Oregon Health Authority: Public Health - Office of Environmental Public Health

DESCRIPTIVE ANALYSIS OF PEST CASES

2002–2007

FINAL REPORT
Approved by Dave Leland, Acting Administrator,
Office of Environmental Public Health – February 22, 2010

Pesticide Exposure, Safety and Tracking Program
Office of Environmental Public Health, Public Health Division
Oregon Health Authority

TABLE OF CONTENTS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Informed decisions about pesticide use and policy are only possible if residents, policy makers, advocates, and state agencies have a basic understanding of the nature and magnitude of acute pesticide exposures in the state of Oregon. An analysis has not been conducted of acute pesticide exposures reported to the Pesticide Exposure, Safety and Tracking (PEST) Program since cases reported in 2001 were analyzed in 2003. As a result, an Oregon Public Health Division (OPHD) analysis of acute pesticide exposure data to inform policy decisions has not been available.

PEST conducted a basic descriptive analysis of 689 cases out of the 1038 cases reported from 2002 through 2007. PEST analyzed this subset of cases because they were classified having a "likely" connection between the reported pesticide release and an individual's reported signs and symptoms. Variables relating to the following were assessed: sex, age group, categories of signs and symptoms, illness severity, pesticide event and illness geography (by Oregon county), location types of events and exposures, occupational activities engaged in when exposed, reported intended targets of applications, routes of exposure, types of exposure, reported exposures by month and year, initial source of exposure reporting, and classes of pesticide products reportedly involved.

The findings resulted in six key observations regarding these 689 "likely" cases:

- The majority of pesticide exposures and events occur in the home;
- Pesticide applications to buildings, including houses, account for the largest proportions of pesticide events that lead to pesticide exposures;
- Pesticide events and exposures are disproportionately burdening some rural counties in Oregon;
- The reporting of suspected or confirmed cases of pesticide exposures by health care providers, as required under disease reporting statues, did not often occur despite the substantial portion of "likely" cases being treated at medical facilities;
- Most occupational exposures occurred to employee bystanders who are **not** directly working with pesticides; and
- The available data do not include information that provides insight on the behaviors that commonly lead to misapplication.

METHODOLOGY

METHODOLOGY

Reports made to the PEST Program from 2002 through 2007 from a variety of sources meeting specific PEST case criteria were included in this analysis. PEST's case criteria are:

- One ocular (eye) or one dermal (skin) sign or symptom[1], or;
- Two systemic signs or symptoms (e.g. headache, rapid heart beat, shortness of breathe, etc.), or;
- A referral from the Pesticide Analytical Response Center (PARC) [www.oregon.gov/ODA/PEST/parc.shtml].

PARC is a board of eight state agencies, created under executive order, which tracks and identifies trends in pesticide-related incidents in Oregon. OPHD is a charter member of PARC.

In the study period, PEST received 1708 reports of acute pesticide exposure. An "exposure" is defined as an acute onset of symptoms that is attributed to a pesticide "event"; defined here as a single, specific release of a pesticide product. Of those 1708 reports received, 1038 individual cases of reported acute pesticide exposure in humans met PEST's case criteria, and were classified using case classification criteria developed by National Institute for Occupational Safety & Health (NIOSH) for the Sentinel Event Notification System for Occupational Risk (SENSOR) program (www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_revAPR2005.pdf).

Connecting a specific pesticide event with an individual's signs and symptoms

To aid in classifying a reported case of acute human pesticide exposure, PEST assesses the likelihood of an association between a person's symptoms, the toxicology of a formulated product, and the person's reported exposure to it. Information from the reporting source is used, and is combined with data gathered during investigations conducted by PEST when resources permit.

Obtaining information on the specific pesticide product implicated in the exposure and the signs and symptoms experienced by an individual are critical

1 – By definition, a symptom is any subjective evidence of disease like "pain" that only a patient can perceive, whereas a sign is objective evidence of disease like a "rash," which health care provider or others can observe.

for at least two reasons. First, the signs and symptoms of "pesticide exposure" are quite general and can mimic other health problems (i.e., like those of a cold, flu, or allergies, etc.) There are few "tell-tale" signs or symptoms that are *unique* to pesticide exposure. A person who reports knowledge of a pesticide event and then has symptoms may not have been actually poisoned: such symptoms could result from a disease that produces similar symptoms, but is not pesticide-related. So demonstrating how likely the pathway of association is between the individual's symptoms and the pesticide event is not only important for demonstrating that a pesticide exposure took place, it also may rule out other health conditions, which could be more serious.

Second, the term "pesticide" is a generic term used to denote a wide range of categories of products (like herbicides, rodenticides, disinfectants, etc.) used to control or kill "pests" – unwanted plants, insects, rodents, or other forms of life like algae and bacteria. Within each category are specific active ingredients (AI) that have been chosen to mitigate specific pests. Each of those AI can produce specific symptoms in humans who are acutely exposed to them.

The only reliable source of information allowing access to the names of active ingredients and their concentrations is a product's EPA registration number. This "EPA Reg. No." is the official identifier assigned to pesticides regulated by the Environmental Protection Agency and is, by law, located on the label of pesticide products.

Because of the general nature of symptoms of acute pesticide exposure as well as the *specific* symptoms produced by active ingredients which may *differ* from one another, an attempt to construct a pathway of association linking exposure to symptoms reported must be done to ensure that the burden of acute pesticide exposure on Oregonians is reported accurately.

Specific variables needed to construct such a pathway include the following: the toxicity of a pesticide product, the duration of *time* an individual spent in proximity to the product during application as well and their *distance* from the application; the use of personal protective equipment (e.g. goggles, respirator, gloves, pants, etc.); the reported *route* of a person's exposure (through the skin, inhaled, etc.); weather patterns, if available; and the period of time that elapsed between exposure and the onset of symptoms and the duration of symptoms.

PEST investigations and classification of cases

PEST uses interviews with those who report exposures, bystanders to such exposures, investigative reports from other agencies, and medical records to assess the likelihood of a completed exposure pathway as described above. This information is used is used to classify the *likelihood* of exposure with SENSOR case classification criteria to assess the association between the reported health effects and a pesticide event.

