatic Noxious Weed Management NPDES/State General Permit

The Noxious Weed Management General Permit is issued to entities participating in noxious weed control efforts. It allows treatment of non-native, state listed noxious and quarantine weeds in riparian areas around freshwater and saltwater throughout Washington. The annual reporting totals are listed in Table 28.

**Table 28. Aquatic Noxious Weed Management NPDES Permit, 2010-2011**

| Product Active Ingredient | 2010 Pounds of Active Ingredient Applied | 2011 Pounds of Active Ingredient Applied |
|---|---|---|
| 2,4-D Amine | 294 | 0.11 |
| Adjuvant(s) | 46 | 81 |
| Diquat Dibromide | 381 | 149 |
| Fluridone | 2 | 0 |
| Glyphosate | 7,536 | 8,459 |
| Imazapyr | 961 | 1,173 |
| Triclopyr TEA | 137 | 137 |
| Total Pounds of Active Ingredient | **9,357** | **9,999.11** |

## Fisheries Resource Management NPDES/State Individual Permit

The Fisheries Resource Management Permit is an individual permit issued to the Department of Fish and Wildlife to apply rotenone, and potassium permanganate (KMnO3) for fish management in Washington lakes. Under this permit, seven lake systems throughout the state were treated with a total of 2,750 pounds of rotenone in 2010 and four lake systems were treated with a total of 4,196 pounds in 2011.Treated lakes were located in Central and Eastern Washington.

## Irrigation System Aquatic Weed Control NPDES/State General Permit

The Irrigation System Aquatic Weed General Permit is issued for products that control weeds and algae in irrigation systems. The permit was issued to 16 of the 97 Washington irrigation districts during the 2010 application season and 17 irrigation districts in the 2011 application season. The permitted districts include approximately 81 percent of the total irrigated land in Washington. The amounts of active ingredients applied in irrigation systems are listed in Table 29.

**Table 29. Irrigation District NPDES General Permit, 2010-2011**

| Irrigation District Aquatic Pesticide Permit Annual Report | | |
|---|---|---|
| | **2010** | **2011** |
| **Pesticide** | **Pounds of Active Ingredient** | **Pounds of Active Ingredient** |
| **Captain (CuCO3)** | 971 | 210 |
| **Copper Sulfate (CuSO4)** | 90,936 | 157,530 |
| **Nautique (Chelated Cu)** | 1,407 | 1,873 |
| **Copper Total** | **93,314** | **159,612** |
| | | |
| **Endothall, Teton** | 327.6 | 943 |
| **Endothall, Cascade** | 80,222 | 78,649 |
| **Endothall Total** | **80,549.5** | **79,592** |
| | | |
| **Acrolein** | 45,108 | 56,436 |
| **Xylene** | 46,353 | 3,486 |
| **Sodium Carbonate** | 138 | 138 |
| **Fluridone** | 4 | 149 |
| **Imazapyr** | 0 | 0 |
| Notes: | Missing 2 Districts | Missing 4 Districts |

## Aquatic Mosquito Control NPDES/State General Permit

The Aquatic Mosquito Control General Permit allows the treatment of vector (disease carrying) and nuisance populations of mosquitoes. The use of larvicides and adulticides is allowed. Coverage may be issued to government entities (such as cities, counties, and mosquito control districts) or commercial pesticide applicators.

Table 30 summarizes statewide 2010 and 2011 application season pesticide totals.

Table 30. Aquatic Mosquito Control NPDES General Permit, 2010-2011

| Pesticide Active Ingredient | Total Pounds of Active Ingredient 2010 | Total Pounds of Active Ingredient 2011 |
|---|---|---|
| *Bacillus sphaericus* | 17,708 | 54,596 |
| *Bacillus thuringiensis* israelensis | 279,192 | 350,161 |
| Etofenprox | 0 | 249 |
| Methoprene | 13,268 | 8,586 |
| Monomolecular surface film | 537 | 71 |
| Naled | 180 | 2,249 |
| Paraffinic white mineral oil | 80,331 | 28,385 |
| Permethrin | 1,374 | 989 |
| Piperonyl Butoxide (PBO) | 204 | 460 |
| Spinosad | 0 | 2,478 |
| Sumithrin | 1,728 | 1,768 |
| Temephos | 0 | 95 |
| **Total** | **394,521** | **450,086** |

### Development of a Proposed *Zostera japonica* (Non-Native Eelgrass) Management NPDES General Permit

In 2013, *Zostera japonica* (non-native eelgrass) will be designated as a class C noxious weed statewide. Willapa Bay shellfish growers requested that Ecology develop a permit that would allow them to control this non-native eelgrass using the herbicide Imazamox. Ecology is in the process of developing an NPDES permit that would allow use of the herbicide Imazamox to control *Z. japonica* on commercially managed clam beds in Willapa Bay.

