Louisiana Hazardous Substances Emergency Events Surveillance (HSEES) System

2001 - 2007: Summary Report - Injuries to Responders During HSEES Events

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Louisiana Department of Health and Hospitals
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EXECUTIVE SUMMARY

The Hazardous Substances Emergency Events Surveillance (HSEES) system, maintained by the Agency for Toxic Substances and Disease Registry (ATSDR), actively collects information to describe the public health consequences of acute releases of hazardous substances in participating states. The Louisiana Department of Health and Hospitals, Office of Public Health, Center for Environmental Health Services, Section of Environmental Epidemiology and Toxicology (SEET) has participated in this surveillance system since 2001. Information about acute events involving hazardous substances was collected by SEET, including the substance(s) released, number of victims, number and types of injuries, and number of evacuations. The data were computerized using an ATSDR-provided Web-based data entry system. This report summarizes the characteristics of events that resulted in injuries to emergency responders between calendar years 2001 and 2007.

Between 2001 and 2007, a total of 5150 acute hazardous substances events met the HSEES surveillance definition. During this reporting period, 15 events (0.3% of all reported events) resulted in a total of 27 injured responders. The most frequently reported injuries were respiratory irritation and headaches. Analysis of the data shows that increased usage of PPE as well as the development of injury prevention strategies and techniques could be used to decrease the number and severity of injuries to responders.

INTRODUCTION

The Centers for Disease Control and Prevention defines surveillance as the

> "ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link of the surveillance chain is the application of these data to prevention and control. A surveillance system includes a functional capacity for data collection, analysis, and dissemination linked to public health programs"[1].

Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to describe the public health consequences of releases of hazardous substances. The decision to initiate a surveillance system of this type was based on a study published in 1989 about the reporting of hazardous substances releases to three national databases: the National Response Center Database, the Hazardous Material Information System (HMIS), and the Acute Hazardous Events Database [2]. A review of these databases indicated limitations. Many events were missed because of specific reporting requirements (for example, the HMIS did not record events involving intrastate carriers or fixed-facility events). Other important information was not always recorded, such as the demographic characteristics of victims, the types of injuries sustained, and the number of persons evacuated.

As a result of this review, ATSDR implemented the HSEES system to more fully describe the public health consequences of releases of hazardous substances.

HSEES has several goals:

- To describe the distribution and characteristics of acute hazardous substances releases;
- To describe morbidity and mortality among employees, responders, and the general public that resulted from hazardous substances releases; and
- To develop strategies that might reduce future morbidity and mortality resulting from the release of hazardous substances.

For a surveillance system to be useful, it must not only be a repository for data, but the data must also be used to protect public health.

In the last few years, the last goal of the HSEES system has been emphasized; i.e., to develop strategies to reduce subsequent morbidity and mortality by having each participating state analyze its data and develop appropriate prevention outreach activities. These activities are intended to provide industry, responders, and the general public with information that can help prevent chemical releases and reduce morbidity and mortality if a release occurs.

SEET has participated in this surveillance system since 2001. Currently, fourteen state health departments participate in HSEES: Colorado, Florida, Iowa, Louisiana, Michigan, Minnesota, New Jersey, New York, North Carolina, Oregon, Texas, Utah, Washington, and Wisconsin.

METHODS

In 2005 an updated data-collection form was approved by the U.S. Office of Management and Budget. Information was collected about each event, including substance(s) released, victims, injuries (adverse health effects and symptoms), and evacuations.

Various data sources are used to obtain information about these events. These sources include the Louisiana Department of Public Safety and Corrections, Office of State Police, the Louisiana Department of Environmental Quality (LDEQ), the U.S. Coast Guard National Response Center, and the U.S. Department of Transportation, Hazardous Materials Information System (HMIS). Census data are used to estimate the number of residents in the vicinity of most of the events. All data are computerized using a web-based data entry system provided by ATSDR.

A HSEES event is defined as an uncontrolled or illegal acute release of any hazardous substance (except petroleum when petroleum is the only substance released), in any amount for substances listed on the HSEES Mandatory Chemical Reporting List, or, if not on the list, in an amount greater than or equal to 10 lbs or 1 gallon. Threatened releases of qualifying amounts will be included if the threat led to an action (e.g., evacuation) to protect the public health. Petroleum-only releases are not included because of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). [Note: The Petroleum Exclusion clause of CERCLA excludes any form of petroleum that has not been refined to the point of becoming single-chemical product]. HSEES defines victims as people who experience at least one documented adverse health effect within 24 hours after the event or who die as a consequence of the event. Victims who receive more than one type of injury or symptom are counted once in each applicable injury type or symptom. Events are defined as transportation related if they occur

(a) during surface, air, pipeline, or water transport of hazardous substances, or (b) before being unloaded from a vehicle or vessel. All other events are considered fixed-facility events.

