

NC Pesticide Incident Surveillance Program

Surveillance findings 2007 – 2012

Summary

During 2007 through 2012, the North Carolina Division of Public Health received an average of approximately 1,100 pesticide poisoning reports each year. Most pesticide poisonings occurred at home and during the summer months. One out of four non-occupational cases involved children less than 18 years of age. People used pesticide products at home for a variety of reasons, increasing the chance of harmful chemical exposure. Work-related exposures were less common, but those that did occur involved mostly younger workers and those who worked on a farm or were performing structural pest control or outdoor grounds-keeping tasks. Workers performing routine work activities (not involved in pesticide application) were exposed to pesticides almost as much as those workers directly applying pesticides. The majority of all cases were of low severity and involved insecticides, specifically pyrethroid products.

Background

The benefits of pesticides are well recognized and use is widespread. The majority of pesticides are used in agriculture (80%) and they are also commonly used in other settings such as schools, businesses and homes (1). The U.S. Environmental Protection Agency regulates pesticides and tries to ensure that pesticides do not pose unreasonable risks to the public and the environment. Despite oversight, over-exposures do occur and can result in acute health effects ranging from mild symptoms such as headache, rash or flu-like symptoms to more severe effects such as serious systemic effects, third-degree burns, and neurologic effects (2). Evidence is mounting that links pesticides to chronic health effects such as neurological disorders, cancer, reproductive disorders, asthma and skin disease (3). North Carolina initiated a pesticide illness and injury surveillance program in 2007 for the purpose of tracking and responding to acute pesticide-related exposures at work and in the community. Findings are used to encourage safe use of pesticides to avoid adverse health effects. This report summarizes surveillance findings from 2007 through 2012.

Methods

A pesticide illness is defined as an exposure to a pesticide product resulting in an acute adverse health outcome. The primary source for acute pesticide-related illness reports is the Carolinas Poison Center (CPC). Healthcare providers are required to report pesticide poisoning cases directly to CPC (NC 10A NCAC 41F .0101 - .0103). Reports are classified as confirmed cases when available evidence supports a link between the pesticide exposure and the health outcome. A severity score of death, high, moderate or low is also applied. A score of high represents a case where symptoms are severe, the person seeks treatment and usually has restricted activities. A score of moderate includes symptoms that are serious but less severe, the case seeks treatment and the event may result in restricted activities. A score of low is when mild symptoms occur, the case does not seek treatment and activities are unrestricted. North Carolina uses a standardized case definition, classification scheme, and severity index developed by the National Institute of Occupational Safety and Health (NIOSH), Sentinel Event Notification System for Occupational Risk (SENSOR) Pesticides Program, Center for Disease Control and Prevention (2).

Findings

All Reported Cases

During 2007 through 2012, North Carolina received 5,957 reports of acute pesticide illness or injury, an average of approximately 1,100 case reports per year. The number of reports remained constant from 2008 - 2011 and was highest in 2012 (Figure 1.) These reports represent 5,619 separate events. A total of 2,452 reported cases were confirmed (41%), of which 233 (10%) were occupationally related and 2,219 were non-occupational (90%) (Table 1). Only cases classified as definite, probable, possible or suspicious are included in data analyses for this report. These classifications are reportable to the national surveillance system. For simplicity they are referred to as "confirmed cases."

Confirmed Occupational Cases

There were 233 confirmed cases from 215 separate events (Figure 2). A seasonal trend was observed with most confirmed cases occurring during the summer months (Figure 3). The number of confirmed occupational cases varied by year (Figure 2), but averaged approximately 39. The primary source of reports was the Carolinas Poison Center (Table 2).

Demographics

People aged 20 - 29 years accounted for the largest percentage of exposed workers (33%). Most confirmed occupational cases were male (73%) (Table 3); additionally most confirmed occupational cases were white and non-Hispanic (Table 4). Industry sectors that accounted for most confirmed cases were Services (39%) followed by Agriculture, Forestry and Fishing (26%) (Table 5). The most common occupation was agricultural work (25%) (Table 6) and was comprised largely of farm laborers. The next most common occupation was building, grounds cleaning and maintenance work (24%), comprised largely of pest control operators and grounds-keeping workers in lawn care and landscaping.

Exposures

Most workers had contact with pesticides through targeted exposure (40%) (Figure 4), which occurs when the pesticide is released at the target site and exposes the applicator through direct projection, ricochet, blow back by wind, or airborne exposure by moving through an area actively being treated. Insecticides were responsible for most of the confirmed occupational exposures (51%) (Table 7) and the type of insecticides most commonly involved were pyrethroids (48%) followed by organophosphates (13%) (Table 8). Confirmed occupational exposures occurred at a variety of locations (Table 9), using a variety of equipment types (Table 10). Most workers were either applying pesticides when exposed (46%) or performing routine work tasks not involving pesticide application (43%) (Figure 5). Examples of the latter activity are "feed store sales associate got pesticide residue on hands when customer brought in open bottle", "farmer cleaning a shed got pesticide on hands when moving pesticide bottles on shelf", and "cell tower grounds crew member drank from bottle that had stored a pesticide."

Health Outcomes

Most confirmed occupational cases were of low severity (91%) (Table 11). The most common route of exposure was dermal (36%) (Table 12), and workers experienced a variety of symptoms (Table 13). Most workers sought treatment advice from the Carolinas Poison Center (56%). (Table 14).

Narratives describing confirmed occupational cases classified as high and moderate severity are found in the Appendix.

Confirmed Non-Occupational Cases

The number of confirmed non-occupational cases varied over the report period (Figure 6) for an average of 370 per year. There were 2,219 confirmed cases from 2,211 events. A seasonal trend was noted for non-occupational cases similar to occupational cases (Figure 7). The primary case ascertainment source was the Carolinas Poison Center (98%) (Table 15).

Demographics

Most confirmed non-occupational cases were adults aged 18 years and above (72%). 571 (26%) of cases were below 18 years of age, and most poisonings in this age group occurred in small children, five years old and below (59%). Just over half of non-occupational cases were female (53%) (Table 16). Based on limited available race and ethnicity data, most confirmed occupational cases were white and non-Hispanic (Table 17).

Exposures

Similar to occupational cases, non-occupational cases had contact with pesticides mostly through targeted exposure (55%) (Figure 8), and insecticides were responsible for most of the confirmed non-occupational exposures (58%) (Table 18). The type of insecticides most commonly involved were pyrethroids (56%) (Table 19). Confirmed non-occupational poisonings occurred primarily at home (96%) (Table 20), and pesticides were typically applied manually (e.g., pellets, baits, pet products, ant killer pellets/dusts, pool tabs, mothballs, lice shampoo), or using cans, trigger pumps or foggers (Table 21). Targets for pesticide use varied (Table 22), and most cases were applying when exposed (43%) (Figure 9).

Health Outcomes

Most confirmed non-occupational cases were of low severity (94%) (Table 23). The most common route of exposure was inhalation (36%) (Table 24), and cases experienced a variety of symptoms (Table 25). Advice by Carolinas Poison Center was the most common source of treatment (78%) (Table 26).

Narratives describing confirmed non-occupational cases under 18 years classified as fatal, high and moderate severity are found in the Appendix.

Public Health Significance

- In North Carolina, domestic exposures to pesticides are common and one of every four persons exposed at home is a child under 18 years of age. These findings are consistent with national poison control data and other state pesticide surveillance programs (4,5) and reaffirm the importance of educating the general public on the safe use and storage of pesticide products.
- While many domestic exposures involve attempts to treat the interior surfaces of homes (e.g. carpets and other surfaces in living/working areas), pesticide products appear to be used for many other different reasons in the home environment (structural pest control, lawn, garden, pool, pets, Jacuzzi use, outdoor activities). To reduce risk of exposure in the home, EPA recommends that two alternatives be considered first: pest prevention measures and non-chemical pest control (6). This approach is termed "integrated pest management" or IPM.

- Occupational exposures tend to affect younger workers and those in certain industries such as Services and Agriculture and occupations such as pest control, grounds-keeping and farm work. Workers were often exposed not only during pesticide application, but when performing tasks not associated with pesticide application. These findings point to the importance of pesticide safety training for all workers who may work with or around pesticides. The Environmental Protection Agency (EPA), Worker Protection Standard, provides training guidance for pesticides for agricultural workers, and the Occupational Safety and Health Administration (OSHA), Hazardous Communication Standard 1910.1200, provides training guidance about chemical use for the workplace in general.
- Insecticides, particularly pyrethroid pesticides, account for most of the pesticide exposures at home and at work. This finding mirrors national trends (4,7). At home, these pesticides are contained in household sprays, aerosol bombs, insect repellents, pet shampoos, and lice treatments. At work, they are used in agriculture and structural pest control. While this class of insecticides is less acutely toxic than most other insecticides, they are not risk free, and following label instructions is still important. While pyrethroids have gradually replaced organophosphates (OP) over time (3), surveillance findings provide evidence that OPs continue to be used and present a more significant risk to human health.
- Most exposures result in low severity outcomes. Nonetheless, pesticides have the potential to cause serious acute illness, and chronic health effects may be associated with chronic, low-level or sub-acute pesticide exposure over time (3).

Limitations

Counts in this report are likely underestimates. Not all people who become ill from pesticides recognize the source of their illness or seek healthcare. Additionally, clinician reporting may not be consistent.

Investigations are performed on all work-related cases, but approximately half of these cases are lost to follow-up (no call backs or refusals), which leads to insufficient circumstantial data, important for understanding why over-exposures to pesticides occur. Only serious non-occupational cases are investigated (e.g. deaths, hospitalizations, drift, school exposures, public sprays), which limits what we know about these cases and also eliminates a large portion from data analysis.

Figure 1

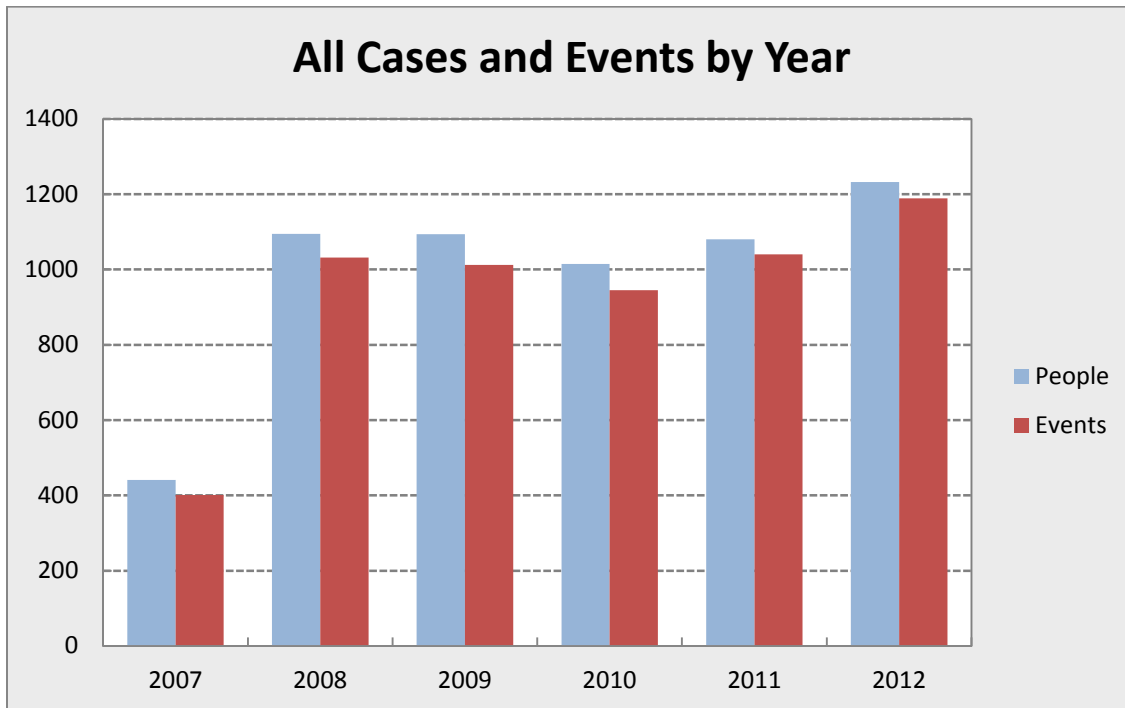


Table 1. Case Confirmation by Work-Relatedness, 2007 - 2012.

Status	Occupational	Non-Occupational	Unknown	Total
Definite Case	21	79	0	100
Probable Case	30	124	0	154
Possible Case	182	2015	0	2197
Suspicious Case	0	1	0	1
<i>Subtotal</i>	<i>233</i>	<i>2219</i>	<i>0</i>	<i>2452</i>
Unlikely Case	54	295	0	349
Insufficient Information	97	2979	0	3076
Exposed/Asymptomatic	16	25	0	41
Unrelated	17	22	0	39
Unknown/Uncoded	0	0	0	0
<i>Subtotal</i>	<i>184</i>	<i>3321</i>	<i>0</i>	<i>3505</i>
	417	5540	0	5957

Figure 2

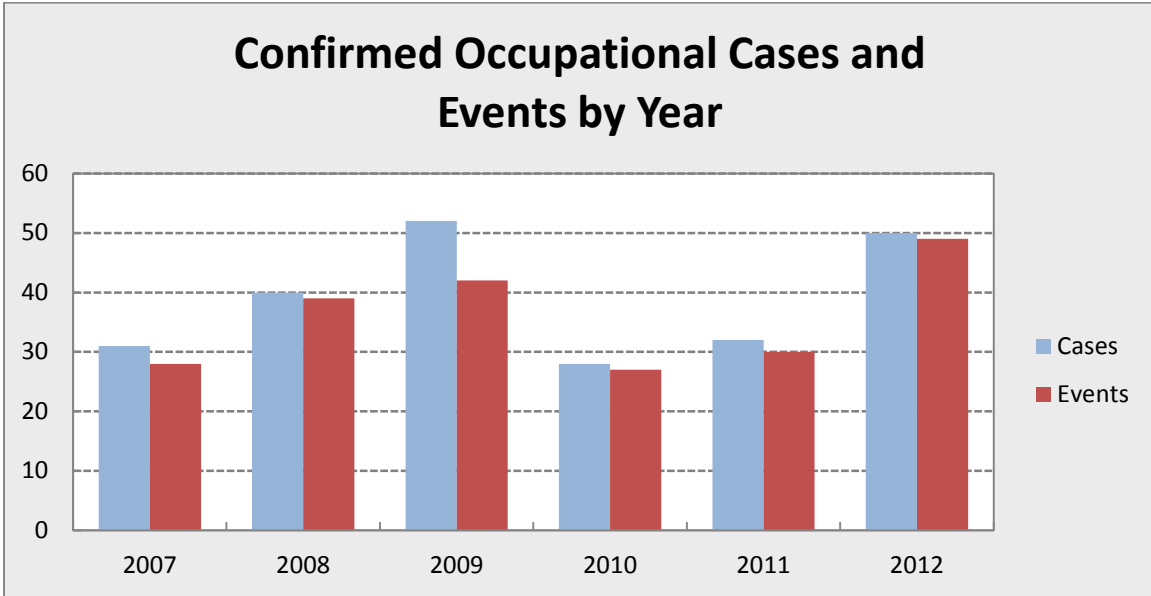


Figure 3



Table 2. First Report Source, Confirmed Occupational Cases, 2007 - 2012 and 2012 Separately.

Report Source	Cumulative	Percent	2012	Percent
Poison control center	214	91.8%	47	94.0%
Report/refer. from gov. agency	12	5.2%	2	4.0%
Another bureau/program in DOH	4	1.7%	0	0.0%
Physician report	1	0.4%	0	0.0%
Worker representative	1	0.4%	1	2.0%
Other	1	0.4%	0	0.0%
Total	233	100.0%	50	100.0%

Table 3. Confirmed Occupational Cases by Age Group and Gender, 2007 - 2012 and 2012 Separately.

Age Groups	Cumulative			2012		
	Female	Male	Unknown	Female	Male	Unknown
Unknown	0	7	2	0	0	0
00-09	0	0	0	0	0	0
10-19	1	11	0	1	1	0
20-29	18	59	0	5	8	1
30-39	11	33	0	1	7	0
40-49	17	29	0	5	8	0
50-59	6	17	0	3	3	0
60-69	8	12	0	2	3	0
70-79	0	2	0	0	0	0
80+	0	0	0	1	0	0
Total	61	170	2	18	30	1

Table 4. Confirmed Occupational Cases by Race and Ethnicity, 2007 - 2012 and 2012 Separately.

Race	Cumulative			2012		
	Hispanic	Not Hispanic	Unknown	Hispanic	Not Hispanic	Unknown
American Indian/Alaskan	0	2	0	0	0	0
Asian/Pacific Islander	0	2	0	0	1	0
Black	0	18	1	0	3	0
White	6	108	5	1	24	1
Mixed	0	0	0	0	0	0
Other	3	0	0	2	0	0
Unknown at this time	24	4	60	1	0	17
Total	33	134	66	4	28	18

Table 5. Confirmed Occupational Cases by NIOSH Industry Sectors 2007 - 2012 and 2012 Separately.

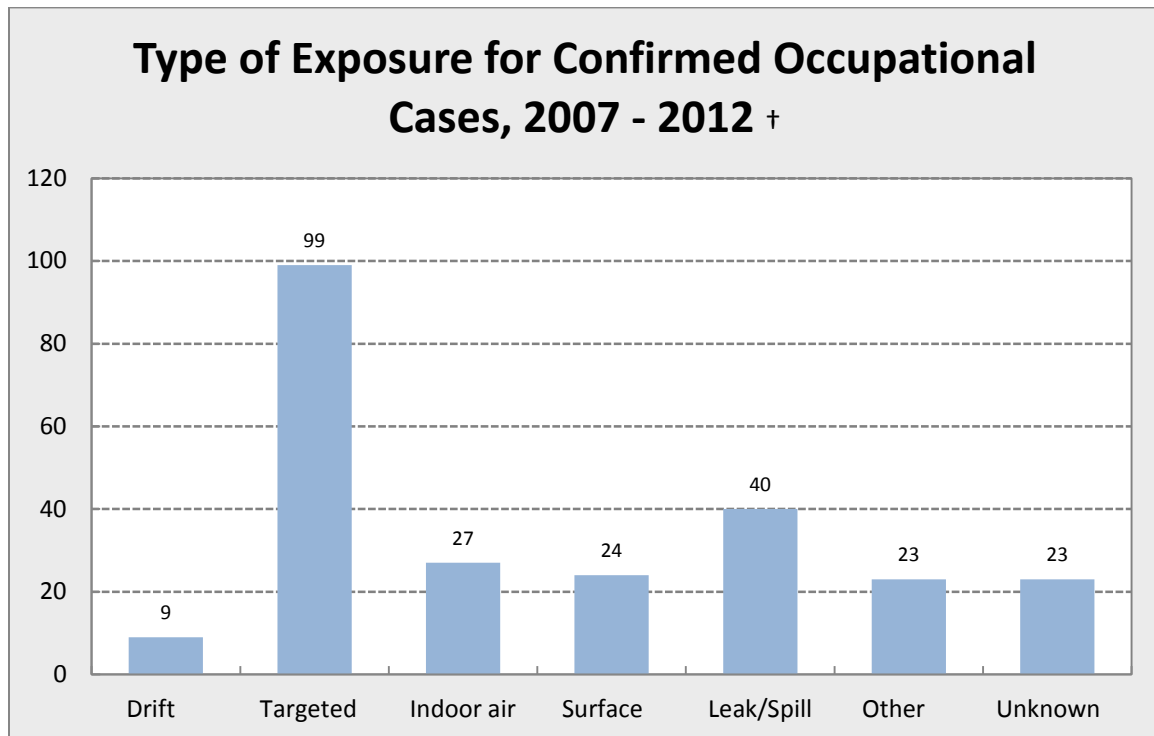
Industry Sector	Cumulative	Percent	2012	Percent
Services (exc. Public Safety)	89	38.7%	17	35.4%
Agriculture, Forestry, Fishing	60	26.1%	5	10.4%
Wholesale & Retail Trade	19	8.3%	4	8.3%
Construction	14	6.1%	2	4.2%
Healthcare & Social Assistance	13	5.7%	5	10.4%
Transportation, Warehousing, Utilities	10	4.3%	5	10.4%
Manufacturing	5	2.2%	1	2.1%
Public Safety	4	1.7%	1	2.1%
Unknown	19	7.0%	8	16.7%
Total	233	100.0%	48	100.0%

Table 6. Confirmed Occupational Cases by Occupation, 2007 - 2012 and 2012 Separately.

Occupation *	Cumulative	Percent	2012	Percent
Farming, Fishing and Forestry	57	24.5%	5	10.0%
Building and Grounds Cleaning and Maintenance	55	23.6%	6	12.0%
Office and Administrative Support	14	6.0%	3	6.0%
Construction	14	6.0%	1	2.0%
Transportation and Material Moving	13	5.6%	5	10.0%
Sales and Related	11	4.7%	1	2.0%
Management	8	3.4%	5	10.0%
Healthcare Practitioner and Technical	7	3.0%	1	2.0%
Protective Services	7	3.0%	2	4.0%
Production	7	3.0%	5	10.0%
Healthcare Support	4	1.7%	1	2.0%
Food Preparation and Serving Related	4	1.7%	2	4.0%
Life, Physical and Social Sciences	3	1.3%	0	0.0%
Installation, Maintenance and Repair	3	1.3%	2	4.0%
Architecture and Engineering	2	0.9%	0	0.0%
Community and Social Services	2	0.9%	0	0.0%
Personal Care and Service	2	0.9%	0	0.0%
Education, Training and Library	1	0.4%	0	0.0%
Arts, Design, Entertainment, Sports and Media	1	0.4%	0	0.0%
Business and Financial Operations	1	0.4%	0	0.0%
Unknown	17	7.3%	11	22.0%
Total	233	100.0%	50	100.0%

* Categories based on 2002 Census of Occupation Codes

Figure 4



† Some individuals had more than one type of exposure.

Table 7. Confirmed Occupational Cases by Pesticide Type, 2007 - 2012 and 2012 Separately.

Pesticide Type	Cumulative	Percent	2012	Percent
Insecticide	134	50.8%	37	59.7%
Herbicide	61	23.1%	14	22.6%
Disinfectant ††	15	5.7%	2	3.2%
Insecticide & Other	13	4.9%	0	0.0%
Fungicide	11	4.2%	1	1.6%
Insect Repellent	7	2.7%	1	1.6%
Fumigant	6	2.3%	0	0.0%
Insect Growth Regulator	2	0.8%	1	1.6%
Rodenticide	1	0.4%	0	0.0%
Herbicide & Other	1	0.4%	1	1.6%
Other	4	1.5%	0	0.0%
Multiple	1	0.4%	0	0.0%
Unknown	8	3.0%	5	8.1%
Total	264†	100.0%	62†	100.0%

† Some individuals were exposed to more than one type of pesticide.

††Data collection for disinfectants ceased May 2007 except for algacides reported by CPC.

Table 8. Chemical Classes Associated with Insecticide Exposures for Confirmed Occupational Cases, 2007-2012 and 2012 Separately.

Chemical Class	Cumulative	Percent	2012	Percent
Pyrethroids	72	47.7%	15	36.6%
Organophosphorus compounds (AChE Inhibitor)	20	13.2%	2	4.9%
Pyrethrins	12	7.9%	8	19.5%
N-methyl carbamates (AChE Inhibitor)	8	5.3%	1	2.4%
Organochlorine compounds	5	3.3%	0	0.0%
Pyrethrin plus pyrethroid only	3	2.0%	0	0.0%
Inorganic compounds	2	1.3%	1	2.4%
Pyrethrin plus other	2	1.3%	2	4.9%
AChE Inhibitor and other	2	1.3%	1	2.4%
Pyrethroid plus other	1	0.7%	1	2.4%
Other	10	6.6%	3	7.3%
Multiple	8	5.3%	3	7.3%
Unknown	6	4.0%	4	9.8%
Total	151	100.0%	41	100.0%

Table 9. Location of Exposure for Confirmed Occupational Cases, 2007 - 2012 and 2012 Separately.

Location	Cumulative	Percent	2012	Percent
Farm	47	20.2%	3	6.0%
Private Residence - Type Unk.	29	12.4%	7	14.0%
Office/Business	19	8.2%	5	10.0%
Service Establishment	16	6.9%	6	12.0%
Retail Establishment	15	6.4%	1	2.0%
Single Family Home	7	3.0%	0	0.0%
Other Institution	6	2.6%	0	0.0%
Nursery	5	2.1%	2	4.0%
Livestock & Animal Production	5	2.1%	0	0.0%
Multi-unit housing	4	1.7%	1	2.0%
Pesticide Mfg Facility	4	1.7%	0	0.0%
Road/Rail	4	1.7%	3	6.0%
Pet Care & Veterinary Svcs.	3	1.3%	0	0.0%
Road, Rail, Util. Right-of-Way	3	1.3%	0	0.0%
Greenhouse	2	0.9%	0	0.0%
Industrial Facility	2	0.9%	0	0.0%
Residential Institution	1	0.4%	1	2.0%
School	1	0.4%	0	0.0%
Prison	1	0.4%	0	0.0%
Hospital	1	0.4%	0	0.0%
Farm Product Warehouse & Strg	1	0.4%	0	0.0%
Other Manufacturing	1	0.4%	1	2.0%
Park	1	0.4%	0	0.0%
Golf Course	1	0.4%	0	0.0%
Other	13	5.6%	5	10.0%
Emergency Response Vehicle	1	0.4%	0	0.0%
Unknown	40	17.2%	15	30.0%
Total	233	100.0%	50	100.0%

Table 10. Equipment used in Confirmed Occupational Cases, 2007 - 2012 and 2012 Separately.

Application Equipment	Cumulative	Percent	2012	Percent
Pressurized can/bomb	23	9.9%	8	16.0%
Sprayer, backpack	15	6.4%	3	6.0%
Manual Placement	14	6.0%	3	6.0%
Spray line, hand held	12	5.2%	1	2.0%
Total Release Fogger	11	4.7%	4	8.0%
Ground sprayer, NEC	10	4.3%	5	10.0%
Handheld granular/dust applic.	9	3.9%	1	2.0%
Trigger pump/compressed air	8	3.4%	1	2.0%
Aerial application equipment	3	1.3%	0	0.0%
Aerosol generator/fogger	3	1.3%	0	0.0%
High pressure fumigator	3	1.3%	0	0.0%
Dip tank or tray	2	0.9%	1	2.0%
More than one type of equip.	2	0.9%	2	4.0%
Other	1	0.4%	0	0.0%
Not applicable	35	15.0%	7	14.0%
Unknown	82	35.2%	14	28.0%
Total	233	100.0%	50	100.0%

Figure 5



Table 11. Severity of Confirmed Occupational Cases, 2007 - 2012 and 2012 Separately.

Severity	Cumulative	Percent	2012	Percent
Fatal	0	0.0%	0	0.0%
High	4	1.7%	0	0.0%
Moderate	18	7.7%	6	12.0%
Low	211	90.6%	44	88.0%
Total	233	100.0%	49	100.0%

Table 12. Route of Exposure for Confirmed Occupational Cases, 2007 - 2012 and 2012 Separately.

Route of Exposure	Cumulative	Percent	2012	Percent
Dermal	100	36.0%	18	30.5%
Inhalation	92	33.1%	24	40.7%
Ocular	41	14.7%	9	15.2%
Ingestion	28	10.1%	3	5.1%
Unknown	17	6.1%	5	8.5%
Total	278[†]	100.0%	59[†]	100.0%

† Some individuals had more than one route of exposure.

Table 13. Types of Signs and Symptoms for Confirmed Occupational Cases, 2007 - 2012 and 2012 Separately.

Sign and Symptom Category	Cumulative	Percent	2012	Percent
Neurological	103	19.9%	26	19.7%
Gastrointestinal	92	17.8%	20	15.0%
Dermal	89	17.2%	19	14.4%
Respiratory	85	16.4%	19	14.4%
Ocular	70	13.5%	17	12.9%
General	52	10.1%	19	14.4%
Cardiac	24	4.7%	12	9.1%
Renal	2	0.4%	0	0.0%
Total	517[†]	100.0%	132[†]	100.0%

† Some individuals had more than one type of symptom.

Table 14. Confirmed Occupational Cases by Treatment Location, 2007 - 2012, and 2012 Separately.

Treatment Location	Cumulative	Percent	2012	Percent
Advice of poison control center	160	55.7%	48	63.2%
Emergency Department	71	24.7%	16	21.1%
Physician Office / Urgent Care	36	12.5%	8	10.5%
Declined Medical Care	9	3.1%	2	2.6%
Other	5	1.7%	0	0.0%
Hospital Inpatient Care	3	1.0%	1	1.3%
On-site by Emergency Responder	2	0.7%	1	1.3%
Employee Health Clinic	1	0.3%	0	0.0%
Total	287[†]	100.0%	76[†]	100.0%

† Some individuals sought multiple forms of care such as those calling poison control and subsequently going to the emergency department.

Figure 6

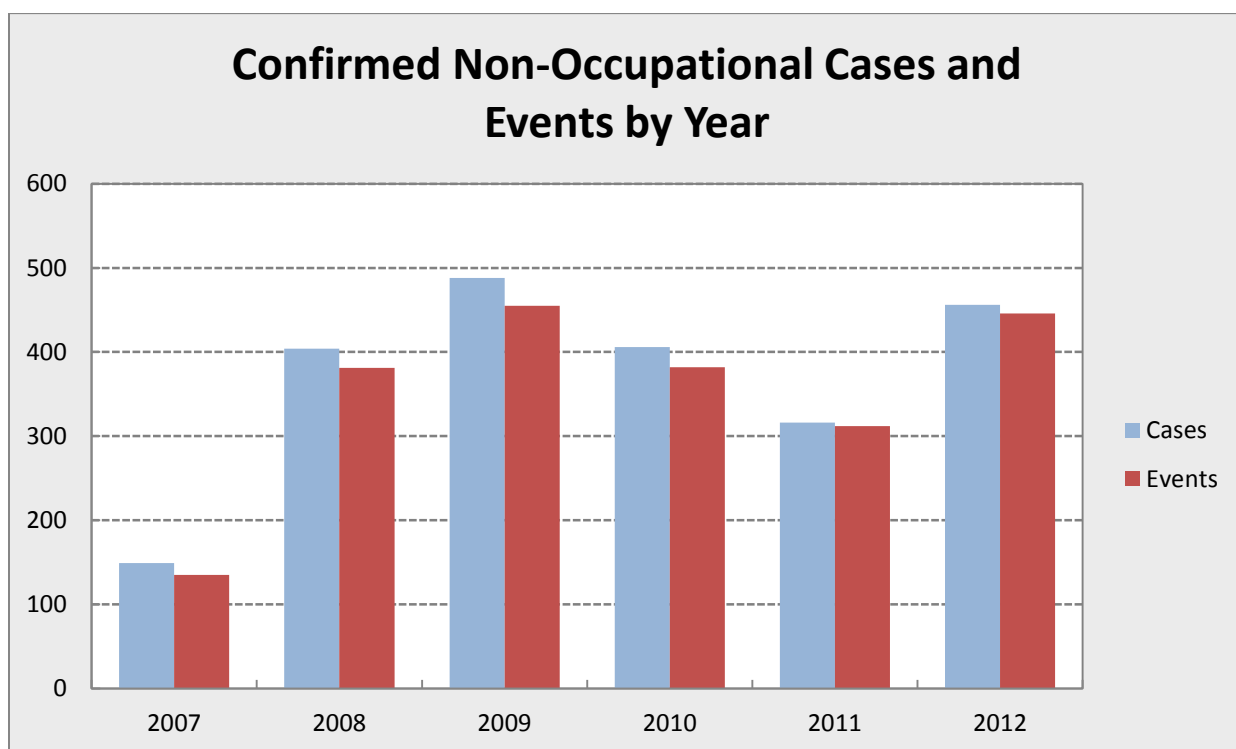


Figure 7



Table 15. First Report Source, Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Report Source	Cumulative	Percent	2012	Percent
Poison control center	2177	98.1%	450	98.7%
Report/refer. from gov. agency	34	1.5%	5	1.1%
Self-report	5	0.2%	0	0.0%
Physician report	1	0.1%	1	0.2%
Friend or relative report	1	0.1%	0	0.0%
Local health department	1	0.1%	0	0.0%
Total	2219	100.0%	456	100.0%

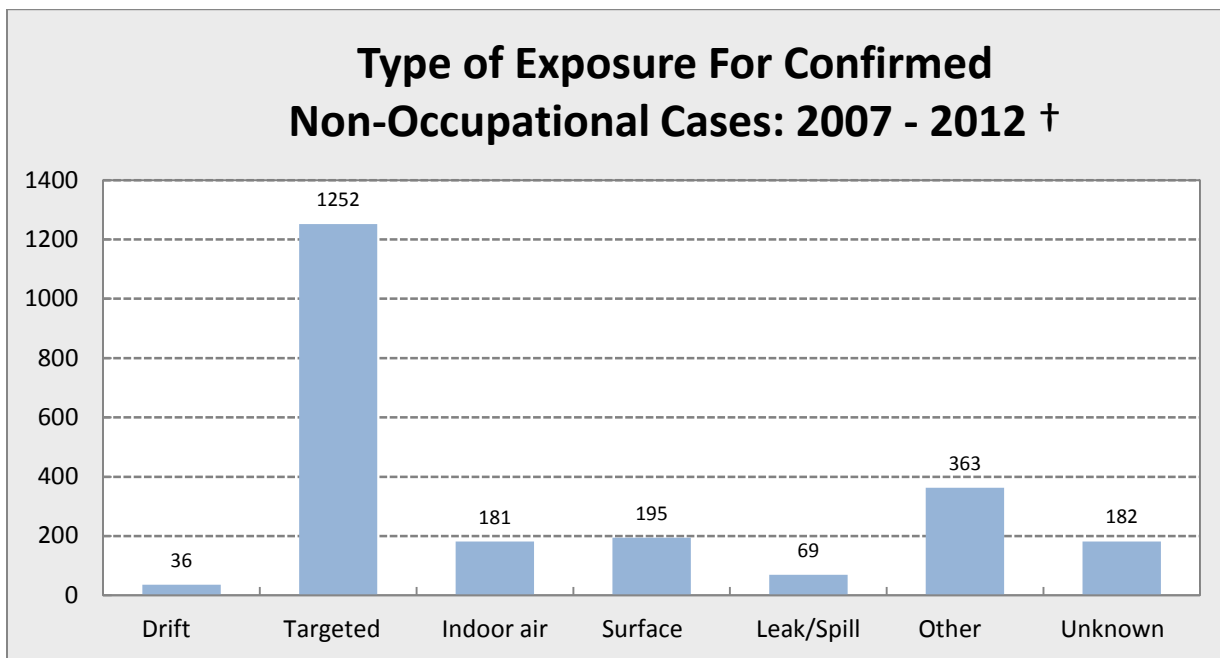
Table 16. Confirmed Non-Occupational Cases by Age Group and Gender, 2007 - 2012 and 2012 Separately.

Age Groups	Cumulative			2012		
	Female	Male	Unknown	Female	Male	Unknown
Unknown	29	24	0	6	7	0
00-<1: Infants	9	13	0	1	5	0
01-02: Toddlers	81	91	0	17	20	0
03-05: Preschool	58	85	0	11	18	0
06-11: Child	53	72	0	4	13	0
12-17: Youth	51	58	0	8	9	0
18-64: Adult	785	639	0	172	127	0
65+: Senior	104	67	0	23	15	0
Total	1170	1049	0	242	214	0

Table 17. Confirmed Non-Occupational Cases by Race and Ethnicity, 2007 - 2012, and 2012 Separately.

Race	Cumulative			2012		
	Hispanic	Not Hispanic	Unknown	Hispanic	Not Hispanic	Unknown
American Indian/Alaskan	0	2	0	0	0	0
Asian/Pacific Islander	0	1	0	0	1	0
Black	0	13	2	0	3	0
White	6	76	4	0	6	0
Mixed	0	0	0	0	0	0
Other	2	0	0	1	0	0
Unknown at this time	10	7	2096	1	1	443
Total	18	99	2102	2	11	443

Figure 8



† Some individuals had more than one type of exposure.

Table 18. Confirmed Non-Occupational Cases by Pesticide Type, 2007 - 2012 and 2012 Separately.

Pesticide Type	Cumulative	Percent	20122	Percent
Insecticide	1347	58.1%	255	53.3%
Insect Repellent	236	10.1%	46	9.6%
Disinfectant ††	207	8.9%	47	9.8%
Herbicide	200	8.6%	45	9.4%
Insecticide & Other	119	5.1%	25	5.3%
Rodenticide	43	1.9%	7	1.5%
Insect Growth Regulator	40	1.7%	12	2.5%
Other	38	1.6%	6	1.3%
Fungicide	17	0.7%	2	0.4%
Fumigant	9	0.4%	2	0.4%
Multiple	6	0.3%	2	0.4%
Herbicide & Other	3	0.1%	1	0.2%
Unknown	57	2.5%	25	5.2%
Total	2322†	100.0%	475†	100.0%

† Some individuals were exposed to more than one type of pesticide.

†† Data collection for disinfectants ceased May 2007 except for algaecides reported by CPC.

Table 19. Chemical Classes Associated with Insecticide Exposures for Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Chemical Class	Cumulative	Percent	2012	Percent
Pyrethroids	734	56.2%	148	274.1%
Pyrethrins	108	8.3%	24	44.4%
Organophosphorus compounds (AChE Inhibitor)	107	8.2%	20	37.0%
N-methyl carbamates (AChE Inhibitor)	70	5.4%	5	9.3%
Pyrethrin plus pyrethroid only	53	4.1%	11	20.4%
Inorganic compounds	34	2.6%	5	9.3%
Pyrethrin plus other	8	0.6%	4	7.4%
Organochlorine compounds	2	0.2%	0	0.0%
Triazines	1	0.1%	1	1.9%
Indandiones	1	0.1%	0	0.0%
Microbial	1	0.1%	0	0.0%
Pyrethroid plus other	1	0.1%	1	1.9%
Other	102	7.8%	11	20.4%
Multiple ingredients	54	4.1%	5	9.3%
Unknown	29	2.2%	11	20.4%
Total	1305	100.0%	54	100.0%

Table 20. Location of Exposure for Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Location	Cumulative	Percent	2012	Percent
Private Residence - Type Unk.	1978	89.1%	400	87.7%
Single Family Home	125	5.6%	26	5.7%
Multi-unit housing	24	1.1%	7	1.5%
Private vehicle	10	0.5%	2	0.4%
Farm	4	0.2%	0	0.0%
Retail Establishment	4	0.2%	0	0.0%
Mobile home	4	0.2%	1	0.2%
Service Establishment	4	0.2%	2	0.4%
Residential Institution	3	0.1%	1	0.2%
School	3	0.1%	1	0.2%
Other Institution	3	0.1%	0	0.0%
Office/Business	2	0.1%	1	0.2%
Park	2	0.1%	0	0.0%
Road/Rail	1	0.0%	0	0.0%
Other	26	1.2%	6	1.3%
Unknown	26	1.2%	9	2.0%
Total	2219	100.0%	456	100.0%

Table 21. Equipment Used in Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Application Equipment	Cumulative	Percent	2012	Percent
Manual Placement	522	23.5%	85	18.6%
Pressurized can/bomb	477	21.5%	87	19.1%
Trigger pump/compressed air	321	14.5%	32	7.0%
Total Release Fogger	274	12.3%	56	12.3%
Ground sprayer, NEC	12	0.5%	2	0.4%
Aerial application equipment	7	0.3%	1	0.2%
More than one type of equip.	6	0.3%	1	0.2%
Sprayer, backpack	5	0.2%	0	0.0%
Handheld granular/dust applic.	4	0.2%	1	0.2%
Spray line, hand held	3	0.1%	1	0.2%
Soil injector	2	0.1%	2	0.4%
Air Blast Sprayer	2	0.1%	0	0.0%
High pressure fumigator	1	0.0%	1	0.2%
Other	12	0.5%	2	0.4%
Not applicable	133	6.0%	25	5.5%
Unknown	438	19.7%	160	35.1%
Total	2219	100.0%	456	100.0%

Table 22. Application Target for Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Application Target	Cumulative	Percent	2012	Percent
Building surface	533	24.0%	78	17.1%
Human - skin/hair	151	6.8%	9	2.0%
Veterinary - domestic animals	138	6.2%	18	3.9%
Landscape/ornamentals	99	4.5%	16	3.5%
Pool, Spa, Hot Tub, Jacuzzi	74	3.3%	21	4.6%
Building structure	71	3.2%	6	1.3%
Undesired plant	58	2.6%	1	0.2%
Humans	41	1.8%	19	4.2%
Bait for rodent, bird, predator	38	1.7%	8	1.8%
Building space treatment	19	0.9%	8	1.8%
Vegetable crops	9	0.4%	0	0.0%
Human - skin/hair & clothing	9	0.4%	4	0.9%
Misc. vegetables	8	0.4%	0	0.0%
Misc. field crops	8	0.4%	0	0.0%
Tree Fruits	7	0.3%	0	0.0%
Human - clothing	6	0.3%	1	0.2%
Forest trees/land	4	0.2%	1	0.2%
Soil	3	0.1%	2	0.4%
Veterinary - livestock	3	0.1%	0	0.0%
Seed/pod vegetables	2	0.1%	0	0.0%
Fiber crops	2	0.1%	1	0.2%
Aquatic-pond, stream, lake, canal	2	0.1%	0	0.0%
Fruit crops	2	0.1%	1	0.2%
Citrus fruits	1	0.0%	1	0.2%
Curcubit vegetables	1	0.0%	0	0.0%
Fruiting vegetables	1	0.0%	0	0.0%
Root/tuber vegetables	1	0.0%	0	0.0%
Oil crops	1	0.0%	0	0.0%
Other	40	1.8%	8	1.8%
Not applicable	304	13.7%	73	16.0%
Unknown	583	26.3%	180	39.5%
Total	2219	100.0%	456	100.0%

Figure 9

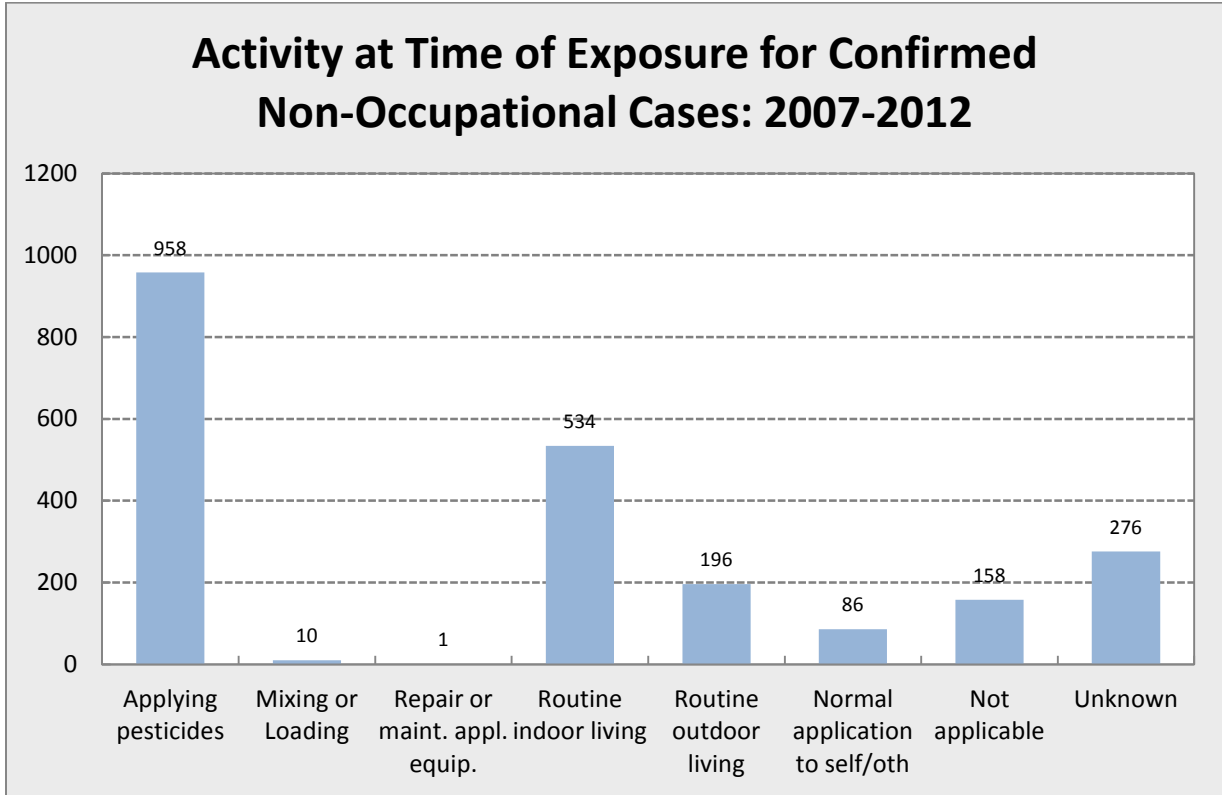


Table 23. Severity of Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Severity	Cumulative	Percent	2012	Percent
Fatal	4	0.2%	0	0.0%
High	19	0.9%	5	1.1%
Moderate	112	5.0%	42	9.2%
Low	2084	93.9%	409	89.7%
Total	2219	100.0%	456	100.0%

Table 24. Route of Exposure for Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 separately.

Route of Exposure	Cumulative	Percent	2012	Percent
Inhalation	910	35.7%	162	31.5%
Ocular	610	24.0%	135	26.2%
Dermal	607	23.9%	118	22.9%
Ingestion	285	11.2%	50	9.7%
Injection	2	0.1%	1	0.2%
Unknown	131	5.1%	49	9.5%
Total	2545[†]	100.0%	515[†]	100.0%

† Some individuals had more than one route of exposure.

Table 25. Reported Signs and Symptoms for Confirmed Non-Occupational Cases, 2007 - 2012 and 2012 Separately.

Sign and Symptom Category	Cumulative	Percent	2012	Percent
Respiratory	875	23.4%	165	20.6%
Ocular	707	18.9%	153	19.1%
Gastrointestinal	638	17.1%	101	12.6%
Dermal	547	14.7%	113	14.1%
Neurological	528	14.2%	123	15.4%
General	252	6.8%	85	10.6%
Cardiac	171	4.6%	60	7.5%
Renal	11	0.3%	1	0.1%
Total	3729[†]	100.0%	801[†]	100.0%

† Some individuals had more than one type of symptom.

Table 26. Confirmed Non-Occupational Cases, by Treatment Location, 2007 - 2012 and 2012 Separately.

Treatment Location	Cumulative	Percent	2012	Percent
Advice of poison control center	1982	77.9%	448	74.7%
Emergency Department	359	14.1%	85	14.2%
Physician Office / Urgent Care	93	3.7%	26	4.3%
On-site by Emergency Responder	35	1.4%	11	1.8%
Hospital Inpatient Care	29	1.1%	13	2.2%
Declined Medical Care	24	0.9%	3	0.5%
Other	18	0.7%	9	1.5%
Unknown If Care Sought	5	0.2%	5	0.8%
Total	2545[†]	100.0%	600[†]	100.0%

† Some individuals sought multiple forms of care such as those calling poison control and subsequently going to the emergency department.

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Appendix

Confirmed Occupational Cases in High and Moderate Severity Category

Exp NC 01015

A private pesticide applicator was preparing soil for cantaloupe planting, using a tractor and fumigation rig (halocarbon fumigant). Equipment was stopped because the fumigation lines were stopped up. When the applicator tried to unstop the lines they broke loose and pesticides spurt out and went into his eyes. He developed burning in both eyes, swelling and vision went blank. The applicator had left his safety glasses in tractor. Went to the emergency department and subsequently had two eye surgeries to correct vision in the left eye.

Exp NC 01765

Lawn care service owner worked with weed killer (phosphonate herbicide) for two days and deliberately made mixture double strength by using only half amount of water needed to mix for use. Did not usually wear personal protective equipment (PPE). He developed chest pain, dehydration, dyspnea, chest tightness, mild renal failure and was admitted to the hospital.

Exp NC 02788

A laborer for a cell tower construction company was loading work equipment at the end of the work day. He picked up a Gatorade bottle from the back of a truck, opened the bottle and drank from it. He was hot and thirsty. He realized it was not Gatorade and spit most of it out. There had been some pesticides in the bottle. He became sick traveling home from work. He developed acute respiratory failure, drooling, pinpoint pupils, gastrointestinal distress, weakness, altered mental status, and neuropathy. Hospitalized for six days. The owner of the construction company had organophosphate insecticide (restricted use) ant killer in his shop. The laborer's co-worker got the ant killer and placed it in the Gatorade bottle to use later on his yard at home to spray ants.

Exp NC 03549

Farmworker was topping and suckering tobacco in a field. She developed a rash with blisters on mid-forearms bilaterally, especially on right arm where gloves appeared to end. By the end of the day her mouth and throat felt like they were swelling. She went to a community health center that evening. It was determined that she had been exposed to pesticides residues likely containing organophosphate, a sucker control agent (fatty alcohols) and a plant growth regulator (2,6 dinitroaniline).

Exp NC 02597

Farmer was spraying gramoxone (paraquat herbicide) in a field and he got the mist in his eyes. Developed photophobia, redness, swelling. Went to the emergency department.

Exp NC 02701

Farmer got insecticide (pyrethroid) in his eyes. He flushed but still had eye irritation. Went to emergency department.

Exp NC 03343

Farmworker was refilling the tank of a low pressure ground sprayer with insecticide (organophosphate) and as he was pouring he hit the top of the container and pesticide splashed on his cheek and into his right eye. He developed eye burning and pain. He went to the local urgent care and was diagnosed with chemical conjunctivitis and corneal abrasion. He stated he was in a hurry and did not wear goggles or other PPE.

Exp NC 04257

Farmworker got paraquat herbicide on his feet and developed severe burns with blisters. Reported to a community health center.

Exp NC 04878

Farmworker was spraying Christmas trees with Dimethoate 400 (organophosphate insecticide) and noticed his jeans were damp or wet. Had itching and burning from the knees down and was admitted to the hospital.

Exp NC 05079

Worker was spraying 2,4-D (chlorophenoxy herbicide) and was doused with the product. He went home showered and developed vomiting, headache, shortness of breath, skin inflammation, an arm rash and cough. Went to a doctor.

Exp NC 00183

State park worker was spraying grass to kill weeds with a 20-gallon tank stationed on a golf cart with a 20-foot hose. He was applying triazine herbicide. He was wearing safety glasses but it was so hot he could not keep equipment on. The spray crew also increased the concentration of the pesticides while spraying. Reported the pesticide was blowing back in the wind and got it on his skin and he inhaled some. After the application he became short of breath, started coughing and felt nauseated and vomited. Went to the emergency department.

Exp NC 00759

Pest control operator applied Mavrik Insecticide (pyrethroid) at an outdoor location. He had some blow back in his face and breathed in the pesticide and got it on his skin. He developed dyspnea, wheezing, chest pain, fogginess and tingling of his skin. He went to the emergency department.

Exp NC 02232, Exp NC 02237

Two migrant farm workers presented to a hospital emergency room with symptoms consistent with suspected organophosphate or carbamate pesticide exposure (event involved total of seven workers). Workers developed symptoms of nausea, diarrhea, vomiting, dizziness, weakness and hyper salivation after eating a watermelon grown in a personal garden at the hog farm where they worked. Both workers were admitted to the hospital and discharged soon after. It was determined that someone had applied Temik (carbamate insecticide) to the watermelon garden to prevent rats from eating the fruit and the plant absorbed the pesticide. Investigators found the Temik in an unmarked container in a farm shed.

Exp NC 02725

Farmworker working on tobacco farm with Temik (carbamate insecticide) and developed weakness & shortness of breath. Went to the emergency department.

Exp NC 02918

Laborer working for carpet cleaning company was cleaning carpet in a house that had been treated the same morning for fleas with a pyrethroid insecticide by a pest control company and was not told about it. Worker developed headache, nausea, wheezing, vomiting, tachycardia and reported to emergency department.

Exp NC 03202

Worker was working on a pool and he accidentally inhaled some fumes from pool tabs. Developed shortness of breath, chest tightness, wheezing. Went to emergency department.

Exp NC 03270

Worker at restaurant set off foggers (pyrethroid insecticide) and put down boric acid (insecticide). He stayed in the building for 30 minutes after starting foggers. He developed dyspnea, dry cough, chest pain, chest soreness, dizziness, light-headedness, wheezing, headache, vomiting, nausea and went to emergency department.

Exp NC 05095

A woman and her co-worker were walking in a public area during a work break. They walked past a lawn care company applying pesticides (2,6 dinitroaniline herbicide) with a hose out of a truck. The applicator did not stop spraying when they walked by. There was a strong odor & they both accidentally breathed in fumes/mist. They covered their faces with their arms to try to shield themselves. The wind was blowing very hard that day. One worker developed fatigue, sore throat, headache, nausea, burning eyes, burning sensation in nose and throat, cough, and lung congestion and went to the emergency room.

Exp NC 00135

A farmworker and his coworker were going to spray a wasp nest on a tree with Recco Stinger II (pyrethroid insecticide). The co-worker had the spray nozzle pointing in the wrong direction and when they tried to spray the insecticide, it splashed on the farmworker's face. He was wearing safety glasses. He started experiencing nausea and vomiting within a few minutes of being exposed. He says that he did not shower immediately because he was far away from the building. He eventually left work, went home and showered. He later developed dizziness, headache, weakness, paresthesia, nausea, vomiting and blurred vision. He went to see a doctor.

Exp NC03856

A farmer had worked with Temik (carbamate insecticide) over the weekend and developed nausea, vomiting, diarrhea, tremors, weakness, lack of appetite, sweating, stomach upset, and stomach cramping. He went to the doctor and was put out of work for five days.

Exp NC 03111

A railroad inspector was working with weed and brush herbicides (phosphonate, pyridinecarboxylic acid, and imidazolinone) using a truck that goes down the railroad track spraying. The worker was trying to guide the sprayer down the track. When he was at railroad crossings he was walking through the area being sprayed and was exposed to vapors all day. Late in the day he developed a severe headache with distorted vision and went to the emergency department and was out of work for three days. Personal protective equipment worn: hard hat, gloves, goggles.

Confirmed Non-Occupational Cases under 18 Years; Fatal, High and Moderate Severity Category

Exp NC 01163

Seven-year-old boy drank paraquat herbicide out of a Dr Pepper bottle. A teenage brother had obtained the pesticide from a neighbor (certified applicator) and used it on weeds at the family home. He then stored the herbicide in a Dr Pepper bottle in the garage and child found it on a window sill and drank from it. Died in the hospital two weeks later.

Exp NC 00781

Four-month-old child exposed to pesticides in home of migrant farm workers, specific source unknown. Presented to emergency department in respiratory failure and recovered in the ICU. Urine metabolite testing showed high concentrations of organophosphates.

Exp NC 02372

Teenager trying to make a chlorine gas bomb for fun with crushed chlorine pool tablets and rubbing alcohol and inhaled fumes. Developed respiratory distress and was hospitalized for four days.

Exp NC 01082

Father laying carpet in a house and put Roach Away Roach Powder (boric acid) in corner of room. Later on found 18-month-old child playing in same corner. Child became ill that evening. He vomited and seemed somewhat lethargic to parents. Was brought to the emergency department and admitted overnight for observation.

Exp NC 03577

Seventeen-month-old boy ingested a mouthful of Roundup (phosphonate herbicide) that was in a cup found in a new rental home. Multiple chemicals were left in the house by previous tenants. The child developed an inflamed, excoriated upper lip, blisters on upper and lower lips, an ulceration and abrasion on the tongue, vomiting and drooling. Admitted to the hospital.

Exp NC 04107

Two-year-old child found spraying Hartz Ultraguard Plus Flea and Tick Home Spray (pyrethroid and insect growth regulator insecticide). Legs and clothing became soaked. Became listless, unresponsive and developed tachycardia, nausea, and vomiting. Brought to the emergency department.

Exp NC 05334

Child ingested half a tube of permethrin cream 5% (Pyrethroid insecticide). Vomited multiple times and brought to emergency department.

Exp NC 00843

Two-year-old child found with sprayer nozzle of Bayer Advance Home Pest Control (pyrethroid insecticide) in his mouth and ingested an unknown amount. Vomited four times and coughed a lot. Brought to emergency department.

Exp NC 04532

Three-year-old child picked up and drank a pesticide called Silencer (pyrethroid) and some spilled over his face and eyes. Skin was inflamed and he started to foam at the mouth. Brought to the emergency room.

Exp NC 05196

Child was in a room when sister accidentally set off Raid fogger (pyrethroid). Child was brought to emergency department with coughing and vomiting.

Exp NC 01529

Four-year-old child ran barefoot through a neighbor's yard where they had put out some liquid and granules for fire ants (carbamate and indandione insecticides). Child brought to emergency department with blistering on feet and partial and full thickness burns. Some fingers had blisters.

Exp NC NC00065

A 2-year-old boy sprayed Tat Area Fogger II (pyrethrum and parathyroid) and put the straw attached to the container in his mouth and sucked on it. Child started coughing and was taken to the emergency department. At the hospital, child went into respiratory distress and was admitted.

Exp NC 00108

Nine-year-old boy was lured by a friend to take a whiff of Pool Shock 35 (disinfectant). The boy started experiencing bronchospasm, coughing, wheezing, dyspnea and hyperventilation. He was taken to the emergency department where he was treated and released.

Exp NC 01982

Man put Temik (carbamate insecticide) (restricted use) in his garden soil to keep insects away from the squash plants. He picked and ate his squash together with his wife and stepdaughter. They all became ill and went to the emergency department. The stepdaughter developed atrial fibrillation, nausea, vomiting, diarrhea and weakness.

Exp NC 00609

Teen accidentally inhaled a Raid Roach fogger (pyrethroid insecticide) he set off in his home. He developed a cough and complaints of pain on deep inspiration. Went to the emergency room.

Exp NC 01552

Teen accidentally set off a can of fogger (pyrethroid insecticide) and it sprayed her directly in the face. She developed symptoms of coughing and wheezing and went to urgent care.

Exp NC 05377

Child ingested a mosquito control tablet (organophosphate insecticide) as suicide gesture. Developed symptoms of sweating, tachypnea, nausea, pain, vomiting and oral irritation. Went to emergency department.

Exp NC 01713

Four year old child ate unknown amount of rat bait. Develop abnormal INR, PT, PTT. Was admitted to hospital and given Vitamin K. Family states that the rodenticide is always out at home.