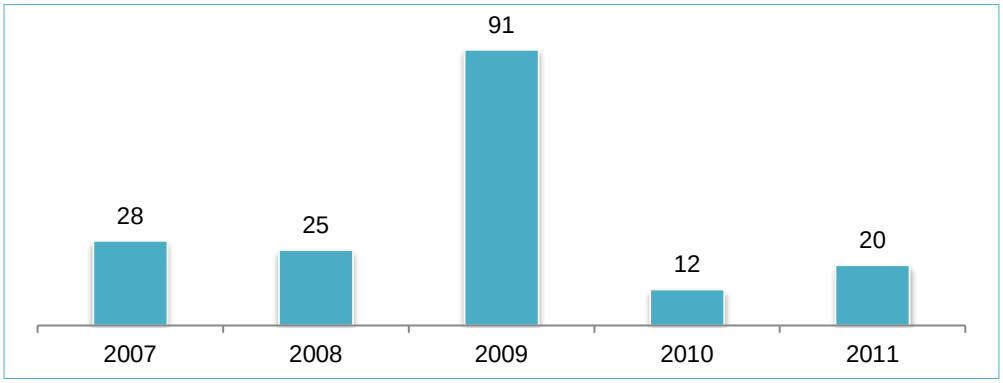
## Labor and Industries

### Enforcement and Consultation

The Division of Occupational Safety and Health investigators may issue citations requiring employers to implement changes in their programs to enforce safety and health requirements in the workplace. Washington Industrial Safety and Health Act violations are typically categorized as either “serious” or “general.” All violations require employers to implement changes in the workplace and provide Labor and Industries confirmation of these corrections. Inspections conducted by Labor and Industries can result in citing several different violations that may be classified as either serious or general. This section summarizes the results of pesticide-related safety and health inspections conducted by Labor and Industries.

Figure 9 shows the number of workplace safety and health inspections from 2007 through 2011.

**Figure 9. Labor and Industries Workplace Safety and Health Inspections, 2007-2011**

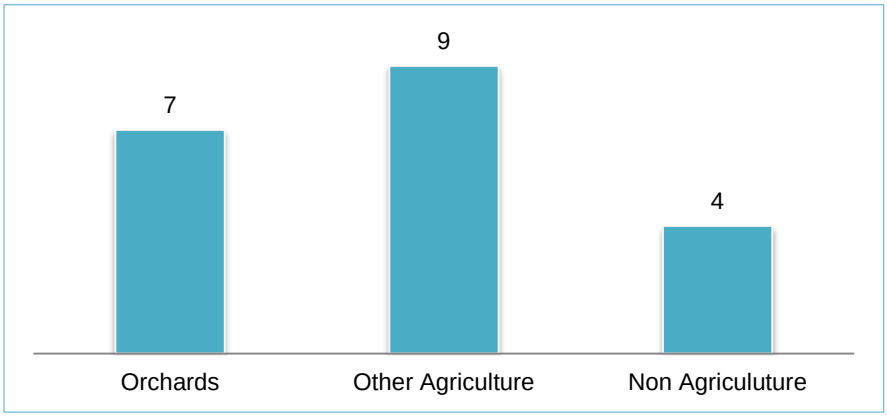



In 2010, 24 inspections were possibly related to pesticides. Of those 24 inspections, 12 resulted in a citation. These inspections were conducted throughout the state with eight (67 percent) located in eastern Washington. Three (25 percent) were located in western Washington and one (8 percent) was in central Washington. Of the 12 pesticide-related Labor and Industries inspections, seven were referrals from sources such as state agencies, health care providers, or the public. One inspection was conducted during a response to an unrelated accident, and the other remaining five inspections were unannounced and initiated by Labor and Industries. All 12 inspections involved the agricultural industry.

In 2011, 25 inspections were possibly related to pesticides. Of those, 20 resulted in a citation. Twelve (60 percent) of the 20 inspections were located in eastern Washington and eight (40 percent) were located in western Washington. Of the 20 pesticide-related Labor and Industries inspections, nine were referrals from sources such as state agencies, health care providers, or the public. One inspection was a complaint and the other remaining 10 inspections were unannounced and initiated by Labor and Industries. Sixteen inspections occurred in the agricultural environments and four occurred in general industry.

Figure 10 shows the number of safety inspections performed by Labor and Industries by type of workplace for 2011.