For data analyses, the substances released are categorized into the following 16 groups:

- Acids
- Ammonia
- Bases
- Chlorine
- Formulations
- Hetero-Organics
- Hydrocarbons
- Mixture
- Other
- Other inorganic substances
- Oxy-Organics
- Paints & dyes
- PCB's
- Pesticides
- Polymers
- VOC's

The category “mixture” comprises substances from different categories that were mixed or formed from a reaction before the event; the category “other inorganic substances” comprises all inorganic substances except acids, bases, ammonia, and chlorine; and the category “other” comprises substances that could not be grouped into one of the other existing categories.

RESULTS

Summation of All Events, 2001-2007

During calendar years 2001-2007, 5150 acute hazardous substances events met the HSEES surveillance definition. The parishes in Louisiana with the most events were Calcasieu (724 [14.1%]) and East Baton Rouge (656 [12.7%]) (Table 1). The most common industry where all events occurred was the manufacturing of paper, printing, chemical, petroleum, leather, lumber and stone products (NAICS code 32); 3629 events occurred in this industry (Figure 1). A total of 4240 (82.3%) events occurred in fixed facilities with manufacturing of paper, printing, chemical, petroleum, leather, lumber and stone products (NAICS code 32) being the most common industry for incidents to occur. A total of 910 (17.7%) were transportation events with transportation and warehousing (NAICS code 48) being the most common industry for incidents to occur. There were a total of 520 victims of HSEES events. Employees were the most common victim (Figure 2).

Parish	Type of Events				All Events	
	Fixed Facility		Transportation			
	No. Events	%	No. Events	%	No. Events	%
Acadia	5	41.7%	7	58.3%	12	0.2%
Allen	5	83.3%	1	16.7%	6	0.1%
Ascension	493	84.1%	93	15.9%	586	11.4%
Assumption	1	100.0%	0	0.0%	1	0.0%
Avoyelles	0	0.0%	1	100.0%	1	0.0%
Beauregard	2	33.3%	4	66.7%	6	0.1%
Bienville	1	33.3%	2	66.7%	3	0.1%
Bossier	14	33.3%	28	66.7%	42	0.8%
Caddo	68	41.0%	98	59.0%	166	3.2%
Calcasieu	678	93.6%	46	6.4%	724	14.1%
Caldwell	2	66.7%	1	33.3%	3	0.1%
Cameron	16	88.9%	2	11.1%	18	0.4%
Catahoula	1	33.3%	2	66.7%	3	0.1%
Clairborne	0	0.0%	2	100.0%	2	0.0%
Concordia	0	0.0%	2	100.0%	2	0.0%
De Soto	7	63.6%	4	36.4%	11	0.2%
E. Baton Rouge	586	89.3%	70	10.7%	656	12.8%
E.Carroll	0	0.0%	2	100.0%	2	0.0%
E. Feliciana	1	33.3%	2	66.7%	3	0.1%
Evangeline	1	50.0%	1	50.0%	2	0.0%
Franklin	1	50.0%	1	50.0%	2	0.0%
Grant	7	77.8%	2	22.2%	9	0.2%
Iberia	7	53.8%	6	46.2%	13	0.3%
Iberville	353	90.3%	38	9.7%	391	7.6%
Jackson	1	100.0%	0	0.0%	1	0.0%
Jefferson	197	73.5%	71	26.5%	268	5.2%
Jefferson Davis	3	33.3%	6	66.7%	9	0.2%
La Salle	1	50.0%	1	50.0%	2	0.0%
Lafayette	16	34.8%	30	65.2%	46	0.9%
Lafourche	16	55.2%	13	44.8%	29	0.6%
Lincoln	5	55.6%	4	44.4%	9	0.2%
Livingston	7	43.8%	9	56.3%	16	0.3%
Madison	3	30.0%	7	70.0%	10	0.2%
Morehouse	1	20.0%	4	80.0%	5	0.1%
Natchitoches	4	57.1%	3	42.9%	7	0.1%
Orleans	47	39.5%	72	60.5%	119	2.3%
Ouachita	218	90.8%	22	9.2%	240	4.7%
Plaquemines	120	84.5%	22	15.5%	142	2.8%
Pointe Coupee	3	9.7%	28	90.3%	31	0.6%
Rapides	14	40.0%	21	60.0%	35	0.7%
Richland	2	25.0%	6	75.0%	8	0.2%
Sabine	2	66.7%	1	33.3%	3	0.1%
St. Bernard	411	98.3%	7	1.7%	418	8.1%
St. Charles	487	93.1%	36	6.9%	523	10.2%
St. James	188	88.3%	25	11.7%	213	4.1%
St. John the Baptist	70	88.6%	9	11.4%	79	1.5%
St. Landry	22	84.6%	4	15.4%	26	0.5%
St. Martin	1	12.5%	7	87.5%	8	0.2%
St. Mary	11	64.7%	6	35.3%	17	0.3%
St. Tammany	15	65.2%	8	34.8%	23	0.4%
Tangipahoa	8	32.0%	17	68.0%	25	0.5%
Tensas	0	0.0%	1	100.0%	1	0.0%
Terrebonne	12	38.7%	19	61.3%	31	0.6%
Union	5	71.4%	2	28.6%	7	0.1%
Vermilion	11	100.0%	0	0.0%	11	0.2%
Vernon	3	42.9%	4	57.1%	7	0.1%
W. Baton Rouge	53	73.6%	19	26.4%	72	1.4%
W. Carroll	1	100.0%	0	0.0%	1	0.0%
W. Feliciana	2	100.0%	0	0.0%	2	0.0%
Washington	8	88.9%	1	11.1%	9	0.2%
Webster	14	66.7%	7	33.3%	21	0.4%
Winn	2	66.7%	1	33.3%	3	0.1%
Total‡	**4233**	**82.3%**	**908**	**17.7%**	**5141**	**99.9%**