These criteria may not perfectly capture exposures as they truly occurred; no criteria will. But it's the most widely used criteria in the United States for assessing acute pesticide exposures. Moreover, its use allows the burden of acute occupational pesticide exposure in Oregon to be compared to that in other states and brought to the attention of national policy-makers.

PEST defines aspects of each reported case using variables in NIOSH-SENSOR's Standardized Variables for State Surveillance of Pesticide Illness and Injury **(www.cdc.gov/niosh/topics/pesticides/pdfs/SV_081506.pdf).** Table 1 is a quick-reference guide for definitions for many of the variables used in this analysis.

After a case is classified as "likely", PEST uses NIOSH SENSOR's Severity Index www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf as a simple, standardized way to assign illness severity. Doing so is important for being able to evaluate the burden of acute pesticide exposure on Oregonians.

Analytical methodology

Frequencies and cross-tabulations of select variables were examined using the analytic software package SPSS 15.0. ArcGIS 9.3 geographic software was used to display pesticide events and exposures by Oregon county, and to compute per capita rates (per 100,000 people) per county.

Table 1
Quick-reference guide to select variables queried

Query	Page number in *Standardized Variables*
Signs and symptoms of "likely" cases	pp. 37-45
Location type of pesticide events and exposures	pp. 20-22
Occupational exposures and activities engaged in when exposed	p. 14
Intended target definitions	pp. 17-20
Routes of exposure	pp. 12-14
Types of exposure	pp. 9-12
Source of initial reporting for cases	pp. 4-5

LIMITATIONS

LIMITATIONS

Reporting sources of data

As discussed below, the data available to PEST is not always complete due to the nature of the reporting sources. Since over three-fourths of case information reported to PEST were collected to serve an emergency situation, data for a number of variables used to track and classify acute pesticide exposures (e.g. age, county of exposure, the exact pesticide product suspected, medical records, etc.) are not always available.

Although PEST receives all cases reported to the OPC, these cases do not represent a complete census of all acute pesticide exposures in Oregon. Nationally, it is known that pesticide exposures are unrecognized and/or unreported

Specification of pesticide's EPA Registration Number

Another potential limitation of PEST's data is the lack consistency in specifying the exact EPA Registration Number. For example, in the past when EPA Registration Number was not reported to PEST staff, an incorrect EPA Registration Number may have been chosen from a menu in the database for a pesticide product suspected for being responsible; resulting in inconsistencies of active ingredients and known toxicity of a product. Knowing the brand name of a product or the class of the product (insecticide, etc.) is insufficient to assist in the determination of a completed exposure pathway from pesticide application event, resulting in a person's symptoms. PEST does not track individual pesticide products by brand name for the following reasons:

- Brand name is not a reliable source of information for tracking pesticide exposures since it is primarily a marketing tool;
- Brand names are an unreliable source of toxicological information because they can change frequently and because often multiple products can carry the same "brand name" yet have differing active ingredients;
- The concentrations of active ingredients may not be the same for products of the same brand name;

- Manufacturers often use the same brand name for products assigned with different EPA registration numbers; and
- The same EPA registration number may be assigned to a pesticide product that is marketed with several brand names.

Inert or "other" ingredients

An ongoing source of concern for many Oregonians is the role of inert or "other" ingredients **(http://npic.orst.edu/factsheets/inerts.pdf)** i.e. substances other than the active ingredients in pesticide formulations. These other ingredients can range from essentially non-toxic to extremely toxic. (Because of this range, the term "inert" may be a misnomer — many can cause acute injury or illness, particularly if incorrectly applied.) Where active ingredients in a pesticide formulation are the one(s) that prevent, destroy, repel, mitigate, or other adversely affect a pest or an unwanted plant, inert (other) ingredients are those that do not have a direct pesticidal activity. These may include propelling the active ingredients, ensuring their adherence to a surface, extending their shelf life, etc. Inert (other) ingredients can comprise of up to 99 percent or more, by volume, of a pesticide formulation.

By law, EPA requires that active ingredients be listed on the pesticide label, but considers most inert (other) ingredients to be confidential business information. Manufacturers are not required list them or their individual percentage (by volume) on the pesticide label. An exception is made for inert (other) ingredients of highest toxicological concern. In late September 2009, in responding to national petitions, EPA announced it was moving forward with a plan to disclose the identities of all inert ingredients in pesticides, including those that are potentially hazardous **(http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/393ca340951496ce852576940053463f!OpenDocument)**.

Manufacturers rarely release inert (other) ingredients of specific formulations, and PEST staff took this fact into account when classifying cases in 2002–2007. When classifying cases using the NIOSH system, staff took the whole product (not just the active ingredients) into consideration, as appropriate, when assessing the strength of the association between symptoms, the reported exposure, and the reported pesticide.

For example, if PEST staff knew from available medical literature that petroleum or solvent-based carriers in aerosolized pesticides could be toxic or irritating to the human eye/skin (and body, if ingested), they would take these facts into account when evaluating the relationship between the reported exposure, the reported signs/symptoms and classifying a case, as appropriate.

Chronic diseases reported after pesticide exposure

The development of several chronic diseases have been linked to pesticide exposure, especially long-term exposure. Yet, concurrently, there may be hundreds of other substances, genetic factors, or activities that the individual was engaged which may play a role in the development of that individual's cancer, birth defect, developmental disorder, or other chronic illness. Because of such confounding causes, linking a pesticide exposure(s) to the development of a chronic disease, particularly for an individual, with any degree of certainty is difficult. For this reason, PEST currently focuses on immediate signs and symptoms (or those that appear soon after) that are reported following an acute pesticide exposure, signs and symptoms of acute illnesses that can be readily assessed. For similar reasons, PEST was unable to assess any synergistic effects that two or more pesticides may have on individuals who report exposure.

For the future, the Oregon Public Health Division's Environmental Public Health Tracking (EPHT) Program is beginning work with other states and the Centers for Disease Control to develop systematic methods of measuring pesticide releases into a community's environment, health outcomes of its residents, and connections between the two.

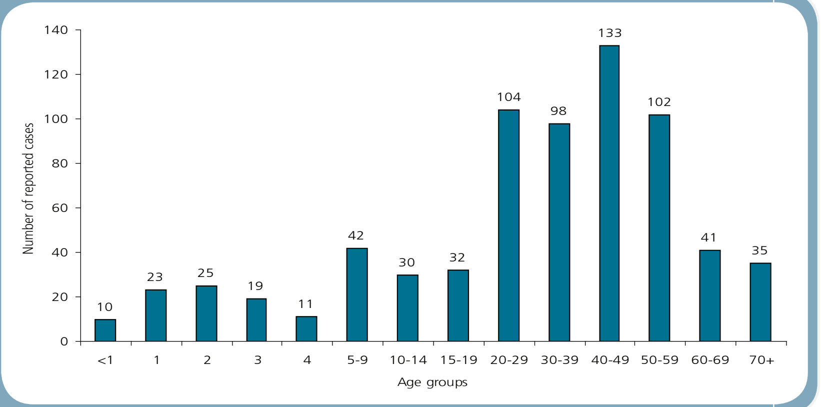
FINDINGS

Basic information about all cases reported to PEST 2002–2007

For the period 2002–2007, of the 1038 cases reported, 1010 were reported with a gender. Of these, 517 individuals (51.2%) were reported as female, 493 (48.8%) were reported as male. PEST was unable to gain basic information, like age, for 32% of the reported cases (Figure 1). These missing data may be due to the fact that the Oregon Poison Center (OPC) reported 81% of the cases in this analysis to PEST, and very often, the OPC report is the only piece of information PEST has for a case, especially if the case is not investigated further. For OPC and other reporters of incidents of acute pesticide exposure, collecting information on demographic data including exact age, sex, county and location type of the pesticide event and exposure may not be relevant to triage care in emergent situations.

Figure 1 shows the age distribution of all reported cases, where the age was known. For pediatric cases, the age groups were further broken down to reflect the specific developmental stages of children both physiologically and behaviorally. These numbers may allow these findings to be applied to specific interventions and may highlight unique susceptibilities of different age groups.

Figure 1
Age Distribution of Reported Cases to PEST, 2002-2007 (n=705)*



*Ages or dates of birth for 333 (32%) of the 1038 cases are unknown.

Of those 1038 cases, which were all classified using SENSOR case classification criteria, 689 (66.4%) cases were found to meet the criteria for the “definite,” “probable,” or “possible categories (Table 2). Specifically, PEST determined that there was, to varying degrees, a completed exposure pathway from the reported exposure. Cases with any one of these three classifications were collectively termed “likely.” These "likely" cases are the focus of the analysis below.

PEST determined that there was less of or none of this pathway for the remaining 349 (33.6%), which were altogether deemed to be "unlikely" as they were classified "suspicious," "unlikely," "insufficient information," or "unrelated" using the same **SENSOR case classification criteria**.

Table 2
All cases with date of exposure, 2002 – 2007 (n = 1038)

Relationship of symptoms to exposure	Frequency	Percent
Likely	*689*	*66.4*
Definite	48	7.0
Probable	54	7.8
Possible	587	85.2
Unlikely	*349*	*33.6*
Suspicious	25	7.2
Unlikely	77	22.1
Insufficient information	197	56.5
Asymptomatic	23	6.6
Unrelated	27	7.7

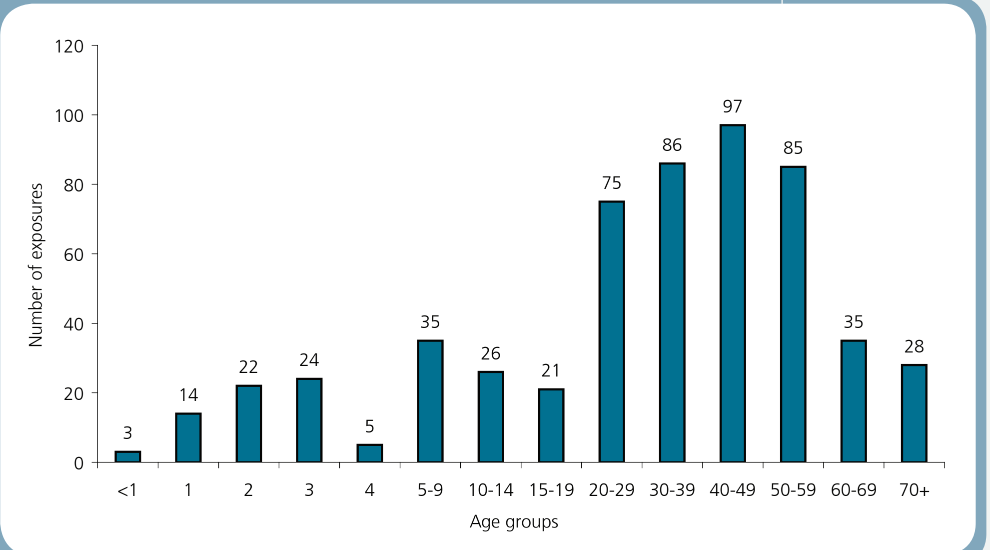
One feature of the 349 "unlikely" cases that merits discussion is the proportion (33.6%) of cases where there was "insufficient information" to make a determination about the association (Table 2). For this group of 197 individuals, information about one or more of the factors that make up the pathway of association was lacking. The most common reason for this lack of information was PEST's inability to contact the exposed individual to gather information with which to assess this pathway.

From 2002 to 2007, the PEST program did not collect data on the race, ethnicity or socioeconomic status of reported cases. But it recognized the importance of doing so, and in its 2009 application to NIOSH-SENSOR for federal funding, PEST staff included a project whereas PEST could collect these data to better understand health disparities, or inequitable burdens of pesticide exposures to populations based on age, gender, race, ethnicity, rural or urban living conditions, or socioeconomic status.