**Figure 10. Labor and Industries Inspections by Type of Workplace, 2011**



## Inspections Involving Violations

In 2010, Labor and Industries conducted 12 inspections involving citations related to pesticide use. Labor and Industries assessed monetary penalties totaling $4,300 for 10 serious pesticide-related violations from six of the 12 inspections. There were 56 general pesticide-related violations which had no assessed penalties — these were cited on all 12 inspections. The 10 serious violations resulted in a total monetary penalty of $4,300 with an average penalty of $430 per serious violation.

In 2011, Labor and Industries conducted 20 inspections involving citations related to pesticide use. Monetary penalties totaling $20,070 were assessed for 36 serious pesticide-related violations from 12 of the 20 total inspections with an average penalty of $558 per violation. There were 127 general pesticide-related violations, which had one assessed penalty of $200.

The most frequent type of serious and general Washington Industrial Safety and Health Act violations cited in 2010 and 2011 were the following:

- Respirator deficiencies, including no respirator program, improper storage or cleaning of respirators, no medical evaluations of worker's ability to wear a respirator, or no respirator fit-testing.
- Hazard communication deficiencies in safety programs, including missing written programs, chemical inventories, or material safety data sheets, no employee training; or insufficient chemical labeling
- Accident prevention program deficiencies.
- Employees not trained about pesticides, the hazards, or field sanitation.
- No emergency eyewash provided.
- Deficiencies in appropriate personal protective equipment.
- No hand-washing facilities or toilet.
- No required safety committee or safety meetings.
- Not posting safety, emergency, or pesticide spray information as required.
- Incomplete pesticide inventory.
- No decontamination supplies.
- Inadequacies in the cholinesterase monitoring program.
- Improper use of product, rather than as directed by the label.

# Ecology and the Environment

## Ecology

### Surface Water Pesticide Monitoring in Salmonid-Bearing Streams

The report, *Surface Water Monitoring Program for Pesticides in Salmon-Bearing Streams, 2009-2011 Triennial Report*, includes a full discussion of the 2009-2011 results. This report is available online.

As a part of this monitoring project, annual data summary reports were published describing 2009 and 2010 data. Two special studies were also published during 2009-2010.

*Skagit-Samish Basin Intensive Surface Water Sampling for Pesticides in Salmon-Bearing Streams, 2009*. Publication No. 10-03-043. Pesticide results from three sampling areas were compared during 2009: weekly sampling, daily sampling for seven consecutive days, and continuous sampling using a continuous low-level aquatic monitor.

*Surface Water Monitoring Program for Pesticides in Salmon-Bearing Streams: DH-81 and Grab Sample Comparison Study* (Publication No. 11-03-066). 2011 comparison study of two pesticide sampling methods: sampling using a DH-81 depth-integrating sampler and side-by-side grab sampling. No significant difference was discovered between the two.

These publications are on Ecology's website.

### Other Pesticide Related Water Quality Studies Published during 2010-2011:

- *Grayland Ditch: An Evaluation of Organophosphate Pesticides and Pesticide Test Kits* (Publication No. 10-03-012). Organophosphate pesticide monitoring in cranberry growing areas located between Grayland (Grays Harbor County) and North Cove (Pacific County) on the Washington coast in 2009. Cranberry farmers have been implementing management practices to reduce the amount of organophosphate pesticides in the Grayland ditch system. While some improvements have been made, concentrations of chlorpyrifos and diazinon don't meet water quality standards. Two organophosphate pesticide test kits were evaluated to determine if they could be used by growers as a less expensive tool for evaluating organophosphate pesticides. Neither test kit was helpful in evaluating organophosphate pesticide levels. This publication is available on Ecology's website.
- *Yakima River Pesticides and PCBs Total Maximum Daily Load, Volume 1. Water Quality Study Findings* (Publication No. 10-03-018). The Yakima River and several of its tributaries and irrigation returns is on the federal Clean Water Act 303(d) list for not meeting Washington water quality standards for

a range of chemical contaminants. The chemicals include six legacy pesticides or breakdown products (DDT, DDE, DDD, dieldrin, chlordane, and alpha-BHC), two current-use insecticides (endosulfan and chlorpyrifos), polychlorinated biphenyls (PCBs), and dioxin (2, 3, 7, 8-TCDD). The water quality study analyzed 303(d) pesticides, PCBs, suspended sediment, and turbidity in surface waters, municipal wastewater treatment plant effluents, fruit packer and vegetable processor effluents, and urban storm water runoff. The chemical analysis was expanded to include toxaphene, an unlisted legacy pesticide detected in the fish tissue survey. This report describes how the study was conducted and analyzes the data in terms of compliance with water quality criteria, temporal and seasonal patterns, trends, pollutant loading, and the relative importance of sources. This Yakima River publication is posted online.

- *Washington State Toxics Monitoring Program: Trend Monitoring for Chlorinated Pesticides, PCBs, PAHs, and PBDEs in Washington's Rivers and Lakes, 2008*.( Publication No. 10-03-027). Trend monitoring of 12 statewide sites for persistent bioaccumulative and toxic (PBT) chemicals including chlorinated pesticides. Chemicals frequently detected were PCBs, polybrominated diphenyl ethers (PBDEs), polycyclic aromatic hydrocarbons (PAHs), and the pesticides DDT, endosulfan, and wood preservative degradate: pentachloroanisole. All sites except the reference site failed to meet one or more Washington or EPA water quality criteria for PCBs, DDE, toxaphene, and dieldrin. This Toxics Monitoring Program publication is posted online
- *Potholes Reservoir: Screening Survey for Dieldrin, Other Chlorinated Pesticides, and PCBs in Fish, Water, and Sediments* (Publication No. 10-03-053). 2007-08 study of Potholes Reservoir and major wasteways for chlorinated pesticides, and PCBs in fish, water, and sediments. Dieldrin, total PCBs, and 4,4'-DDE did not meet EPA National Toxics Rule human health criteria for consumption of fish. Dieldrin was detected in surface water only during the non-irrigation season. Dieldrin and other contaminants in surface water met water quality criteria and dieldrin was not detected in surface sediments. This publication is on the Department of Ecology website.
- *Control of Toxic Chemicals in Puget Sound: Characterization of Toxic Chemicals in Puget Sound and Major Tributaries, 2009-10* (Publication No. 11-03-008). 2009-2010 study to address data gaps identified by the Puget Sound Toxics Box Model. Samples were collected from the marine water column and five major rivers discharging to Puget Sound and analyzed for various toxic chemicals including chlorinated pesticides. Many were present in low concentrations but others were seldom if ever detected. Marine water concentrations were used to evaluate exchange of toxic chemicals between Puget Sound and the ocean. Most chemicals, except for cadmium, appeared to be exported from Puget Sound. River water concentrations and flows were

used to calculate daily loads of toxic chemicals. The Control of Toxic Chemicals in Puget Sound publication is posted online.

- *Lower Okanogan River Basin DDT and PCB Total Maximum Daily Load: Water Quality Effectiveness Monitoring Report* )Publication No. 11-03-009). DDT and PCB concentrations in composite fish tissue samples collected from the Lower Okanogan River in 2001 were compared against a similar data set collected in 2008. The number of samples not meeting (exceeding) National Toxics Rule criteria was similar between the 2001 and 2008 studies. No carp specimens were obtained from the lower reach in 2001 due to unavailability. However, large specimens of carp collected from this reach in 2008 had elevated concentrations of total DDT. The Lower Okanogan River Basin publication is available online.
- *Toxics in Surface Runoff to Puget Sound: Phase 3 Data and Load Estimates* (Publication No. 11-03-010). This publication on Puyallup and Snohomish watershed sampling of 16 streams for heavy metals and organic compounds, including pesticides, in 2009-2010 is on Ecology's website.
- *Washington State Toxics Monitoring Program: Monitoring with SPMDs for PBTs in Washington Waters in 2009* (Publication No. 11-03-029). Third year (2009) monitoring results for persistent bioaccumulative toxic (PBT) chemicals include chlorinated and other select pesticides. The water bodies monitored in 2009 did not meet water quality criteria for PCBs, toxaphene, and DDE. This publication can be found online.
- *EDB and 1,2-DCP in Domestic Groundwater Supplies, Follow-Up Investigation: Bertrand Creek Area (Whatcom County)* (Publication No. 11-03-050). This 2008 follow-up study presents pesticide groundwater sampling results for 32 domestic wells. Pesticides were detected in 59 percent of the wells sampled. Six wells did not meet the drinking water standard for ethylene dibromide (EDB) and one well did not meet the drinking water standard for 1,2-dichloropropane (1,2-DCP). This publication on the Bertrand Creek Area of Whatcom County is posted online.