Table 1. Number of Events Meeting the Surveillance Definition, by Parish and Type of Event — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

‡ Percentages may not total 100% because of rounding.

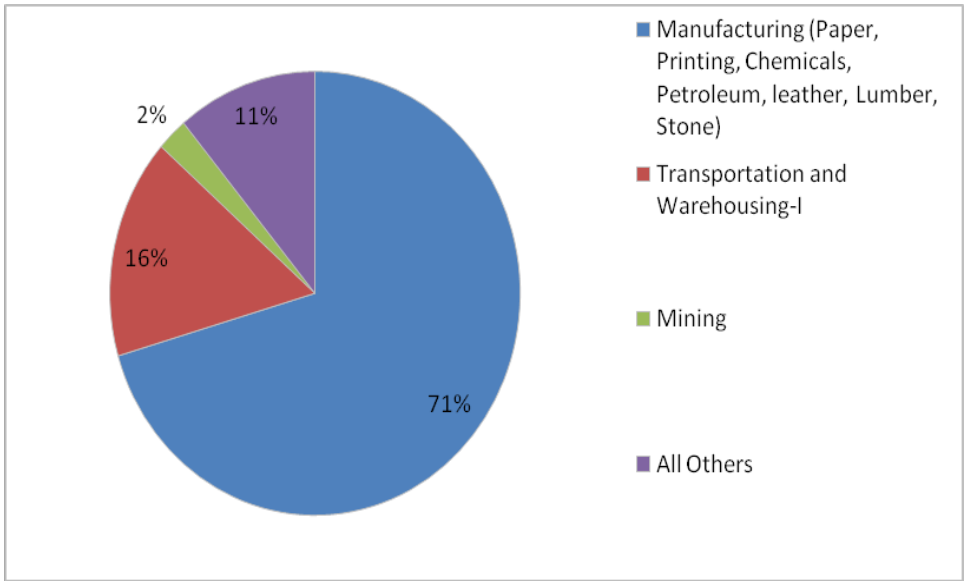

Figure 1. Industry Breakdown of All Events (both Transportation and Fixed Facility) — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

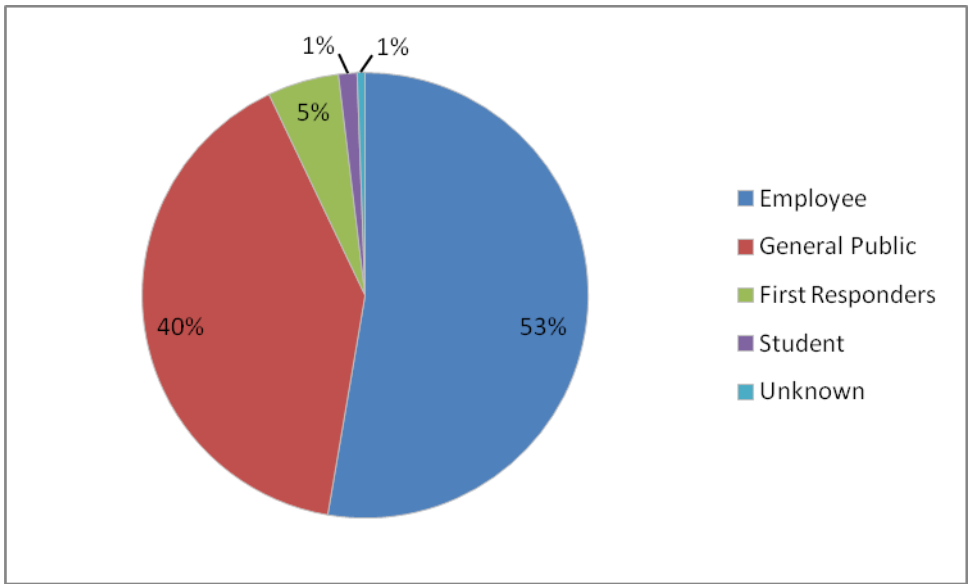

Figure 2. Victim Breakdown of All Events — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

Information on who responded to the event was not collected until 2002. Since that time, 3,446 (67.0%) events involved a response by a first responder (not all events had a response). Nearly 72% of all events were responded to by a company's response team (Table 2).

Five percent of the victims in HSEES events were considered "responders" (Figure 4). HSEES considers a responder to be "a person whose job is to bring the release under control, provide medical assistance to victims, or conduct crowd control" [3]. This document summarizes the events that resulted in injured responders.

Type of Personnel Who Responded to the Event	Number of Incidents Responded To*	Percentage of Total Responders
Company's Response Team	3077	71.8%
Law Enforcement Agency	298	7.0%
Fire Department	226	5.3%
3rd Party Clean-up Contractors	219	5.1%
Environmental Agency	187	4.4%
Certified HazMat Team	156	3.6%
EMS	51	1.2%
Dept. of Works / Utilities / Transportation (Includes Coast Guard)	19	0.4%
Health Department / Health Agency	16	0.4%
State, County or Local Emergency Managers / Coordinators / Planning Committees	15	0.4%
Hospital Personnel / Poison Control Center	12	0.3%
Other	6	0.1%
Unknown	3	0.1%
Total‡	**4285**	**100.1%**

Table 2. Number of Incidents Responded to by Type of Responder Group — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.
* Many incidents involve more than one responding party. In addition, these numbers represent groups, not individual responders.
‡ Percentages may not total 100% because of rounding.

Summation of Responders That Were Injured in HSEES Events

A total of 27 responders were injured in 15 events (0.3% of all events) between calendar years 2001 - 2007. Of the 15 events with responder victims, 9 (60.0%) events involved only one victim.

Profession

Firefighters (13 [48.1%]) constituted the largest proportion of the responders injured followed by police officers (12 [44.4%]) (Table 3).

Responder*	Type of Event	Number of Victims	Percentage
Firefighter	Fixed Facility	13	48.1%
Police Officer	Fixed Facility	6	22.2%
Police Officer	Transportation	6	22.2%
Responder (Not Specified)	Fixed Facility	2	7.4%
Total‡		**27**	**99.9%**

Table 3. Number of Injured Responders by Type — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.
* Numbers are individuals, not groups.
‡ Percentages may not total 100% because of rounding.

Gender

Responders that were injured were either male (74.1%) or the information was not reported (26.9%). Because only the gender of injured responders is collected, no comparison can be made to all personnel that responded to HSEES incidents.

Age

Age was generally not reported for injured responders (55.6%). Of those that did have their age reported, the majority (75%) were between 20 and 44 years of age. Because only the age of

injured responders is collected, no comparison can be made to all responders that responded to HSEES incidents.

HazMat Training Status

Status of whether or not the injured responders were trained to handle hazardous materials or not was generally not reported (55.6%). Of those that did have their hazmat status reported, the majority (41.7%?) were not hazmat trained. Because only the hazmat status of injured responders is collected, no comparison can be made to all responders that responded to HSEES incidents.

Personal Protective Equipment

Of the responders that reported information on personal protective equipment (PPE), 44.4% were not wearing PPE (Table 6). Because only the PPE status of injured responders is collected, no comparison can be made to all responders that responded to HSEES incidents. In addition, no injured responders reported wearing protective equipment such as a hard hat, steel-toed boots, gloves or eye protection.

PPE Status of Injured Responder	Number of Injured Responders	%
Not Reported	12	44.4%
None	12	44.4%
Wearing Fire fighter turn-out gear with respiratory protection	1	3.7%
Wearing Fire fighter turn-out gear without respiratory protection	1	3.7%
Unknown	1	3.7%
Total[‡]	**27**	**99.9%**

Table 4. PPE Status of Injured Responders — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.
[‡] Percentages may not total 100% because of rounding.

Injuries to First Responders

For all events, headache (23.8%) and respiratory system problems (7.1%) were the most common injuries. Responders were injured more often in fixed facility events (77.8%). In fixed-facility events, the most common injury was headache (29.4%), while the most common injury for transportation events was respiratory system problems (37.5%) (Table 5).

Type of Injury	Type of Event				All Events	
	Fixed Facility		Transportation			
	Number	%	Number	%	Number	%
Burns (Chemical)	0	0.0%	1	12.5%	1	2.4%
Dizziness or Other CNS Symptoms	5	14.7%	0	0.0%	5	11.9%
Eye Irritation	3	8.8%	2	25.0%	5	11.9%
Gastrointestinal Problems	5	14.7%	1	12.5%	6	14.3%
Headache	10	29.4%	0	0.0%	10	23.8%
Heat Stress	3	8.8%	0	0.0%	3	7.1%
Respiratory System Problems	7	20.6%	3	37.5%	10	23.8%
Skin Irritation	0	0.0%	1	12.5%	1	2.4%
Trauma (Not Chemical Related)	1	2.9%	0	0.0%	1	2.4%
Total‡	**34**	**81.0%**	**8**	**19.0%**	**42^**	**100.0%**

Table 5. Types of Injuries Reported by Responders for All Types of Events — Louisiana Hazardous Substances Emergency Events Surveillance, 2007.

‡ Percentages may not total 100% because of rounding.

^ Responders may report more than one type of injury; therefore there are more injuries than victims

Nearly 80% of all responders that were injured were in the immediate area of the release (Figure 3). Of those victims in the immediate area, the most commonly reported symptom was a headache (Figure 4). Of the responders that were injured, 33% were admitted to a hospital for treatment (Figure 5).

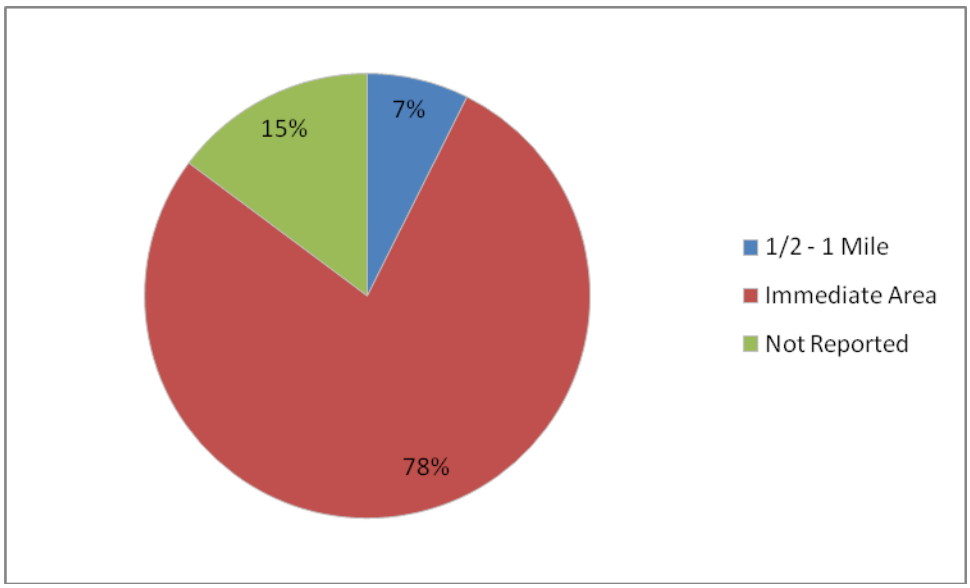

Figure 3. Location where First Responders were Injured — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

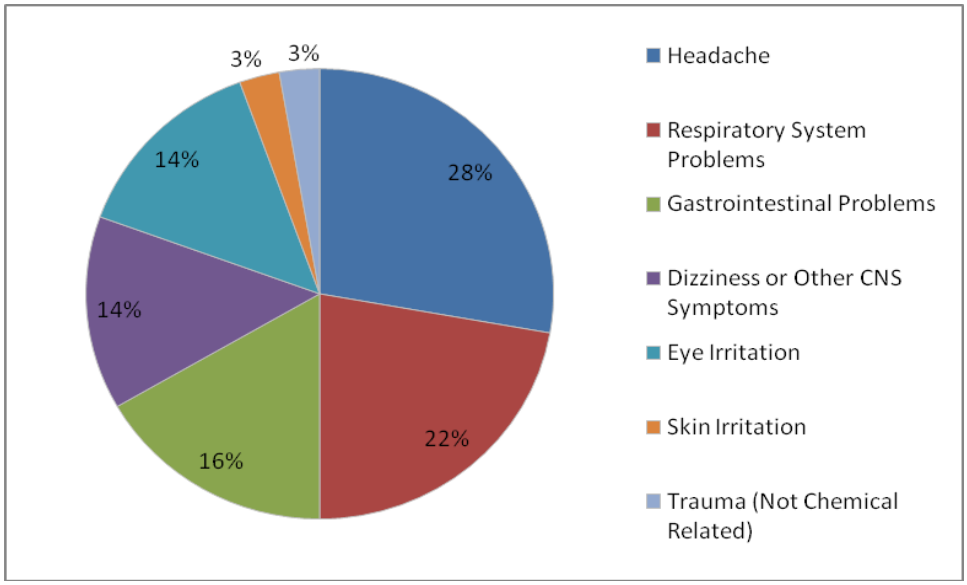

Figure 4. Injuries of Responders that were in the Immediate Area of the Event — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

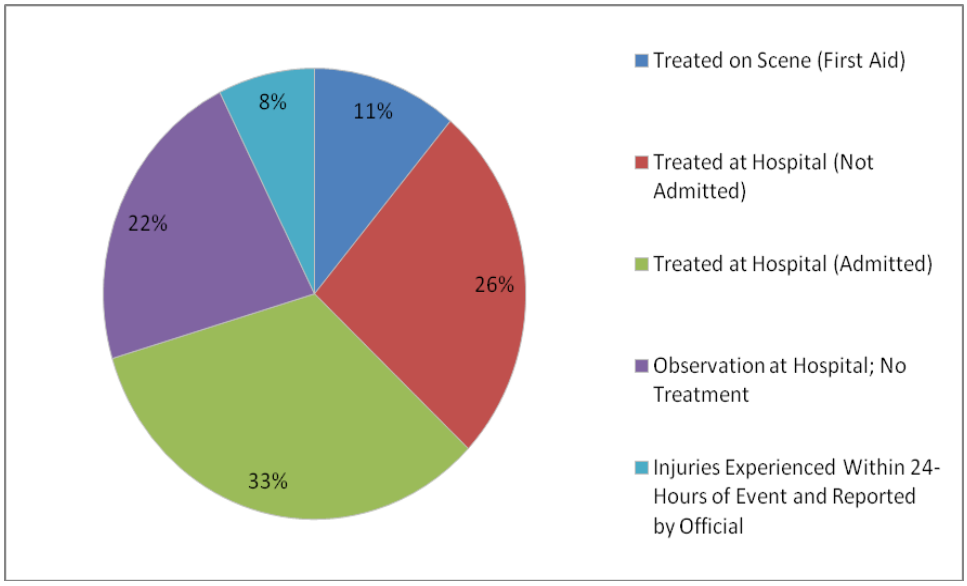

Figure 5. Severity of the Injured Responders — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

Decontamination

Seventeen injured responders (63.0%) did not receive any decontamination. Of the 27 injured responders that were decontaminated, 63% were decontaminated at a medical facility (Figure 6). Of the 15 incidents with injured responders, 7 *uninjured* responders were decontaminated at the scene in 2 events.

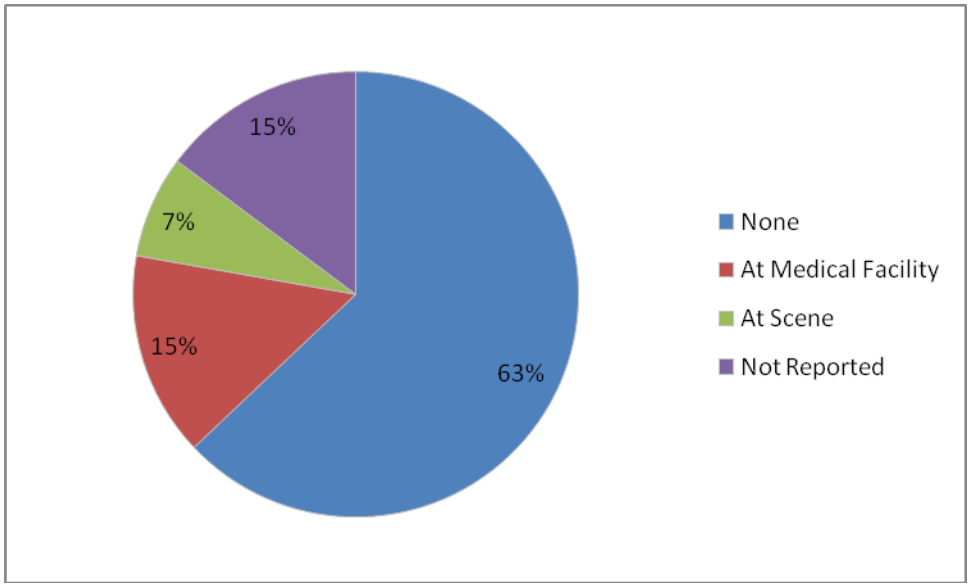

Figure 6. Decontamination Status of the Injured Responders — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007

Summation of Events where Injuries to Responders Occurred

Fixed Facility Events

Area where the event occurred or the equipment involved with the event was reported for the 10 fixed-facility events that occurred in mining, utilities, or manufacturing industries. One or two choices can be selected. Two events involved a process vessel (20%), one event each (10%) involved storage area above ground, heating/cooling for building, and piping, and the area involved was unknown for 5 (50%) fixed-facility events.

Transportation Events

Of the 5 transportation-related events, all events occurred during ground transport (e.g., truck, van, or tractor). Four (80.0%) involved tanker truck as the means of transportation, and 1 (20.0%) was unknown. Two (50.0%) of the four tanker truck incidents occurred from a moving vehicle, 1 (25.0%) occurred from a stationary vehicle, and 1 was listed as other.

Primary and Secondary Factors

Primary and secondary factors contributing to the events were reported. Primary factors were reported for 13 (86.7%) events (Figure 5). Human error was the most frequently reported primary factor for transportation events (60.0%) and comprised 26.7% of all events. Intentional cause was the most frequently reported primary factor for fixed facility events (30.0%) and comprised 20.0% of all events. Secondary factors were reported for 8 (53.3%) events.

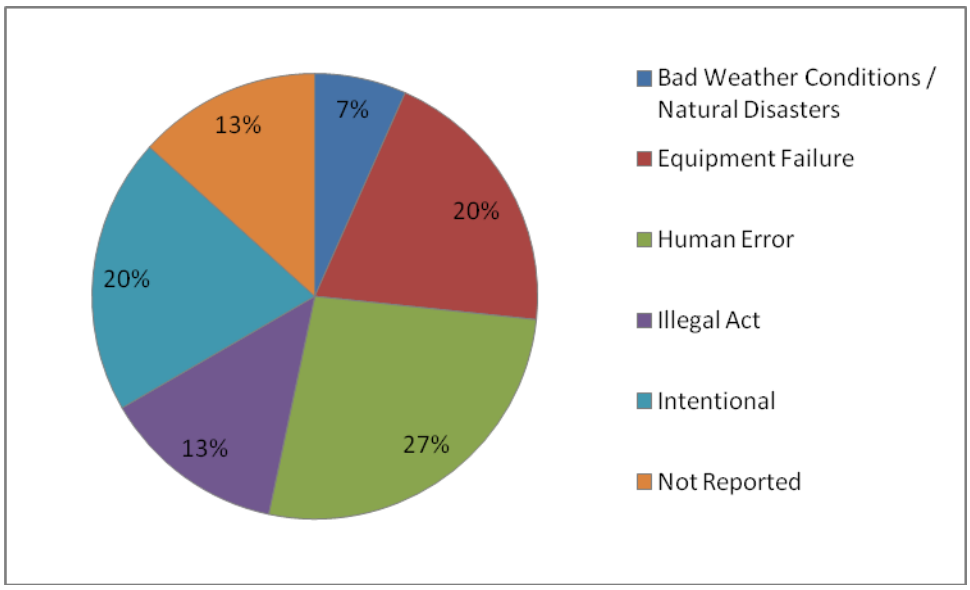

Figure 7. Primary Factors Reported as Contributing to All Events Where Responders were Injured* (both Transportation and Fixed Facility) — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.
*2 Events did not have primary factors.

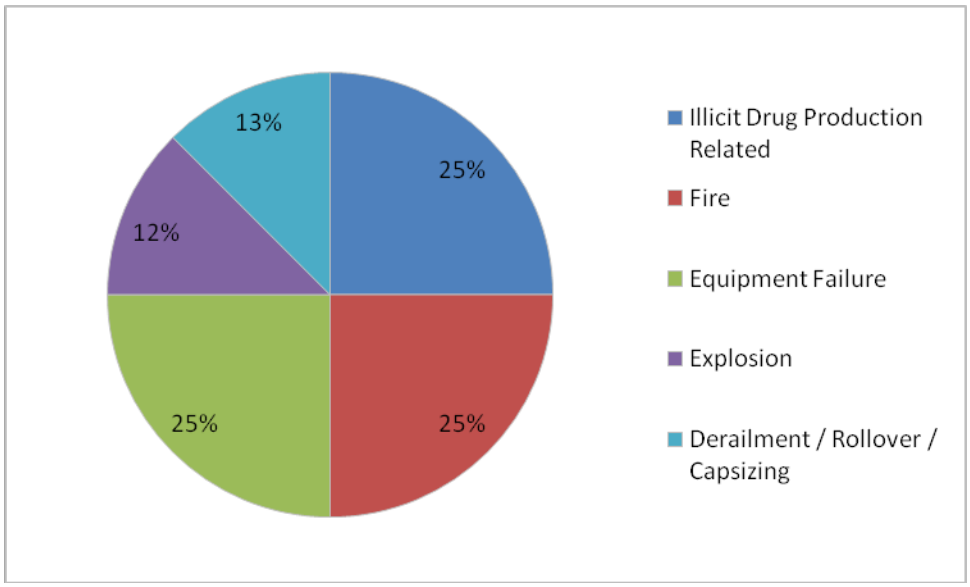

Figure 8. Secondary Factors Reported as Contributing to All Events Where Responders were Injured (both Transportation and Fixed Facility) — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

Substances

All 15 events where responders were injured involved the release of just one substance for each incident (Table 6).

Standardized Chemical Name	Number of Releases where Responders were Injured	Number of Injured Responders
Ammonia	3	3
Acid NOS	1	4
Carbon Monoxide	1	6
Fluorocarbon 22	1	2
Gas NOS	1	1
Methamphetamine Chemicals NOS	1	2
MIX: Boron NOS/Potassium Perchlorate/Vinyl Acetate	1	2
MIX: Hexane/Toluene	1	1
MIX: Hydrocarbon/Hydrogen Sulfide/Water	1	1
Monoethanolamine	1	1
Phenol	1	1
Silicon Tetrafluoride	1	2
Triethanolamine	1	1
Total	**15**	**27**

Table 6. Chemicals Released in Events where Responders were Injured — Louisiana Hazardous Substances Emergency Events Surveillance, 2001 - 2007.

CONCLUSION

During 2001-2007, 27 responders were injured in 15 events (0.3% of all events). HSEES considers a responder to be "a person whose job is to bring the release under control, provide medical assistance to victims, or conduct crowd control" [3]. Ten events were classified as fixed facility and resulted in twenty-one responder victims. Five events were classified as transportation events and resulted in six responder victims.

Most of the events were responded to by a company's response team. The highest numbers of reported injuries were among fire fighters and police officers, as they are usually first on the scene to events where little is known about the situation. Most of the responders were male. Age was not reported for most of the responders (55.6%), but 75% of the injured responders that did report age ranged from 20 to 44. Information about Hazmat training and certification was not reported in majority of cases (55.6%); only 5 (18.5%) of the injured responders were trained. It is important that responders receive certified training in order to prevent responders from becoming victims themselves.

Although only 27 responders were injured, this number could likely be decreased with the use of PPE. Of the injured responders, 44.4% said that they were not wearing PPE. The percentage of responders not wearing PPE is probably much higher as an additional 44.4% did not report if they were wearing PPE or not.

The most commonly reported symptoms experienced by responders were headache and respiratory system problems. Most of the responder-victims were confined to the immediate area of release and might have inhaled chemicals that may have caused inhalation symptoms resulting

in respiratory tract problems and headache. Information on decontamination after exposure was not available for most of the responders; immediate and proper decontamination is likely to prevent or lessen the severity of injuries and symptoms.

Information regarding the chemicals was also collected, and the most frequently released chemical that involved responder-related injury was ammonia. Exposure to ammonia can cause respiratory tract irritations resulting in coughing and burns. It can also cause irritation to the skin. Exposure to eyes can result in burns and even blindness. Swallowing high concentrations may result in gastrointestinal irritations [4]. The largest number of victims in one event was due to carbon monoxide.

Individuals who are susceptible to respiratory irritants or have prior respiratory sensitivity including asthma are at higher risk to get adverse affects of ammonia. At a very high level it is known to cause lung tissue damage and death may also result [4, 5]. The Occupational Safety and Health Administration (OSHA) has set minimum concentration of 50ppm of ammonia that may cause eye, nose, and throat (ENT) irritations of the most susceptible individuals [5]; therefore, responders must take necessary precaution while responding ammonia-related events to avoid any kind of hazardous affects of ammonia.

Although responders made up only 5% of total victims in LAHSEES, effective efforts can be made to reduce this number. For instance our data analyses found that ammonia was released on most often in events where responders were injured. This suggests that emphasis should be given to making responders aware of the health hazards associated with ammonia and how to prevent exposure to ammonia. Development of material safety data sheet (MSDS) that contain all

pertaining information specifically about ammonia is quite essential to respond ammonia-related events in particular by firefighters and police officials.

Furthermore, it is of great importance to develop prevention strategies and techniques to reduce the number of injuries to responders. The first priority on an event is personal well being and health of responders, and this can be achieved by recognizing the significance of scene safety. Responders should be encouraged to utilize proper responding techniques with full preventive measures. Appropriate engineering control and administrative control can help ensure proper safety and health of responders.

Utilization of proper PPE can minimize and reduce responder-related injuries. