BACKGROUND

According to the National Agricultural Statistics Service (NASS), in 2002, Texas had 130 million acres of total farmland with the largest amount of farmland designated as cropland (38 million acres) in the U.S. (NASS, 2004). Agriculture is a major industry in Texas with the market value of agricultural products worth more than 14 billion dollars (NASS, 2004). Texas also ranks number one nationwide in the production of cotton. To maintain the large agricultural industry in Texas most farm owners find it necessary to use pesticides. Further, pesticide application to cotton is three to five times greater per hectare compared to other products (USGS, 2003). In Texas, the potential for workers to be exposed to pesticides is not limited to agricultural occupations. Given the mild climate and the resultant nuisance and destructive pests, many commercial exterminators, golf course managers, parks and recreation departments, schools, highway departments, public health agencies, utility companies, and others often use pesticides. Although there are 3,000 licensed pest control applicators in Texas, applications often are made by untrained personnel who are unfamiliar with the pesticide. The public health impact of occupational related pesticide exposures has largely been unknown since occupational pesticide poisoning cases had historically been under-ascertained. The purpose of this project was to enhance a systematic occupational pesticide exposure surveillance system to collect, analyze, interpret, and disseminate occupational pesticide exposure data. The timely collection and dissemination of such data are vital to preventing occupational pesticide exposure-related illness. Additionally, the surveillance of occupational pesticide exposures can serve as an early warning system for any harmful effects not detected by the manufacturer during the testing of pesticides.

From 1987 to 2006, the Texas Department of State Health Services (DSHS) received funding from the National Institute for Occupational Safety and Health (NIOSH) under SENSOR cooperative agreements to conduct surveillance of occupational pesticide exposures. With technical guidance and funding support provided by NIOSH, the Pesticide Exposure Surveillance in Texas (PEST) Program collaborated with NIOSH, EPA, and other states to identify occupations at-risk for occupational pesticide exposure and to collect data on occupational related pesticide exposures. This project enabled the PEST Program to improve its ability to systematically collect, analyze, and interpret information on occupational pesticide exposures by enhancing case ascertainment through strengthened ties with other entities. The information collected through this project was used to produce educational materials pertaining to methods of prevention and the fully bilingual staff (Spanish-English) enabled DSHS to conduct culturally appropriate presentations to and establish dialogue with at-risk populations that are traditionally overlooked (migrant farmworkers). Exposures identified through the surveillance activities that met the criteria for field investigation produced information necessary to identify interventions necessary to change pesticide use practices and/or modify regulation (Calvert G., et. al., 2001). Funds used to support this project also enabled the PEST Program to identify emerging pesticide problems such as pesticide poisoning in retail establishments, unintentional lindane ingestions, and pesticide poisonings among working youth. This report summarizes the final SENSOR funding period beginning September 30, 2002 and ending September 29, 2006.

SPECIFIC AIMS FOR THE FINAL GRANT PERIOD (2002-2006)

The five specific aims for the PEST Program for the 2002-2006 final SENSOR funding period pertain to three main categories: I) Case Ascertainment, II) Data Collection and Analysis, and III) Education and Partnerships.

I. Case Ascertainment

- Enhance and perfect case ascertainment methods by strengthening existing ties with Texas Department of Agriculture (TDA) and Texas Poison Control Network (TPCN) and establishing partnerships with migrant clinics.

II. Data Collection and Analysis

- Conduct a follow-up interview with reported case and collect medical information associated with the exposure (if treatment was sought).

- Continue to conduct rapid follow-up field investigations (in collaboration with partnering agencies) and use the results for targeted prevention efforts.
- Conduct ongoing data analysis and distribute summary reports, including professional journal publications.

III. Education and Partnerships

- Develop new bilingual and culturally sensitive educational materials and provide pesticide safety training and other interventions to targeted populations and at-risk communities.

PROCEDURES/ METHODOLOGY

I. Case Ascertainment

The PEST Program has adhered to the same case definition and classification for acute pesticide-related poisoning since 1998, the year that this definition was finalized [Calvert et al., 2001]. To summarize the case definition, specific information regarding the pesticide involved, health effects and consistent association between health effects and the known toxicology of the pesticide is required to determine a classification status of definite, probable, possible, or suspicious; an exposure is considered confirmed if it has one of these 4 classifications. A classification of *Suspicious* is limited to exposure reports lacking toxicological association data to the pesticide because there are fewer than 2 published cases or epidemiologic studies linking health effects to exposure available [CDC, 2000a]. The PEST Program actively collects suspected work-related pesticide exposures. Non-occupational pesticide exposures are processed with the exception of poison control reports. The PEST Program queried poison control reports regardless of occupational status when investigating potential hazards or emerging trends [Alarcon, 2005; CDC, 2003; Forrester, 2003].

Prior to 2004, PEST limited surveillance to the FIFRA definition of pesticides, which includes but is not limited to herbicides, insecticides, rodenticides, repellents, fumigants, and fungicides. The PEST Program incorporated disinfectant exposure in its case definition in 2004. California was the only state conducting surveillance for acute occupational disinfectant exposures until the Michigan and Louisiana surveillance programs began collecting data on disinfectants in 2002. Results from a study of US and California data for 1993-1998 identified a major data gap (presented by poison control data) and strongly recommended that states monitor these exposures, which were found to present a higher risk to working youths than adults (Brevard et al., 2003).

Reporting and Investigatory Authority for Occupational Pesticide Poisoning

The Texas Occupational Conditions Reporting Act, Health and Safety Code, Chapter 84, House Bill 2091, passed in 1985 and the accompanying Texas Administrative Code Chapter 99 requires physicians, laboratory directors, and other health professionals to report acute occupational pesticide poisoning to the state public health agency (Appendix A). In addition to authorizing DSHS to collect information including medical records, the law authorizes collection and analysis of environmental and biological specimens. Medical records are crucial in providing key health related information and often identify the pesticide agent, occupational and contact information critical to successful follow-up interview, and ultimately complete case classification. At the same time, workers who seek care often do not provide the physician with a history of pesticide use and often the presenting symptoms may be nonspecific mimicking other illnesses such as the flu, a stomach virus, or food poisoning.

The Texas Poison Center Network (TPCN)

The TPCN is a network that consists of six poison control centers located in Amarillo, Dallas, El Paso, Galveston, San Antonio, and Temple. DSHS funds the 6 centers, and through language in the contractual agreements requires reporting of pesticide exposures to the PEST Program. From 2002-2004, TPCN reports were received quarterly, and depended on the technological capability of 1 center to combine all 6 centers' data. This information would be posted to an FTP site, which PEST accessed to download reports in MS Access. In 2005, the PEST Program began receiving TPCN reports twice weekly, with the exception of technological problems and absence of personnel.

In addition to DSHS, which has some regulatory authority related to vector control, the Texas Department of Agriculture (TDA) and the Structural Pest Control Board (SPCB) are state agencies with pesticide regulatory authority in Texas. DSHS has a formal memorandum of understanding (MOU) with both of these agencies (Appendix A). TDA is the state's primary pesticide regulator. In addition to regulating pesticide labels, use, and applicator's training, TDA regulates agricultural pesticide applications in Texas. TDA pesticide inspectors often are the first to receive notification of agricultural-related human pesticide exposures. SPCB regulates structural pesticide applications, enforces the state's public school Integrated Pesticide Management (IPM) policy, and licenses commercial applicators. PEST staff continued to work reciprocally with SPCB enforcement staff by referring human exposure cases and following-up on their agency's reports to PEST. Reporting reminders and current staff contact information were faxed to TDA offices statewide annually, from 2002-2006. Staff also met with TDA and SPCB central office (Austin, TX) staff annually to discuss reciprocal reporting needs and methods to improve communication between agencies to enhance investigation outcomes and information exchange. The PEST Program has also worked with the Occupational Safety and Health Administration (OSHA) for occupational health referrals and inquiries.

Other Reporting Sources

Data reporting relationships exist between DSHS PEST and *the Texas Workers' Compensation Commission, DSHS Vital Statistics,* the *Texas Boll Weevil Eradication Foundation,* and the 11 federally funded migrant clinics. These clinics are potential sources of case reports in a population of particular interest -- migrant farm workers. Although TDA reports exposures of migrant workers, many migrant workers will not report pesticide exposures related to misuse, misapplication, or violation of the worker. Other DSHS programs have reported exposures. Self-reports are rare, but are accepted in the surveillance system.

II. Data Collection and Analysis

Upon receiving a report, staff initiated contact with the exposed individual or a proxy for a brief interview to obtain details on the event. If the individual sought medical care, records were requested. In August 2006, NIOSH required Institutional Review Board (IRB) review of states' surveillance protocols. The PEST Program received IRB approval, and interviews were then preceded with a summary of the surveillance initiatives and a request to participate according to IRB protocol.

Interviews were conducted using a questionnaire developed from the SPIDER surveillance database, which organized information for approximately 148 standardized variables. The questionnaire is continually updated as variables are modified systematically (Appendix B). Staff conducted interviews in Spanish as needed. Health effects data from medical records were transcribed into the questionnaire according to signs and symptoms. Information was then evaluated according to the 3 case classification categories: exposure, health effects, and cause. The exposure also was evaluated to determine illness severity (full definition: CDC, 2001). The 4 severity categories are: low severity, for minimal exposures that resolve quickly; moderate severity for exposures that are not life threatening, but that are more pronounced with systemic health effects; and high severity for exposures that are life threatening or that result in significant residual disability. The high severity category also includes fatalities.

During the interview, staff requested permission to contact the individual's employer or supervisor, as needed. Occasionally, employers were contacted to discuss prevention and/or training needs in the workplace. A staff toxicologist was available for consultation with workers or employers. For exposure events that involved potential regulatory violation, PEST staff facilitated contact between individuals/employers and the appropriate regulatory agency.

Exposure events involving 4 or more workers, hospitalization or death, or that represented a repeating problem at the same workplace, met the NIOSH criteria for consideration for field investigation. Additionally, an event involving injured workers despite adherence to pesticide labeling instructions also met these criteria (Appendix B). During field investigations, pesticide safety consultations and workplace evaluations were provided to employers and workers to enhance overall worker safety and prevent future occurrence.

Evaluation of EPA's Worker Protection Standards (WPS)

As part of our SENSOR Pesticides project, we received supplemental EPA funds to evaluate the Worker Protection Standards (WPS). The revised federal WPS, which took effect in 1995, sets requirements for employers of pesticide handlers and agricultural workers. We surveyed 210 farmworkers in 3 regions of the state between 1999 and 2001. Data analysis and presentation of the survey results were concluded in 2004.

Data Analysis
Pesticide exposure data were collected, queried, and organized in MS Access and Excel and entered into the SPIDER Visual FoxPro database. Flat files from SPIDER were analyzed in Excel and SPSS for reports and data requests. All data were sent electronically to NIOSH on an annual basis and contributed to the national aggregate database (http://www2.cdc.gov/niosh-sensor-pesticides/search.asp). Personal identifiers were removed automatically by reporting mechanisms integrated in the SPIDER database. Occupational and Industry information were collected and coded according to the 1990 Bureau of the Census codes. Agriculture industry codes are defined as 010 *farming*; 011 *livestock*; or 030 *agriculture services.* All pesticide exposures reported during the final funding period September 30, 2002 to September 29, 2006 were used to evaluate case ascertainment. Data were confined to work-related pesticide illness classified as definite, probable, possible or suspicious that occurred during the calendar years 2002-2005 for the remainder of analyses in this report unless otherwise stated. Disinfectant exposures were formally included in follow-up protocol beginning January 1, 2004.

III. Education and Partnerships
We developed working relationships with the regulatory agencies responsible for worker safety and health and pesticide misuse/misapplication. When a report is received from the TPCN, a health care provider, or another (non-regulatory) source, PEST staff notified the appropriate regulatory agency if any information obtained during the course of follow-up suggested the presence of imminent danger, misuse, misapplication, or potential violation of the worker protection standard. The field investigation initiative demonstrated that intervention was feasible and has provided unique opportunities for prevention. Conducting telephone interviews with all reported cases provided frequent opportunities for individual education and providing tips on prevention of pesticide illness in the future. Pesticide-specific informational letters, written for lay people were available and offered to individuals during the interview. Letters were translated to Spanish as needed.

The first Regional Ad-hoc Pesticide Exposure Surveillance Steering Committee was created in 2004 to address pesticide exposure in a tri-state region. The committee was comprised of public health, agriculture, industry, labor and academic representatives from El Paso, New Mexico, and NIOSH. Two new representatives from Juarez, Chihuahua joined the committee in 2005. The steering committee has met approximately twice a year to discuss program updates, emerging trends and ideas for effective outreach to the region’s farmworker population.

PEST staff developed bilingual educational literature for reporting partners and the general public. A Pesticide Poisoning Reporting brochure providing detailed information on how to recognize and report incidents of pesticide exposure was developed specifically for health care providers (Appendix C). Our website is in English and Spanish. A second reporting brochure providing guidance on what should be done in the event of a pesticide exposure was developed for the general public. To facilitate reporting we developed a bilingual pesticide incident report form that health care providers could submit by fax 24 hours a day. Finally, we developed bilingual safety and prevention materials for workers who routinely handle pesticides as part of their job. We also worked with the Farmworker Justice Fund on an additional project to provide bilingual pesticide prevention training to migrant clinicians and promotoras (lay health care providers) throughout Texas.

RESULTS AND DISCUSSION

I. Case Ascertainment

Over the 4-year period September 30, 2002 through September 29, 2006, the PEST Program processed 1,501 reports of suspected pesticide exposure. Seventy percent of these reports were work-related. There were 639 confirmed work-related pesticide illnesses reported for the 4 fiscal-year period (report year, Figure 1). Unless otherwise stated, results and discussion from this point forward will address confirmed acute occupational pesticide exposures that occurred (N=524) during calendar years 2002-2005 (Figure 2).

Figure 1. Case Ascertainment for Pesticide Exposure in TX, Reported 9/30/2002-9/29/2006 (FY 03-FY 06)

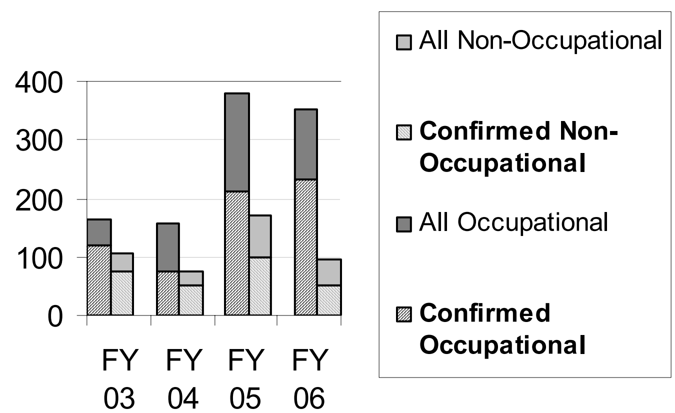
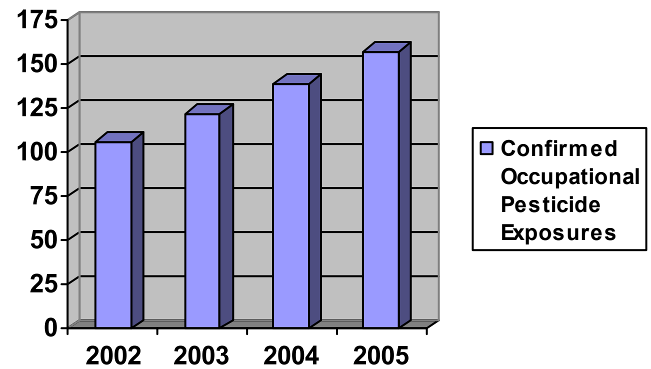
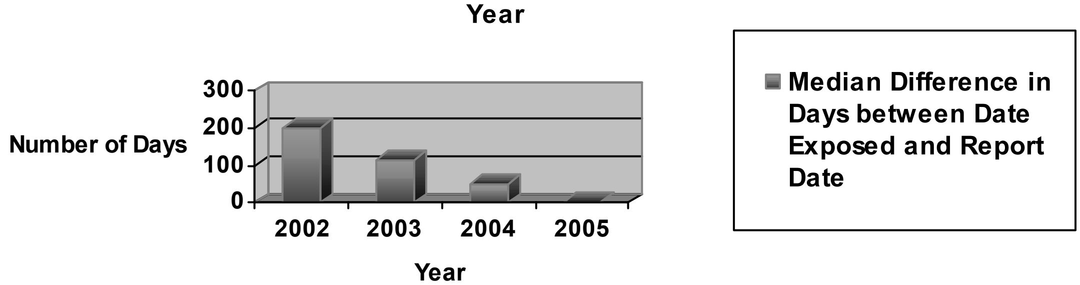


Figure 2. Confirmed Acute Occupational Pesticide Exposures in TX, Event Years Calendar Years 2002-2005



TPCN reported the majority (79%) of these confirmed cases. The Texas Workers' Compensation Commission (TWCC) was the second-highest (8%) reporting source, followed by the TDA (6%). All other sources were responsible for less than 2% of the confirmed work-related illnesses. Figure 3 shows the improvement made in decreasing lag time between exposure and report dates. In February 2005, PEST began receiving TPCN reports approximately twice a week. Previously, we received TPCN reports between 3 and 6 months following exposure date. The median difference between exposure date and report date for persons exposed in 2002 was 202 days, compared to 3 days in 2005.

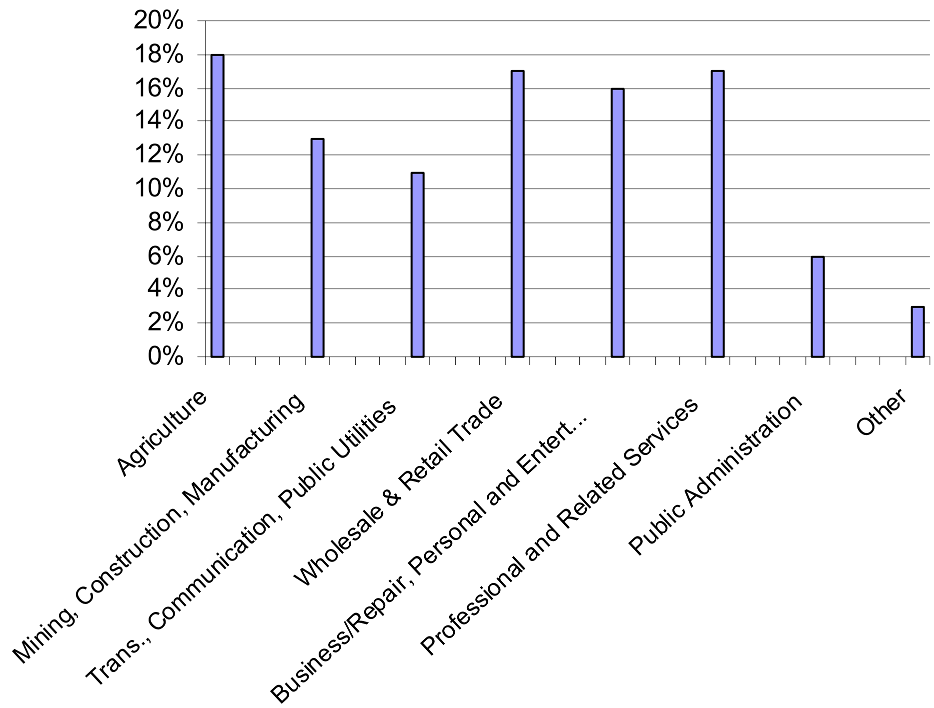
Figure 3. Median Latency between Event and Report Dates by Exposure Year



II. Data Collection and Analysis

Industry information was unknown for 17% of the cases. For those employees whose industries were known, 18% were employed in the agriculture industry (figure 4). The wholesale and retail industry (collapsed) represented the second highest industry, along with the Professional and Related Services industry with 17% of the cases each. The occupation with the most pesticide-related illnesses was farmworker (n=38), followed by Janitors/Cleaners (n=36) and Pest Control Occupations (n=36).

Figure 4. Acute Occupational Pesticide Exposure by Industry 2002-2005



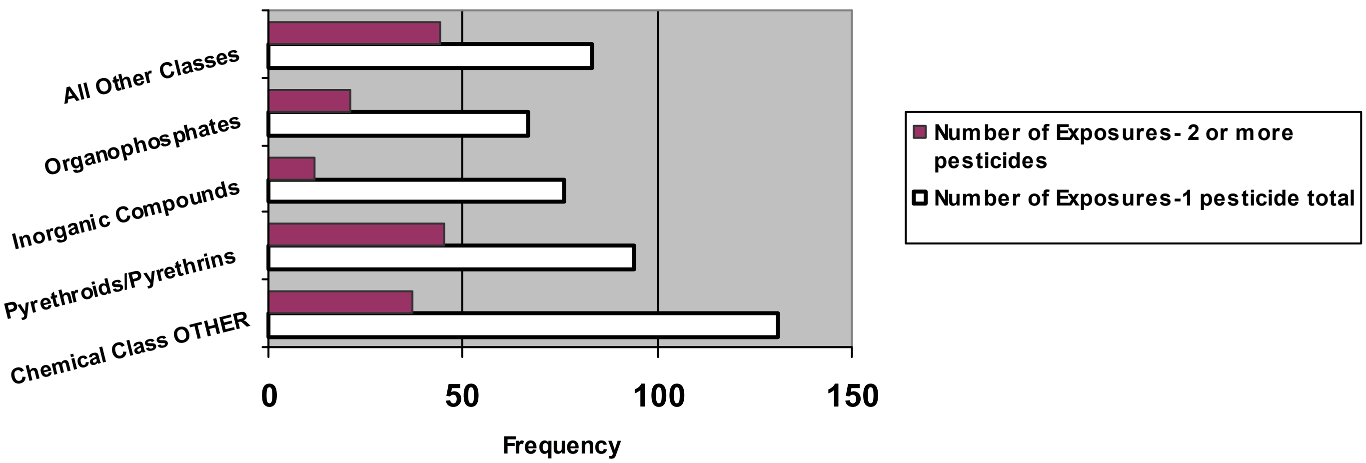
Fifty-eight percent of the cases sought medical attention (medical care was unknown for 2% of the cases), with 37% going to the emergency room, and 5% required hospitalization. Eight percent (n=40) of the cases did not seek healthcare, nor did they consult poison control; the industry with most workers not seeking healthcare was agriculture (33%). Sixty-eight percent of agricultural employees sought medical attention. Within the next 3 industries with highest incidence of exposure illness, 61% of workers in the Business/Repair, Personal and Entertainment Services sector sought medical care; 58% of employees in the Professional Services sector sought medical care; and only 42% of wholesale and retail industry workers sought medical care. Overall, the health effects category reported most was neurological (57%), followed by gastrointestinal effects (42%), and respiratory effects (40%). Ocular and dermal health effects were reported in 32% and 28% of the exposures respectively.

DEMOGRAPHICS

The mean age for all workers was 34 years. Age was unknown for fewer than 6% of all workers. Thirty two percent of all workers were females. The Professional and Related Services industry was the sole industry where females outnumbered males (71%). Exposure was distributed somewhat evenly for all exposed workers, up to age 44 (range 22-25% of all cases), yet there were industry differences. Thirty-five percent of workers age 19 and under were employed in the wholesale/retail industries. The youngest worker was age 14 and employed in agriculture. Employees aged 65 years and older comprised 2% of all cases. The agriculture industry had the largest percentage of workers age 55-64 (28%). Race and ethnicity were unknown for 15% of the cases. The majority of workers were white (79%), and 30% of workers reported Hispanic ethnicity. Four percent of employees were African-American, and 1% (n=6) were Asian or Pacific Islander.

Eighty-six percent (n=451) of the work-related pesticide illnesses involved exposure to 1 pesticide chemical class (Figure 5). The chemical class “Other” includes pesticides ranging from the EPA toxicity class 1 disinfectant Ster-Bac, commonly used in the food service industry, to the insecticide Termidor SC (active ingredient Fipronil), commonly used for termite applications. Pesticides in the “Other” category were involved in 28% of work-related exposures. Exposures to Pyrethroids and Pyrethrins (separately) were involved in 23% of all exposures, and of the work-related pesticide exposures involving more than 1 chemical class, pyrethroids and pyrethrins were the most commonly reported pesticides (28%). Both Inorganic Compounds (which include sodium hypochlorite, chlorine, etc.) and Organophosphates were involved in 14% of work-related exposures.

Figure 5. Acute Occupational Pesticide Exposure by Chemical Class, TX 2002-2005



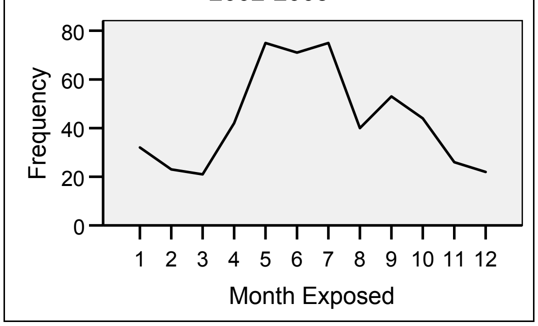
Case activity was unknown for 9% of all exposures. Workers were conducting regular work activities <u>not involved</u> with pesticide application, transport or mixing/loading in 45% of exposures; workers involved with pesticides accounted for 47% of exposures. Personal Protective Equipment (PPE) use was collected for 218 workers. Forty-four percent of workers directly involved with pesticides were not wearing any PPE. Among the Service occupations and Farm, Forestry, and Fishing occupations work activity at time of exposure that consisted of pesticide application, transport or mixing/loading was greater than regular work duties not involved with pesticide application (61% and 78% respectively). Exposure during regular work duties not involved with pesticide application, transport, etc. was greatest in the Managerial, Professional and Administrative and Technical Sales occupations (n=83, 75%).

LOCATION AND DATE

Table 1. Exposures by Application Site

EVENT SITE	N	%
Agricultural	97	19%
Private Residence	32	6%
Institutions	49	9%
Manufacturing	42	8%
Commercial Facilities	111	21%
Other	63	12%
Unknown	130	25%
Total	524	100%

Figure 6. Frequency of Confirmed Acute Occupational Pesticide Exposures by Month 2002-2005

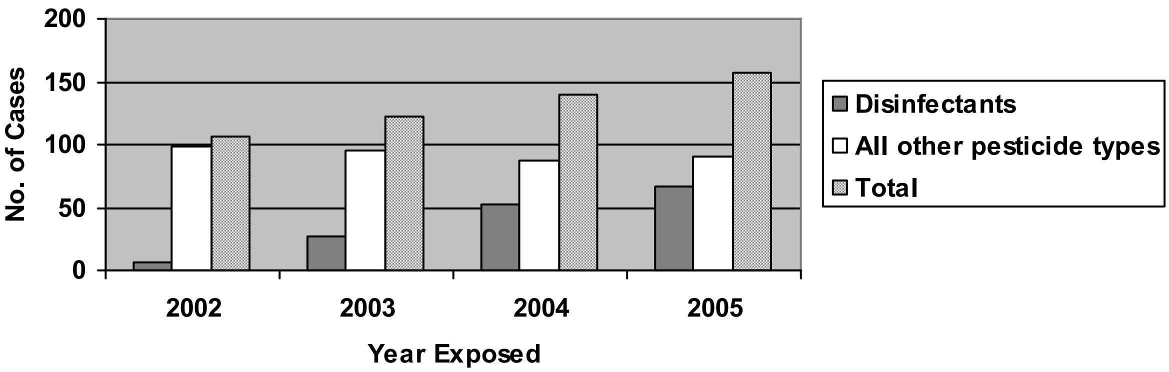


The sites of pesticide application and exposure can identify potential exposure risk for persons at both sites, although in most cases application and exposure site are the same. Table 1 lists the pesticide application sites. Commercial facilities were the event site of 21% of occupational pesticide exposures. Of the commercial facilities, 17% of all occupational exposures occurred in retail and service establishments. Pesticide applications at agricultural sites accounted for 19% of occupational exposures. The majority of agricultural site pesticide applications affected on-site workers (80%), however, there were ten occupational (and over 60 non-work-related) exposures at an elementary school and 9 occupational exposures at other non-agricultural sites. There were 30 exposures in schools, and 12 work-related exposures in hospitals. Application site was unknown in 25% of the cases. Figure 6 above shows frequency of exposures by month for the 4-year period. Exposures increased dramatically in April and peaked in May, with fluctuation a slight spike in August. A final increase occurred again in September, and decreased to fewer than 40 in the winter.

DISINFECTANTS

Follow-up for disinfectant-related exposures began for work-related reports dated January 1, 2004. Despite the inclusion of all confirmed disinfectant exposures reported during the final 2 years of this project period, disinfectants were responsible for 29% of all cases. Figure 7 shows the impact of the consistent inclusion of follow-up for disinfectant-related exposures beginning in 2004, when disinfectant-related exposures doubled from the previous year.

Figure 7. Case Ascertainment for Disinfectant-Related Exposures 2002-2005



Case Studies for Disinfectants

An 18 year-old male busboy at a national franchise restaurant was overcome by fumes as he cleaned the restroom toilet with bleach and a toilet bowl cleaner. He was only wearing gloves. He experienced burning eyes, tears, coughing, nausea and vomiting. He went to the hospital 2 days following the exposure, and signs were wheezing/rhonchi, and difficulty breathing; the diagnosis was toxic effect other gasses. The physician directed that he return to work in 3 days. Medical records showed no indication of workers' compensation notification.

A 47 year-old female cleaning technician at a hospital placed an open bottle of Quat 256 (active ingredient quaternium 12) on a cart and it splashed in her eyes, face, hair and tongue. She rinsed her eye immediately with water. Signs and symptoms from the exposure included erythema to eyelids and eye irritation; sclera/cornea reddened, and dermal pain to her face. She was diagnosed with corneal abrasion

Table 2 shows a breakdown of occupational category with respect to disinfectant and other pesticide exposures. Service occupations, which include custodians and cooks, were impacted the most by disinfectant exposures (n=58) and overall accounting for 24% of all exposures; and disinfectant exposures increased over 300% from 2003 to 2005.

The majority (60%) of disinfectant-related exposures occurred during activity directly involved with pesticides: either application, mixing/loading, transporting, repairing equipment, or a combination of these. This is consistent with the type of disinfectant exposure: 48% of exposures occurred through contact. Thirty-six percent of exposures were indoor air-related. Twenty-six percent of cases involved exposure while completing regular work duties not involved with application.

Table 2. Exposure to Disinfectants 2002-2005 by Occupational Category

Occupational Categories (BOC 1990)	2002		2003		2004		2005				
	All Other	Disin-fectant	All Other	Disin-fectant	All Other	Disin-fectant	All Other	Disin-fectant		TOTAL	%
Managerial, Professional, and Admin Tech Sales 003-389	14	1	25	2	19	7	34	9		**111**	21%
Service Occupations 403-469	**19**	**0**	**15**	**8**	**17**	**21**	**16**	**29**		**125**	24%
Farm, Forestry, Fishing Occupations 479-499	27	2	18	4	10	2	17	6		**86**	16%
Production, Craft, Repair 503-699	7	1	5	3	8	4	2	3		**33**	6%
Operators, Fabricators, Laborers 703-889	16	3	17	8	25	10	11	7		**97**	19%
All Other Occupations	7	0	3	2	2	8	8	12		**42**	8%
Unknown	9	0	12	0	6	0	3	0		**30**	6%
Total	**99**	**7**	**95**	**27**	**87**	**52**	**91**	**66**		**524**	**100%**

SEVERITY

Of all 524 exposures, there were eight cases classified as high severity and 67 cases were classified as moderate. More than three-fourths of the cases were low severity.

High severity cases not involved in pesticide application

Among three of the eight high severity cases, the individuals were not involved in the pesticide application process. The first case was a 46 year-old male prison maintenance worker who was exposed to Suspend SC after an exterminator fogged a work area. Exposure occurred when the worker entered the contained area and become ill. He was hospitalized for three days with signs and symptoms of fatigue, dyspnea, chest pain, headache, memory loss, muscle pain, nausea, and vomiting.

Another case involved a 46 year-old male construction contractor working at a small airport where the pyrethroid permethrin had been applied 2 days earlier for termites. The worker was exposed to the still-wet pesticide on the floor of the hangar through clothing and skin contact. He sought medical treatment at his physician's office with signs of dyspnea, upper respiratory tract irritation, blurred vision, diarrhea, nausea, pain, and vomiting. He subsequently missed 2 weeks of work. Prior to developing symptoms, the worker was not aware of the application. He specifically requested no follow-up with personnel at the airport.

The third case involved a meter reader who was investigating a gas leak in a residential area. Cans of the organophosphate Malathion had been put into the trash and then collected by a nearby garbage truck. While being compacted, the cans spilled and leaked on the ground, releasing a pungent odor in the neighborhood. The meter reader neared the spill site several times during his 3-hour investigation. He developed mydriasis, hematuria, chest pain, confusion, and nausea and was hospitalized for 6 days.

High severity cases involving pesticide application

A 45 year-old female school janitor mopped the walls of the school (in July) with a mixture of Comet, Bleach, Measure Up and White Drum (for stripping floors) that another janitor had mixed in a bucket. In the process of mopping the walls, she was exposed from head to toe and stayed in the wet clothes all day. The janitor was hospitalized for 3 days and experienced an asthma attack (she previously had asthma). She was not able to find her supervisor to request leave and indicated that she knew the mixture was against rules. This case was reported by workers' compensation 18 months after it occurred.

According to medical records, an 18 year-old male laborer was spraying weeds at work with the herbicide Tordon 22K (Picloram), when the barrel containing the herbicide bounced off the forklift and the laborer ran over it. He experienced corneal abrasion and burns, conjunctivitis, and dermal rash. Discussion with the employer revealed that the laborer had not properly secured the load and did not follow instructions.

A 36 year-old male operating engineer was exposed to chlorine and hydrochloric acid after pouring the chemicals into a pool. He was admitted to the hospital for 3 days with signs of fainting and headache.

A 55 year-old female bookkeeper sprayed STOMP (Resmethrin, Pyrethroid) all over her office and on her leather chair and developed a severe allergic reaction. She initially went to the emergency room and was released. Two days later, the bookkeeper returned and was hospitalized for three days with edema, hives, pruritis, rash, redness, anxiousness, weakness, and nausea.

The most severe case reported involved a 56 year-old unlicensed supervisor at a peanut production facility. The case entered the peanut warehouse to supervise after the building was fumigated with aluminum phosphide for rodent control. The peanuts were covered with plastic and the supervisor was first exposed when the other workers removed the plastic. To our knowledge, no other employees were exposed. Wearing leather gloves, the supervisor then transferred the pellets to 5-gallon drums. As he stood over the drums, the pellets were activated by moisture from the humidity outside (misting). The supervisor conducted these processes for the restricted use pesticide "under supervision of a licensed applicator" as the label permits; though the licensed applicator was not on site. The supervisor was hospitalized for 8 days with edema, weakness, anorexia, cough and wheezing. Because the supervisor did not initially inform medical personnel about the pesticide exposure, his signs and symptoms were confused for a new heart medication for several days. X-rays taken after notification of the pesticide exposure demonstrated acute pulmonary infiltrates.

WORKPLACE INTERVENTION

One of the criteria for conducting a field investigation is a pesticide exposure event involving more than four workers. In June 2004, the PEST program received seven pesticide exposure report forms faxed by hospital reporting staff. Seven employees of a pet-food manufacturing company entered their workplace (warehouse) where a pesticide applicator had applied aluminum phosphide 3 days earlier. They entered before the pesticide applicator was able to clean the residue, test the air and ventilate the facility. Two employees had been sent home ill before management transported all seven to the local hospital emergency department. PEST staff conducted an on-site field investigation and collaborated with the company risk manager to develop a written protocol for pesticide applications (Appendix D).

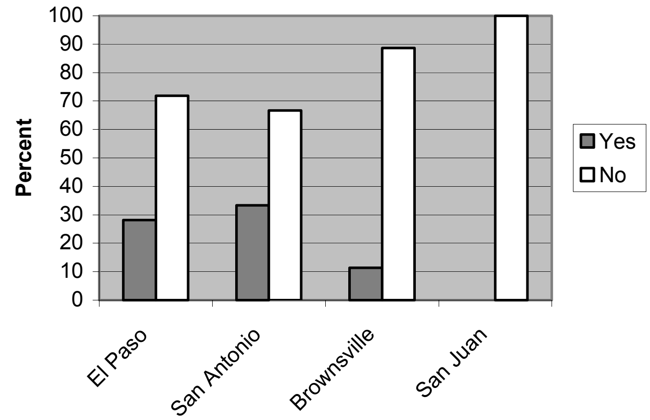
WORKER PROTECTION STANDARDS (WPS) EVALUATION

The PEST program conducted the Texas Farmworker Protection Survey to assess whether farmworkers in Texas received WPS training and whether those who received the training understood the pesticide training objectives of the training. Twenty-nine percent of the workers interviewed reported that they had received safety training in pesticide use with 23% indicating that they had received WPS training. Less than 20% reported having the WPS "blue card" in their possession at the time of the interview. Of the workers who received WPS training 91% indicated that they understood all of the training; 79% indicated that the training was useful; and 94% indicated that they plan to use WPS training in the future. Training was provided via video (19%), manual (31%), and flipchart (19%) with 68% of the respondents indicating that the training was provided in Spanish.

Table 3. TX Farmworker Survey—Health-Related Questions

Question	%
How would you get to the doctor	
Walk	3.9
Own Car	16.2
Friend's Car	27.0
Farmer / Supervisor	32.3
Other	20.6
Any health symptom experienced in previous year	
Yes	71.9
No	28.1
Ever seek medical care for health problems	
Yes	41.1
No	58.9
Given transportation to medical facility	
Yes	45.0
No	55.0
Ever miss work because of health problems	
Yes	43.3
No	56.7

Figure 7. WPS training received (by location)



Comparing the 4 geographic sites, more farmworkers from the San Antonio National Farmworker Conference population received pesticide training (41%) compared to the other populations. Only two of the 24 farmworkers interviewed during the San Juan survey indicated receiving any pesticide training; none reported receiving any pesticide training (Figure 7).

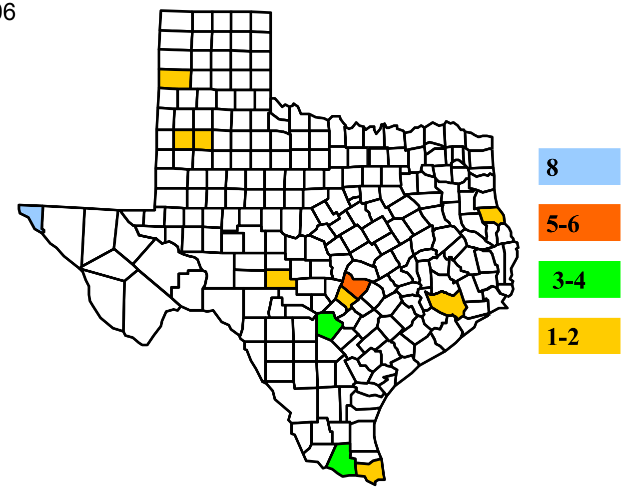
Twenty-six percent of the farmworkers indicated that they had at some time mixed or applied pesticides to fields or crops and 75% indicated that they had worked in fields treated with pesticides. With respect to WPS compliance in the workplace, although 67% indicated that there was no central posting area for notification of recent pesticide applications, 53% indicated that they received pesticide application information from their boss. Fifty-eight percent reported that emergency numbers were not posted and 54% indicated that pesticide safety posters were not displayed. Twenty-nine percent of the respondents indicated that they or their co-workers had been in a situation in which their safety was at risk due to pesticides.

The results of this survey indicate that the majority of Texas farmworkers do not appear to be receiving the required EPA WPS training. The percentage of farmworkers in this survey who reported ever receiving training in pesticide use and safety (28.6%) was lower than the percentage of farmworkers in a North Carolina survey (35.2%) who indicated that they received such training (Arcury et al. 1999). Only 17% of the farmworkers interviewed in this survey reported that they had been trained in pesticide use or safety in the last five years. Additionally, agricultural employers do not appear to be following the guidelines of WPS such as providing pesticide application and emergency notification. Fewer than 27% of the farmworkers indicated that they would tell a supervisor about health problems experienced on the job and 59% denied ever seeking medical care for the health problems that they experienced (Table 3). Communication barriers between farmworkers and supervisors, farm owners, and/or crew chiefs can lead to complications or affect treatment, particularly if the farmworker doesn't seek necessary medical attention and/or does not know the name and active ingredient of the pesticide to which he or she may have been exposed. The final report for this survey is in the final review stages for submittal to a peer-reviewed journal (Appendix E).

III. Education and Partnerships

PEST staff created a semi-bilingual (English-Spanish) brochure to serve several audiences including health providers and workers in high-risk occupations. Additionally, 4 postcards (2 bilingual English/Spanish) were created for healthcare providers, occupations that use disinfectants, agricultural labor and home safety for persons who work with pesticides. Staff also presented and participated in health fairs, seminars and other conferences around the state (Figure 8, Appendix C). In the past 4 years, the PEST Program has met with migrant clinicians, several farmworker unions, and increased communication with the TWCC Occupational Safety Outreach Coordinator to share industry and occupational information. Outreach has also targeted children of agricultural workers, who often work in the fields themselves.

Figure 8. Educational Outreach Activities by County, FY 2002-FY 2006



Texas data contributed to an article regarding pesticide exposures at schools, which found that incidence rates for children increased significantly from 1998-2002. After association with insecticides (35%), most illnesses were associated with disinfectants (32%) (Alarcon WA, 2005). From 2002-2003, with supplemental funding from EPA to address environmental health issues along the US-Mexico border, the PEST Program prepared bilingual skits to teach pesticide exposure prevention and raise awareness of the occupations at-risk for exposure. Outreach targeted elementary schools located within ¼ mile from potential agricultural fields where pesticides might be applied. DSHS staff from the Art Department and the Geographic Information System (GIS) program assisted in the development of bilingual educational posters. The posters were disseminated in three US-Mexico border regions where outreach took place. The PEST program educated more than 3,000 people about pesticide exposure, including school children, teachers, school nurses and public health professionals.

In 2003, PEST collaborated with the TPCN epidemiologist to write an article looking at Texas poison center data for exposure to the pesticide lindane (Forrester M, Sievert J et al. 2004). PEST data contributed to another lindane article, providing follow-up data from TPCN reports on accidental ingestions (MMWR 2005). Both articles contributed to the growing literature regarding this dangerous organochlorine pesticide that is banned in California for head-lice use, but is still prescribed by physicians in Texas and most other states where it is legal. EPA announced in December 2006 actions to ban all FIFRA registrations of lindane (Federal Register, 2006).

In 2004, the PEST Program presented NIOSH and other states with data that showed an increase in exposures among retail employees, especially stockers. NIOSH collected and analyzed eight states' data for the years 1998-2003 and a draft publication is in press (Calvert GM, in press). In March 2006, PEST staff alerted NIOSH and EPA partners regarding an increase in pesticide exposures among Wal-Mart employees around the state. Program staff then notified Wal-Mart Corporate Safety and Risk Management staff by phone and written communication. Staff provided Wal-Mart with aggregate data regarding exposures in the retailer's stores; the 2 groups met to discuss prevention strategies in July 2006. Currently, Wal-Mart staff plan to present pesticide safety talking points to garden store managers in the Southwest region of the U.S. The corporation also plans to improve training and raise awareness among employees about chemical safety in general.

The first Regional Ad-hoc Pesticide Exposure Surveillance Steering Committee was created in 2004 to address pesticide exposure in a tri-state region. The committee is comprised of public health, agriculture, industry, labor, and academic representatives from El Paso, New Mexico, and NIOSH. Two representatives from Juarez, Chihuahua joined the committee in 2005.

CONCLUSIONS

During the 4-year period from 2002-2005 there was an overall improvement in case ascertainment which we attribute to the improved ties with the Texas Poison Control Network (TPCN). The number of confirmed occupational pesticide exposures rose from 106 in 2002 to 157 in 2005. Improving ties with the TPCN also resulted in a marked reduction in the time interval from when the event took place until the report of the event was received. The median latency between when the event took place and the report was received was reduced from 202 days in 2002 to 3 days in 2005. The reduction in the latency period enabled PEST staff the ability to triage cases such that follow-up interviews, medical record ascertainment, and field investigations could be accomplished in a timely manner; all of which enable timely interventions where appropriate.

Another factor which contributed to the apparent increase in case ascertainment was the inclusion of disinfectant exposures in the case definition. The inclusion of these products provided exposure information on an entirely different worker population: primarily cleaning and food service occupations. Occupational pesticide exposures to workers in the Wholesale/Retail industries and Professional/Related Service industries differed from pesticide exposures among the Agricultural workforce by only one percent. The inclusion of disinfectant exposures also increased the number of females found to be occupationally-exposed to pesticides as 71% of the people exposed to disinfectants in the Professional and Related Service industry were female. This outcome is also evidenced by the increase of disinfectant-related exposures in service occupations 2004-2005.

The fact that pyrethroids and pyrethrins together were involved in the greatest number of exposures (with the exception of the broad Other Chemical Class) is concerning as these chemicals often are advertised as the “safe” alternative. While they may be less toxic than some other choices, they still can be toxic when not used properly. Increased education on the potential hazards associated with the improper use of these products is warranted.

Four of the 8 high severity exposures could have possibly been prevented or minimized with better communication in the workplace. Of the three cases where the exposed individuals were not involved in pesticide application, two were pyrethroids and one was an organophosphate. Of the five cases where the exposed individuals were involved in pesticide application two involved disinfectants, the other three involved an herbicide, a pyrethroid, and a rodenticide, respectively. Two of cases where the person who was exposed was not an applicator involved poor notification of application by the pesticide applicator and one case involved improper disposal of a pesticide. Four of the cases where the person who was exposed was involved in the application of the pesticide involved improper usage and one case involved not taking proper precautions.

The results of the Texas Farmworker Protection Survey that the program conducted suggest that the majority of Texas farmworkers do not appear to be receiving the required EPA Worker Protection Standards training; only 28.6% of the farmworkers surveyed reported ever having received training in pesticide use and safety. Additionally, only 17% of the farmworkers interviewed in this survey reported that they had been trained in pesticide use or safety in the last five years. The results of the survey also suggest that agricultural employers did not appear to be following some of the guidelines of WPS such as providing pesticide application and emergency notification. Communication barriers between farmworkers and supervisors, farm owners, and/or crew chiefs were identified as contributing to poor pesticide management.

The data collected over the last four years demonstrate the extent to which human pesticide exposure is a public health problem. As evidenced by the surveillance of disinfectant products, pesticides are not only an agricultural problem. Many health practitioners are not familiar with the symptoms associated with pesticides affecting the identification of cases. Many employers do not always orientate their employees on the proper use of pesticides. Additionally, workers often ignore the warning labels and do not protect themselves by donning the proper PPE; actions which increase the potential for exposure.