Basic information about cases classified as "likely"

"Likely" cases were almost evenly split between males (48.6%) and females (51.4%). Figure 2 shows the distribution of "likely" case if the age of the individual is known.

Figure 2.
Age Distribution of "likely" cases of pesticide illness by known age group in Oregon, 2002–2007 (n=556)*



* Ages or dates of birth for 133 (19.3%) of the 689 cases are unknown.

Signs and symptoms of "likely" cases

Symptoms are either self-reported by the exposed individual, by a health care provider, or both (Table 2). Medical signs, by definition, are only reportable by a health care provider.

The most commonly reported categories of signs and symptoms for "likely" cases were respiratory (36%), including cough and shortness of breath; ocular (36%), including pain and conjunctivitis; neurological (33%) symptoms, like headache and dizziness; and gastrointestinal (32%) signs and symptoms, like nausea and vomiting (Table 3).

Table 3.
Reported pesticide poisoning cases where symptoms determined to be "likely" related to pesticide exposure 2002–2007 (n = 689)*

Sign and symptom categories*	Frequency	Percent
Respiratory	249	36.1
Ocular	248	36.0
Neurological	226	32.8
Gastrointestinal	220	32.0
Dermal	177	25.7
Cardiac	28	4.1
Other (fever, fatigue, etc…)	74	10.7
Renal	2	0.3

* Total number of signs and symptoms is greater than the total number of "likely" cases due to a case being able to report more than one sign or symptom.

As shown in Table 4, the vast majority of "likely" cases reported to PEST were classified as "possible" with adverse health effects of "low" severity.

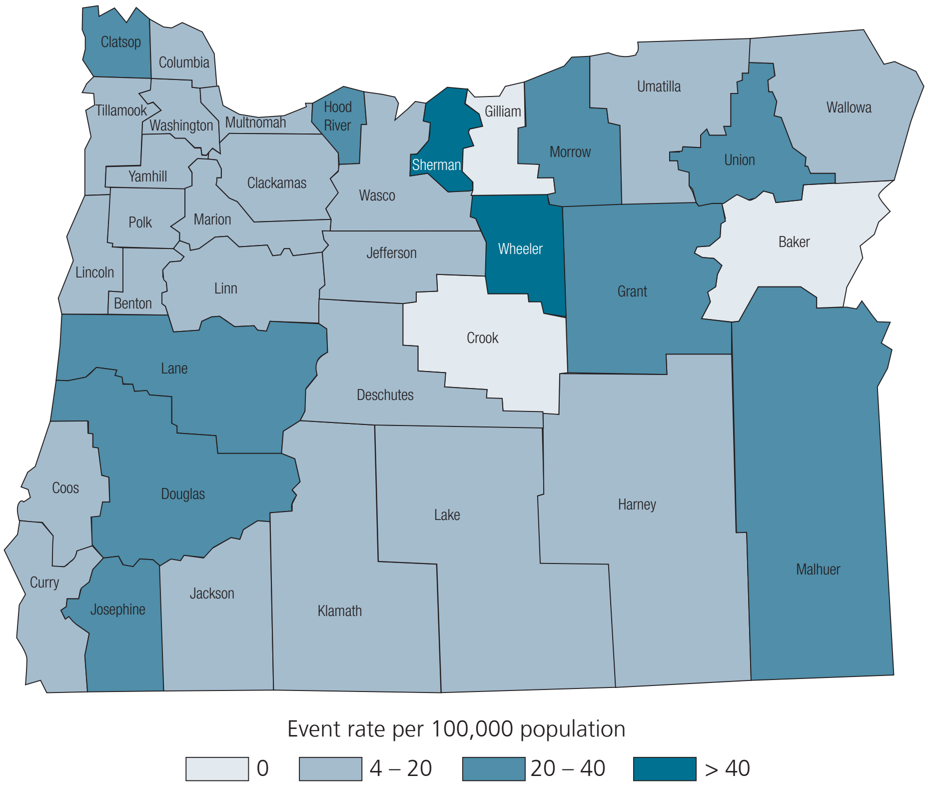
Table 4.
Severity of adverse health effects by case classification category in "likely" grouping

Severity of adverse health effects	Case classification			Total
	Definite	Probable	Possible	
Death	1	0	0	1
High	3	1	0	4
Moderate	8	7	8	23
Low	36	46	579	661
Total	48	54	587	689

Event and illness geography

For the period 2002–2007, 689 cases reported to PEST were classified as "likely" the result of pesticide exposure. Six hundred and fourteen (614) pesticide events were reportedly responsible for those exposures. One pesticide event can result in exposures to more than one person. Of those 614 pesticide events, the county in which the event and exposure(s) reportedly took place was unknown for 85 events. Figure 3 displays events, per capita, for 529 events where a county was known.

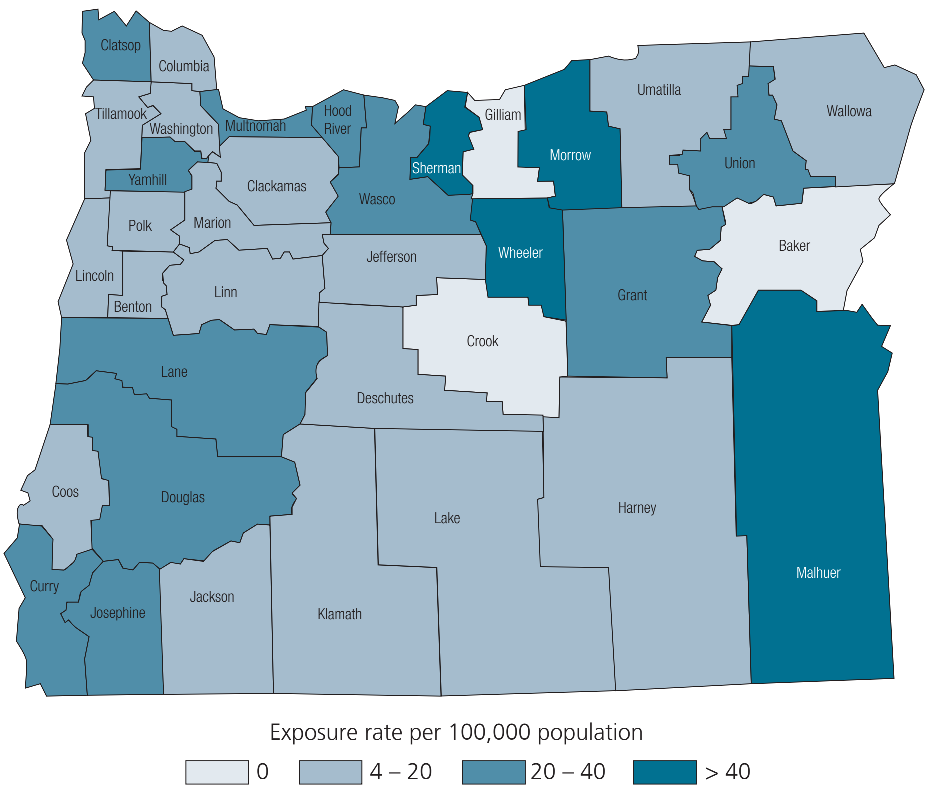
Figure 3.
Reported events by Oregon county, per capita, resulting in illnesses determined to be "likely" the result of acute pesticide exposure, 2002–2007 (n=529)*



* Rate calculated using 2000 Census county population data. Does not include 85 events where the county was unknown

Similarly, although 689 illnesses reported were classified as "likely," county location of the event was known for only 603 cases (Figure 4).

Figure 4.
Reported illnesses by Oregon county, per capita, and determined to be "likely" the result of acute pesticide exposure, 2002–2007 (n=603)*



* Rate calculated using 2000 Census county population data. Does not include 86 exposures where the county was unknown

Location type of pesticide events and exposures

An important aspect to understanding the burden of pesticide exposure in Oregon is knowing the location type of both pesticide events and exposures. Of the 614 events determined to be responsible for the 689 "likely" cases, 428 (69.7%) were reported as taking place at "residences" (Table 5).

Table 5.
Reported events in Oregon by site category, 2002–2007 (n=614)

NIOSH site category	Frequency	Percent
Farm	31	5.0
Forest	8	1.3
Golf course	1	0.2
Greenhouse	1	0.2
Hospital	2	0.3
Livestock production facility	3	0.5
Nursery	11	1.8
Office/business (non-retail, non-industrial)	10	1.6
Other institution	3	0.5
Other manufacturing facility	2	0.3
Park	5	0.8
Prison	1	0.2
Private vehicle	3	0.5
Residences*	428	69.7
Residential institution	2	0.3
Retail establishment	2	0.3
Road, rail or utility right of way	3	0.5
Road/trail	4	0.7
School	7	1.1
Service establishment	10	1.6
Other	12	2.0
Not applicable	23	3.7
Unknown	42	6.8
Total	614	100.0%

* Single-family home, mobile home/trailer, apartments, housing for laborers, and private residence, not specified (includes grounds of property)

Similarly, of the 689 "likely" cases (individuals reporting exposure) of pesticide-related illness, 498 (72.3%) were exposed while at a "private residence" (Table 6). More specifically, 483 (70.1%) of "likely" exposures in 2002–2007 were reported as non-occupational, and reportedly took place at residences with 219 (45.3%) reportedly male, and 264 (54.6%) reportedly female. Of these with a reported age (n=378), 115 (30.4%) were minors, 245 (64.8%) were 18–64, and 33 (8.7%) were 65 and above.

Table 6.
Reported "likely" exposures resulting in illness in Oregon by NIOSH site category, 2002–2007 (n=689)

NIOSH site category	Frequency	Percent
Farm	29	4.2
Forest	4	0.6
Golf Course	2	0.3
Greenhouse	1	0.1
Hospital	2	0.3
Livestock production facility	5	0.7
Nursery	10	1.5
Office/business (non-retail, non-industrial)	18	1.5
Other institution	5	0.7
Other manufacturing facility	3	0.4
Park	4	0.6
Prison	2	0.3
Private vehicle	4	0.6
Residences*	498	72.3
Residential institution	3	0.4
Retail establishment	6	0.9
Road, rail or utility right of way	1	0.1
Road/trail	4	0.6
School	10	1.5
Service establishment	18	2.6
Other	14	2.0
Not applicable	10	1.5
Unknown	36	5.2
Total	689	100.0%

* Single-family home, mobile home/trailer, apartments, housing for laborers, and private residence, not specified (includes grounds of property)

For several NIOSH site categories, most notably "residences," the frequencies between "events" (Table 5) and "exposures" (Table 6) are relatively close in number. This pattern of exposures and events probably indicates that most pesticide events are local occurrences resulting in local exposures, with minimal spread of the pesticide.

Occupational exposures and activities engaged in when exposed

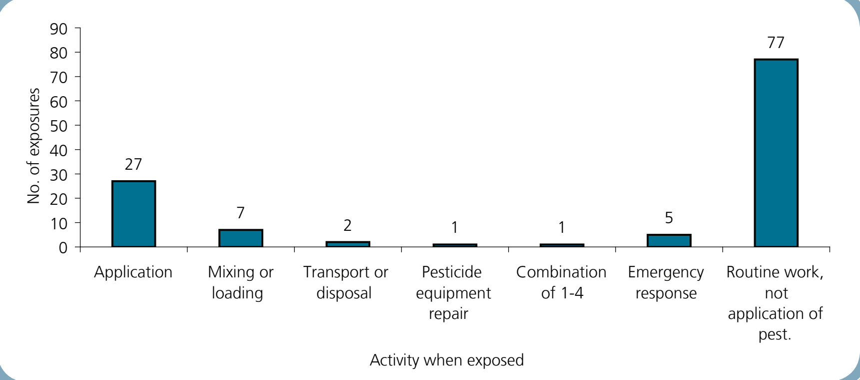
A total of 124 (18.0% of "Likely") individuals were exposed while at work (Figure 5). Only 38 cases involved the **direct use** of pesticides while on the job. Of those reported exposed while on the job, just 27 cases (21.8%) were classified as being exposed while actually applying a pesticide. In contrast, 82 people (66.1%), including five medical personnel exposed while responding to a pesticide event, were occupationally exposed from applications made by others.

Of these 124 "likely" occupational exposures, 68 (54.8%) were males and 56 (45.2%) were female, and of those with a known age (n=111), two (1.8%), were reportedly minors, 107 (96.3%) were 18–65 years old, and two were 65 or above (1.8%).

These exposures to those performing routine work activities **not** involving application of pesticides is similar to the findings of a CDC/NIOSH multi-state study that found that of 673 reported occupational exposures of non-applicators, 341 (50.7%) were exposed by pesticide drift or contaminated indoor air (Calvert, et al., 2004).

There may be several reasons more occupational cases are not reported to PEST. The first is a lack of case reporting by individuals involved in occupational pesticide application. The second is a lack of reporting by physicians who may treat workers who are occupationally exposed to pesticides, but are familiar enough with the symptoms and treatment to not need to consult the Oregon Poison Center.

Figure 5.
Reported work-related activity accompanying exposure (n=124)*



* Not shown are four exposures where the activity is unknown or not applicable.

Target of application events

Table 7 displays the reported events by the target intended for application that led to an exposure resulting in a "likely" case. Applications intended for buildings (including private residences) account for 22.1%. Building treatment represents the most frequent intended application site. The accidental releases of a pesticide with no intended target accounts for the second most frequent (10.9%) events reported. Applications intended for lawns, flowers, and other ornamental plants accounted for 8.6%, while applications intended for humans (e.g. insect repellent) were 7.9% of the targeted application sites. Undesired plants (weeds) accounted for less than 5%. Of note is the small proportion (3.3%) of applications intended for crops. The reported target of a sizable proportion (28.3%) of events is unknown.

Table 7.
Reported intended target of pesticide applications for "likely" cases (n=614 events)

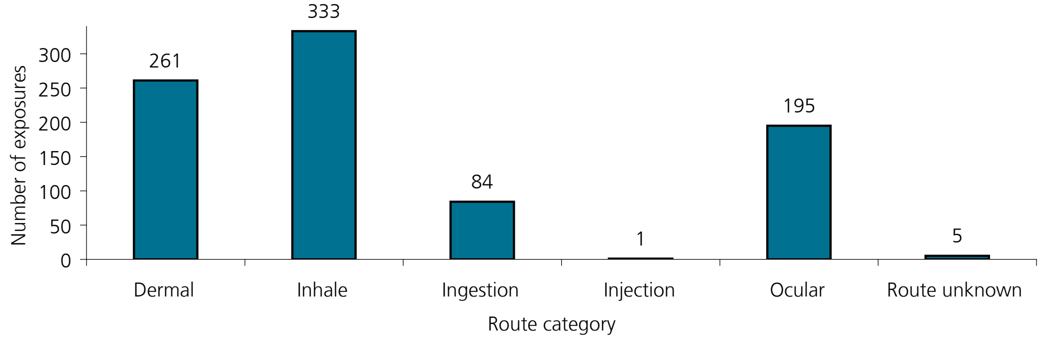
Intended application target	Number	Percent
Aquatic (e.g. pond, stream, lake, canal)	1	0.2
Bait for mammal (e.g. rodent, bird, predator)	2	0.3
Building treatment (e.g. space, structure, surface)	136	22.1
Community-wide application	1	0.2
Crops	20	3.3
Forest (e.g. trees, land)	8	1.3
Human (e.g skin, hair, clothing)	49	7.9
Ornamentals (e.g. lawns, flowers, landscape)	53	8.6
Other	31	5.1
Soil	2	0.3
Undesired plant (e.g. weeds)	28	4.6
Unknown	174	28.3
Veterinary - domestic animals	33	5.4
Veterinary - livestock	7	1.1
Wood product	2	0.3
Not applicable (e.g. no intended target, accidental release)	67	10.9
Total	614	100.0

Routes of exposure

Knowing the route(s) of exposure is important to connect the toxicity of an active ingredient to the symptoms experienced. For example, organophosphates are most efficiently absorbed through the inhalation route of exposure.

Knowing the route(s) of exposure is important for medical treatment since symptoms may be delayed, and/or missed during a clinical examination, if the pesticide is absorbed through the skin or ingested. Figure 6 describes the reported routes of exposure. The total number here exceeds the number of "likely" cases as an individual can become exposed to a pesticide event through more than one route of exposure.

Figure 6.
Reported routes of exposure (n=897)*

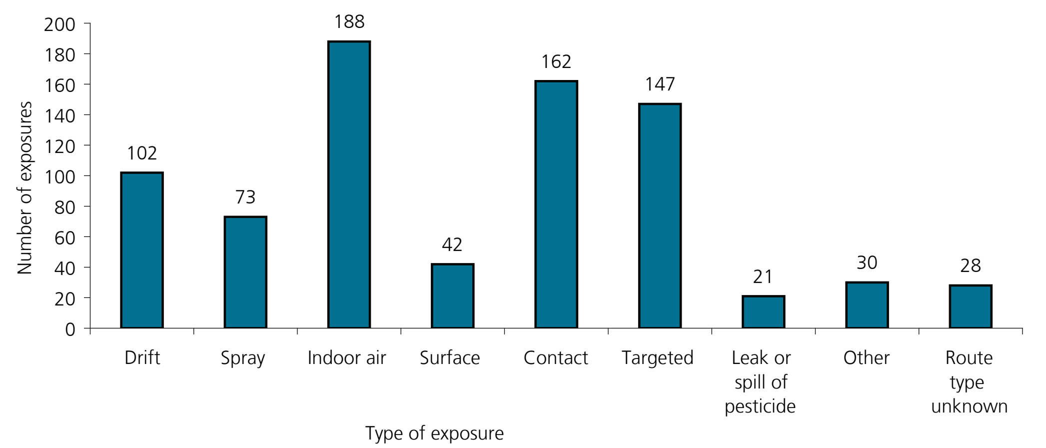


* An individual can be exposed through more than one route into their body.

Type of exposure

For each case, PEST attempts to track and classify the type of exposure that accompanies reported symptoms (Figure 7). Understanding the type of exposure is important both for identifying trends as well as assessing the pathway of association between the pesticide event and the individual's reported symptoms. PEST categorizes these types of exposure – drift, targeted, spray, indoor air, surface, leak/spill, contact, other, or unknown – according to NIOSH's exposure descriptions.

Figure 7.
Reported exposure types (n=793)*



* An individual can be exposed in more than one manner.

Month and years of exposures of "likely" cases

Figure 8 shows that exposures grow and peak with annual outdoor temperatures and with seasons specifically Spring and, especially, Summer. This is trend is similar to reported cases in other states.

Figure 8.
Reported exposure types (n=793)*

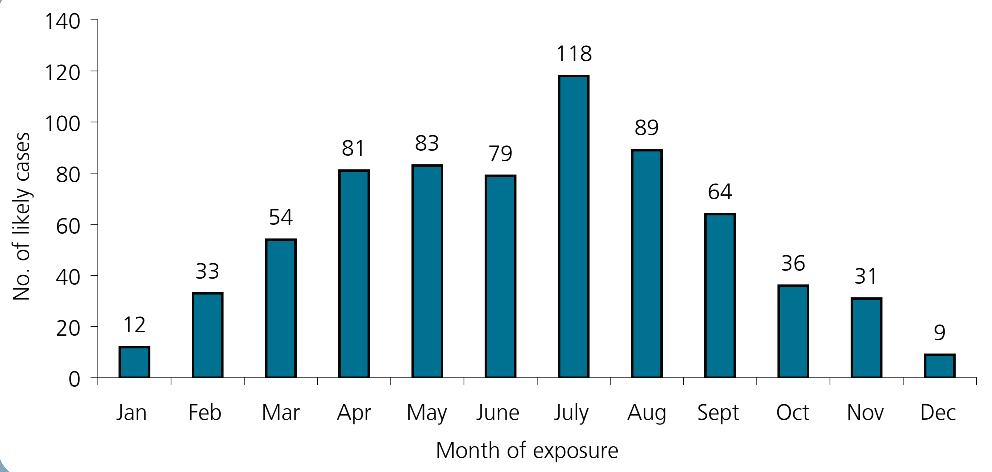
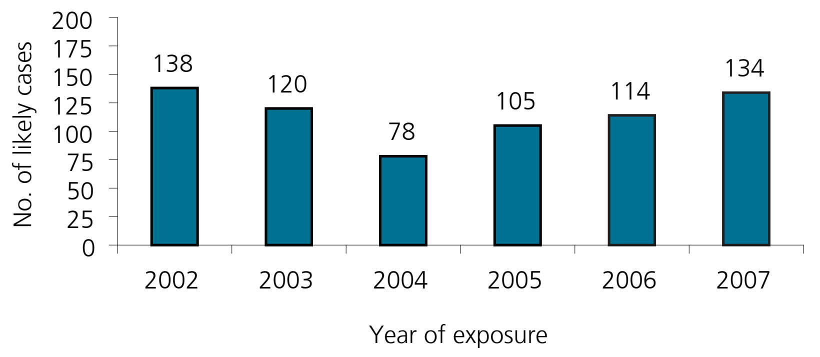


Figure 9 shows the number of "likely" cases that PEST received by year during the study period. The reasons behind the variability in annual numbers are not completely understood.

Figure 9.
Reported exposures by year (2002–2007)



Initial source of report

Incidents of pesticide exposure are reported to the PEST program by a variety of sources. Table 8 shows the source that initially notified the PEST program of a "likely" case. Under Oregon state law, ORS 433.004 and 433.006, requires health care providers (HCP) to report, within 24 hours, cases of suspected or confirmed acute pesticide-related illnesses directly to the PEST program or a local health department (which are then sent on to PEST). Yet this reporting is known to be incomplete despite the fact that four "likely" cases were directly reported to PEST by HCP in 2002-2007. In the study period, 207 (30%) "likely" cases reported by non-HCP sources had a reported site of first care at a medical facility (physician office visits, emergency room visits, or hospital admissions). In addition to increasing understanding of acute pesticide exposures resulting in serious injuries (those likely to be seen by HCP), which may support pesticide education and policy changes, the timely reporting by HCP enables a public health response that could prevent additional injuries.

Moreover, because of important (but not necessarily health-related) implications of a single pesticide event, PEST can refer the case to the **Pesticide Analytical Response Center** with the permission of the affected individual. Unique in the United States, PARC, which is composed of eight agencies in Oregon, is charged with coordinating agency investigations of pesticide-related incidents (which often fall across the purviews of several agencies). For example, human illness reportedly due to an illegally applied herbicide can be referred to the Oregon Department of Agriculture, which regulates the use and sale of pesticides in Oregon, for investigation.

Table 8.
Source of report (n=689 cases)

Source	Percent	Number
Oregon Poison Center	80.8	557
PARC	12.2	84
Self-report from individual reporting exposure	3.3	23
Co-worker, friend, relative	0.9	8
Worker representative (union, lawyer, etc.)	0.6	4
Direct report from HCP in clinic	0.6	2
Report from hospitals	0.6	2
Other	1.3	9
Total	100	689

Functional classes of pesticide products reportedly involved

Table 9 shows the functional classes of pesticide products involved in the 689 "likely" cases. Some cases involved multiple pesticide products. The products reported for some cases are registered for multiple classes of functional use. For these instances, PEST chose the functional use for which the product was actually being used.

Over half (55%) of "likely" cases reported to PEST from 2002 to 2007 result from the misuse or accidental release of a product containing an insecticide. Herbicide or algaecide products are a distant second, implicated in over 20% of "likely" cases.

Table 9.
Available functional classes of pesticide products reportedly associated with "likely" cases (n=693)

Functional class of product	Number	Percent of product class total
Insecticide	384	55.4%
Insect growth regulator	2	0.3%
Herbicide/algaecide	145	20.9%
Disinfectant	35	5.1%
Insect repellant	33	4.8%
Insecticide + fungicide	17	2.5%
Insecticide + other	17	2.5%
Unknown (functional class undetermined)	16	2.3%
Other (plant growth regulators, etc.)	13	1.9%
Fungicide	19	2.7%
Rodenticide	6	0.9%
Herbicide + fungicide	3	0.4%
Fumigant	2	0.3%
Multiple function (product in multiple classes not above)	1	0.1%
Total	693	100.0%

KEY OBSERVATIONS

KEY OBSERVATIONS

This basic descriptive analysis of PEST data reported for 2002–2007 allows for several key observations that point to specific areas of emphasis for pesticide education and outreach efforts.

A. Residences are where the majority of pesticide exposures and events occur.

A review of both investigated and uninvestigated "likely" cases of reported pesticide exposure reveal that over two-thirds of pesticide exposures and events that lead to them occur at private residences among non-workers. Anecdotally, most exposures appear to occur because of misuse or accidental release of unrestricted pesticides. Unrestricted pesticides do not require a pesticide applicators license for purchase. This is consistent with findings in other states and affirms the importance of educating the general public on the safe use and storage of unrestricted pesticide products.

B. Applications to buildings or houses account for the largest proportion of events that lead to "likely" cases of pesticide exposure.

In keeping with the above, it is direct application of pesticides to rid structures of "pests" including insects, weeds, bacteria, rodents, birds, deer, etc., that account for 22% of reported "likely" exposures. More analysis is needed to determine whether these events are due to restricted pesticides or those available for general use.

C. According to available data, pesticide events and exposures are disproportionately burdening some rural counties in Oregon.

As shown in Figures 3 and 4 residents of some rural counties (i.e. Sherman, Morrow, Wheeler and Malheur) are disproportionately impacted by reported acute pesticide exposures and resulting adverse health effects. This finding is consistent with those of other recent investigations done of acute pesticide exposure in Oregon showing higher incidence rates in some rural counties (Sudakin, 2002). The reason(s) for this differential are not currently well understood at this time.

Supporting research and outreach to discern specific risk factors that make rural populations more susceptible to acute pesticide exposures should be a priority. Educational and prevention strategies targeting rural populations should be considered to address this disproportionate burden in the future.

D. Health care providers are not reporting suspected or confirmed cases of pesticide exposures despite the fact that pesticide poisoning is a reportable condition under Oregon law.

PEST has ascertained through other sources, mainly the Oregon Poison Center (OPC), that exposures are occurring and patients are seeking care from a health care provider after their triage care with OPC. Therefore, the total number of clinician-diagnosed cases, particularly those that are of low and moderate severity, are unknown in Oregon. Of particular interest is ascertaining how many suspected/confirmed cases of clinician-diagnosed pesticide exposure among vulnerable populations are not being reported to PEST. PEST is actively building a partnership with an organization that maintains electronic medical records for safety-net clinics in Oregon to gain a better understanding of the burden of pesticide exposures in Oregon, especially on vulnerable populations.

E. Most reported occupational exposures occur to bystanders who are not directly working with pesticides or pesticide equipment.

PEST has used these data about occupational exposures to non-applicators to develop several preventative activities. In its 2009 application to NIOSH-SENSOR for federal funding, PEST included a specific activity to implement a pesticide safety awareness activity for workers in agricultural and non-agricultural settings who are non-applicators, but who regularly work in the vicinity of pesticide applications. This activity will be conducted in partnership with OR-OSHA, as appropriate. In specific response to a 2005 incident where five emergency workers were sickened by a single pesticide application, PEST and the Oregon Health Authority's Emergency Medical Services (EMS) and Trauma Section collaborated on a case study i.e. "lessons learned" module for inclusion in the training standards for emergency responders in Oregon.

F. From the available data, PEST was unable to gain insight on the human behaviors that commonly lead to misapplication.

As mentioned previously, the PEST program enters and classifies data according to criteria standardized by the NIOSH SENSOR pesticides program. From 2002–2007, database variables to describe why an exposure is thought to have taken place were not available; data was collected in narrative form makes analysis difficult. Variables that categorized human behaviors thought to be responsible for accidental exposures would probably provide a firm foundation for policy changes and educational interventions.

In February of 2009 NIOSH added "p-codes" to the standardized variables listed for state surveillance of pesticide related illness and injury. "P-codes" are standardized based on specific factors (i.e., notification/posting lacking or ineffective, people were in the treated area during the application, structure inadequately ventilated before re-entry, etc.) that contribute to pesticide exposures and events. PEST hopes to have the staff resources to support the analysis of p-codes data entered for cases in 2009 onward.

Acknowledgements:

This analysis was conducted with funding from the Oregon Department of Agriculture (ODA) under an intra-agency agreement between ODA and DHS. PEST would like to thank colleagues in the OEPH Research and Education Services section, particularly staff of the Environmental Public Health Tracking and Hazardous Substance Emergency Events Surveillance programs for their technical assistance.

References:

Calvert, GM, et al., Acute Occupational Pesticide-Related Illness in the US, 1998–1999: Surveillance Findings From the SENSOR-Pesticides Program. American Journal of Industrial Medicine, 2004. 45: p.14–23.

Reigert, J.R.; Roberts, J.R. 1999. Recognition and Management of Pesticide Poisoning. Fifth edition. Full text can be found at: **www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.pdf**

Sudakin, D.L.; Horowitz, D.; Griffin, S. Regional Variation in the Incidence of Symptomatic Pesticide Exposures: Applications of Geographic Information Systems. Journal of Toxicology. 2002, 40, 767-773.

DESCRIPTIVE ANALYSIS OF PEST CASES: 2002–2007

Pesticide Exposure, Safety and Tracking Program
Oregon Health Authority, Public Health

Oregon Health Authority

This document can be provided upon request in alternative formats for individuals with disabilities. Other formats may include (but are not limited to) large print, Braille, audio recordings, Web-based communications and other electronic formats. E-mail pesticides.health@state.or.us or call 971-673-0400 (voice) to arrange for the alternative format that will work best for you.