- *Pyrethroids in Freshwater Sediments of King County*. (Publication No. 11-03-061). Pyrethroid sediment screening study of freshwater streams in urbanized King County in 2010. The most frequently detected pyrethroid pesticide was bifenthrin, detected at eight of the 20 sites sampled. Pyrethroids in Freshwater Sediments of King County is on Ecology's website.
- *PCB, Dioxin, and Chlorinated Pesticide Sources to Vancouver Lake* (Publication No. 11-03-063). Vancouver Lake tributary sampling for PCBs, dioxin, and chlorinated pesticides in 2010. Many chlorinated pesticides were detected, but only dieldrin from Burnt Bridge Creek exceeded numeric criteria. This Vancouver Lake tributaries report is published online.
- *Focus on Fish Testing: Snake River fish Tested for Chemicals* (Publication No. 11-03-067). Fish sampling results from 2009 of six sites on the Snake River for mercury, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and polychlorinated dibenzo-p-dioxins, furans, and chlorinated pesticides (DDT and degradates, dieldrin, and toxaphene). None of the six sites met water quality standards because of elevated levels of contaminants in one or more species of fish. This Snake River fish testing publication is available online.

# Prevention, Research and Education

## Agriculture

Agriculture's Farmworker Education Program provides pesticide safety training directly to thousands of farm workers and indirectly to many more through their "Train the Trainer" program and partnerships with employers and groups. While Agriculture's training focuses primarily on farm workers who handle and apply pesticides, the program also provides some training to workers who work in fields and orchards where pesticides were applied. Most training is conducted in partnership with agricultural organizations, growers, and non-profit organizations.

In Fiscal Year 2011(FY11), partners included the Washington State Migrant Council, Farm Bureau, Growers Clearing House, Association of Wine Grape Growers, and individual growers/employers. The program also partners with Labor and Industries, Health, Washington State Department of Employment Security, Washington State University, University of Washington, and community colleges.

Training programs include **Worker Protection Standard (WPS) Training**. Agricultural employers are required to provide specific protections and training to their employees who work with pesticides or in recently treated fields, nurseries, and greenhouses. Agriculture provides a variety of training programs on WPS.

- WPS Worker Training: Two four-hour pesticide safety training sessions for farmworkers covered by WPS. In 2011, Agriculture trainers also spent considerable time planning and participating in safety and health fairs aimed at farm workers.
- WPS Hands-on Handler Training: Full-day workshop for pesticide handlers on safe pesticide handling techniques. The workshops provide practical, hands-on training in mixing and loading, personal protective equipment, proper application techniques, and clean up and disposal. In 2011, 530 handlers received training at 13 sessions. In addition, 70 individuals were trained using components tailored specifically for supervisors of pesticide handlers. This new curriculum was the result of a collaborative project between Agriculture, Health, Labor and Industries, and the Pacific Northwest Agricultural Safety and Health Center. It included brainstorming sessions with handlers and supervisors. The information collected revealed that supervisors could better protect their handler employees if they had more knowledge and skill in selecting, maintaining, and properly wearing personal protective equipment and respirators.
- WPS Train-the-Trainer Training: This one-day workshop prepares trainers from farms and orchards to effectively deliver WPS-mandated pesticide safety training to their employees. Participants learn what topics must be

covered, effective training methods, how to handle cultural differences, and how to create a good learning environment. During 2011, the Farmworker Education Program conducted three Train-the-Trainer workshops for trainers from 22 separate agricultural employers. Agriculture inspectors find that farms that employ an individual who has completed this training have greater compliance with WPS.

- Pesticide Licensing Training: Some farmworkers must have a pesticide applicator license from Agriculture to perform their work duties. Licensing requires passing a written test. Maintaining a license requires earning continuing education credits or re-passing the test every five years. The Farmworker Education Program provides Spanish-language training to help farm workers obtain and maintain needed pesticide licenses:
    - Pre-license training: This is a six-day, two-hour-per-day intensive course that covers pesticide law, safety, and application techniques. It prepares participants for the Private Applicator pesticide exam. In 2011, Agriculture sponsored nine pre-licensing courses that had 323 participants.
    - Recertification: Agriculture trainers are involved in planning, organizing, coordinating, or presenting Spanish-language continuing education programs on a range of topics including pesticide safety, pest control, and integrated pest management. Many of these recertification courses are conducted in cooperation with agricultural industry groups, providing information particularly relevant to the target audience. Because of the time invested in this effort, the number and quality of Spanish-language recertification courses has improved dramatically over the past decade. For example, in calendar year 2010, there were 66 Spanish-language recertification sessions with a total attendance of 3,587.

In addition to these workshops and training sessions, Agriculture Farmworker Education specialists provide trainings requested by growers on such topics as properly using personal protective equipment, calibrating air blast sprayers, combating heat stress, and performing respirator-fit tests. The training is conducted onsite, is as interactive and hands-on as possible, and is specifically targeted to the needs of the farm. This training is often conducted following an inspection by Agriculture and assists growers to come into compliance with pesticide law.

Agriculture trainers also regularly participate in radio programs providing pesticide safety information to the farmworker community, translate materials into Spanish, and work with other agencies, farmworker advocacy groups, and the agricultural community to address farmworker safety issues.

# University of Washington

The University of Washington, School of Public Health houses the Pacific Northwest Agricultural Safety and Health Center (PNASH). The center conducts research and promotes best health and safety practices for Northwest farming, fishing, and forestry. PNASH's goal is to prevent or reduce injury and illness for producers, workers, and their families. The center is affiliated with the National Institute for Occupational Safety and Health (NIOSH) Centers for Research and Prevention, and works in a group of multiple disciplines, institutions, and community partners throughout the Northwest. Pesticide exposure in agriculture is one of the focus areas for PNASH.

## New Study Findings

**Risk Factors for Pesticide Handler Exposure**

PNASH researchers discovered that workers' behavioral practices, such as the availability and use of protective equipment, can dramatically impact their pesticide exposure levels. Results of a five-year study led by PNASH identified several activity risk factors for pesticide overexposure that lead to cholinesterase inhibition: cleaning spray equipment, mixing/loading pesticides, and not using a locker to store personal protective equipment. Protective factors included wearing a full-face respirator and wearing chemical-resistant footwear. These findings helped develop workplace-based solutions to reduce exposures.

**Measuring Exposure**

Scientists at PNASH developed an improved cholinesterase test called the oxime reactive test. It helps diagnose acute organophosphorus (OP) pesticide poisonings when a person comes into an emergency clinic with pesticide poisoning symptoms. The test increases diagnostic accuracy and identifies the specific pesticide that caused the exposure.

Researchers also developed a process to detect exposures to OP pesticides at low levels more reliably than using the original cholinesterase test. The process uses tandem mass spectrometry to assess protein adducts in the blood of exposed workers.

**Genetic Risk and Overexposure Susceptibility**

PNASH researchers compared levels of an enzyme in our bodies that play an important role in breaking down certain OP pesticides into less toxic forms to the results of cholinesterase monitoring results of pesticide handlers. Differences were found in the level of serum cholinesterase inhibition by the enzyme genotype, suggesting that some pesticide handlers were able to metabolize OP pesticides better than others, and that people with high enzyme activity had less cholinesterase inhibition than those with low enzyme activity. This is the first time that a study of a working population has demonstrated the validity of the assumptions behind the enzyme's effect on pesticide overexposure susceptibility. Research suggests that paraoxonase 1 (PON1) levels and how efficiently the enzyme can detoxify reagents may be based on a person's genotype.

### New Products

**Practical Solutions for Pesticide Safety**
The Practical Solutions for Pesticide Safety guide, available in English and Spanish, is a collection of 24 solutions and ideas identified on farms and developed in partnership with farmers, educators and researchers in Washington. The safety guide is available on the University of Washington's website.

**Fluorescent Tracer Training - Hands on Learning**
Pesticide safety trainers use the fluorescent tracer (FT) as a powerful tool for mimicking pesticide contamination and helping workers self-evaluate their personal practices and protective equipment. Online resources include a kit, manual, and video.

**Pesticide Worker Education Packet**
This packet, with make-your-own instructions, is available online.

### Future Work

In the field of pesticide research, PNASH will:

- Continue its biomonitoring work to develop a test that provides greater sensitivity and specificity compared to traditional cholinesterase monitoring — eliminating the need for collection of a baseline pre-exposure blood sample from each worker.
- In partnership with Washington State University, evaluate pesticide application technologies under development and an integrated pest management project to reduce pyrethroid pesticide exposures.

## Washington State University

### Apple Integrated Pest Management (IPM) Transition Project

This project represents an ongoing effort over a four year period, 2008-2011. The first two years were funded by an allocation to the Washington Tree Fruit Research Commission from the state legislature for the Pest Management Transition Project. In the last two years, the Apple IPM Transition Project was supported by the Department of Agriculture's Specialty Crop Block Grant Program.

A principal driving issue for the initial Pest Management Transition Project and later Apple IPM Transition Project was the EPA's decision to phase-out the use of azinphosmethy (AZM) in tree fruit production. AZM has been the single most used insecticide in apple production over the past four decades, primarily for control of the codling moth — the key pest of the apple. Replacements for AZM and other organophosphate insecticides had been or were in the process of being registered by EPA. The project helped Washington's tree fruit industry safely transition to organophosphate (OP)-alternatives.

The Apple IPM Transition Project Final Performance Report is posted online.

Here are highlights from the report:

The overarching goals of the original Pest Management Transition Project and subsequent Apple IPM Transition Project were to enhance and increase adoption of new IPM technologies and practices; leave a legacy that will transcend the project and document how the project has changed perceptions and practices.

The project carried out educational activities through meetings, newsletters, field days, focused training, and self-selected groups called Implementation Units. These Implementation Units consisted of apple growers, orchard managers, and consultants (136 total), located throughout the apple growing regions of Washington. They represented more than 94,000 acres of apple production (55 percent) in the state. The project made great strides in helping the Washington Tree Fruit industry implement best practices using OP alternatives and provided needed baseline data about practices and perceptions of growers and crop consultants.

Much data were collected via grower and consultant surveys during the implementation of the project. Four major surveys were conducted over four years, documenting the project's ability to meet established goals.

Highlights include:

- Growers and crop consultants were concerned that using the OP-alternatives would cost 1.5 to 3 times more per acre than the old IPM tools.
- They were also concerned that using OP-alternatives would be less effective than the older insecticides they had been using.
- Their concerns were valid but after receiving education on the benefits and safety they began to accept and trust the new OP-alternatives.
- The survey results showed that there was a nine percent decrease in the use of OP insecticides reported by growers between 2008 and 2010, and there was a 40 percent decrease in the recommendations for use of OPs by consultants between 2007 and 2009.
- When growers were asked what they knew about the AZM phase-out schedule almost all (99 percent) were aware of it but in 2008 only 35 percent knew that the last year they could use AZM was 2012.
- In 2010, 54 percent of the growers knew that 2012 was the last year they could use AZM.
- In 2008 and 2012 65 percent of growers indicated that they were decreasing the use of AZM and six percent more growers said that they had completely stopped using AZM.
- Most consultants (95-98 percent) recommended use of pheromones for control of codling moth.
- The percent of growers reportedly using pheromones went from 65 percent to 68 percent in 2008 to 2010, respectively. However, based on the total

apple acres managed by respondents in 2010, an estimated 86 percent of bearing apple acres is being treated with pheromones.

- While changes reflected in these surveys might seem small they represent a large reduction in use of OP insecticides by the apple industry, a trend that has continued though the project has now officially terminated.

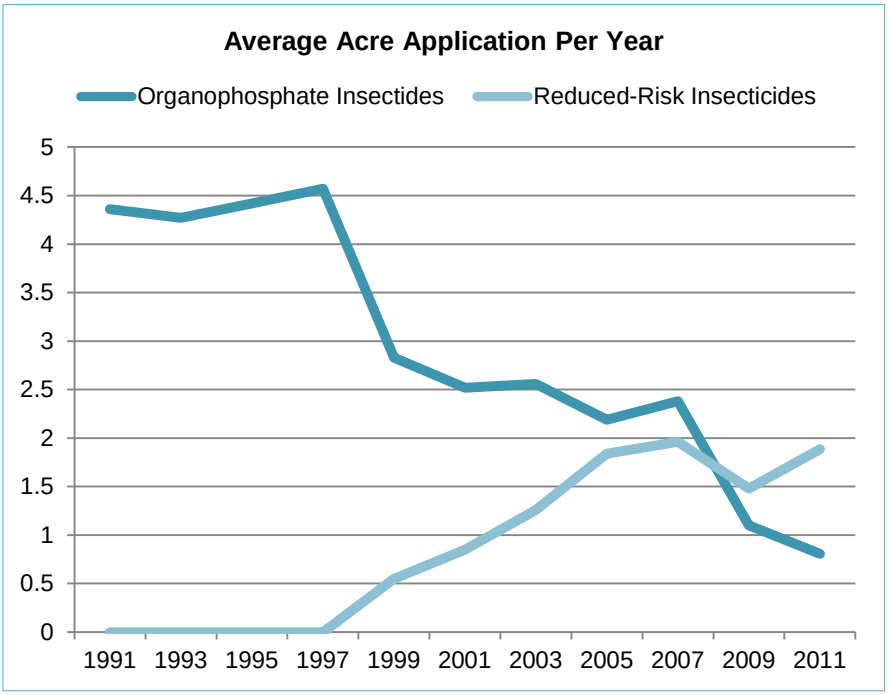
## Organophosphate Use

The Pest Management Transition Project used information from the independent third-party group, National Agricultural Statistics Service (NASS), as additional validation of the change in use of OP and OP-alternatives by Washington's apple growers. These surveys contain pesticides use data from apples for every other year since 1991. These data allowed the transition project to view changes for several years prior to the start of the project as well as during the project. Figure 11 shows the number of OP and OP-alternative applications used per acre on Washington apple orchards from 1991 through 2011. An acre application is the average number of applications of a pesticide, or pesticide group, applied to one acre of a crop. Acre application values are used to compare the use of different products, or pesticide groupings, instead of pounds of pesticides because newer products are used in much lower amounts per acre than older products.

During most of the 1990s an average of 4.5 acre applications of OP insecticides was made per year. The use of OP insecticides declined in the late 1990s due to regulatory action and the adoption of pheromones as a key control for codling moth. During this same time the use of OP-alternatives began to increase as new products were registered for apples. The use of OP insecticides dropped dramatically between 2007 and 2009 with an additional dramatic decline between 2009 and 2011. The pounds of OP insecticides declined from 499,000 in 2007 to 202,000 in 2011, a decline of 60 percent in four years. From 2005 to 2011, the use of OP-alternatives stayed around 1.5 and 2.0 acre applications. The total pounds of OP-alternative insecticides used in 2009 and 2011 were only 35,400 and 31,300, respectively. These data summarize the changes in the use of OP insecticides in apple IPM in Washington. Some of these changes are because of regulatory action, but many of them occurred because growers and consultants were well educated by the Pest Management Transition Project on the benefits of using OP-alternative pesticides.

Figure 11 shows the rate of organophosphate and reduced risk insecticides from 1991 through 2011. These data show a dramatic transition from OPs to alternatives.

**Figure 11. Acre Applications of Organophosphate and OP Alternative Insecticide in WA Apple Orchards Based on NASS Data.**




## WSU Urban Integrated Pest Management and Pesticide Safety Education

In 2011, the Urban Integrated Pest Management (UIPM) and Pesticide Safety Education Program (PSEP) training focused on basic pesticide laws, personal and environmental safety, safe handling, application principles, and integrated pest management.

- Growers and crop consultants were concerned that using the OP-alternatives would cost 1.5 to 3 times more per acre than the old IPM tools.
- Pre-license Training. Study manuals support applicator candidates in their preparation for taking the state Department of Agriculture's pesticide license exams. WSU distributed more than8,000 copies in 2011 and updated three manuals: Agricultural Weed Management Principles, Public Health Pest Control, and Manual Para Aplicadores Privados de Pesticidas. The UIPM&PSEP provided 24 days (7,900 hours) of training in 11 different cities. The Department of Agriculture reported that 1,102 exams were taken and 784 (71 percent) exams were passed, which is significantly higher than the rate for those not attending the class.
- Recertification Training. For those already certified as pesticide applicators, UIPM&PSEP provided 36 days (29,000 hours) of training in 19 cities. Eleven basic pesticide-core topics were covered, including:
    - Label Compliance Cases
    - Label Jeopardy

- Long-Term Residual Herbicides
- Pesticide Exposure
- Pesticide Storage
- Recordkeeping
- National Pesticide Information Center
- NIOSH PPE Assessment
- No Spray Buffer Zones
- Honeybee Colony Collapse Disorder
- Pesticide Impacts on Threatened Species

Eleven pest management topics were addressed.

- Genetically-Engineered Crops/Turf Insect Outbreaks
- Spotted Wing Drosophila
- IPM in Schools
- Landscape IPM:
  - The Seattle University Model
  - Managing Moles and Other Wildlife
  - Turf Management
  - Noxious Weed Board Update
  - Understanding Insects

Another 25 days (4,600 hours) of hands-on training in 20 cities was provided for dealer managers, landscape professionals, pest management professionals, and structural pest inspectors. One aerial application fly-in was held for 12 planes/pilots to assess their droplet spectrum and spray pattern deposition. Twenty-eight one-credit, online recertification training modules were available and 2,338 were purchased with the majority by Washington licensed applicators.

WSU County Extension Educators are also a major contributor to pesticide training by sponsoring their own recertification meetings, working with other course sponsors on agendas/speakers, or giving presentations themselves. Several researchers and extension specialists give presentations. A few WSU County Extension Offices offer pre-license training for private applicators and most counties offer private applicators the opportunity to take exams by appointment.

To address the non-certified applicator, UIPM&PSEP focused on two major areas: Pestsense/Hortsense web-based home/garden fact sheets and the School IPM initiative. Pestsense/Hortsense Fact Sheet access provides unbiased pest management recommendations (and links to pesticide safety information) to homeowners and Master Gardeners. Hortsense had more than one million hits and

66,000 visitors, while Pestsense had more than 202,000 hits and 21,000 visitors. The School IPM Initiative addresses education and adoption of IPM in Washington's K-12 school districts, including basic outreach and technical assistance on School IPM, working closely with school districts that are interested in becoming IPM STAR Certified, and building a School IPM Coalition. The overall purpose of this project is to reduce the risks associated with pesticide use in schools.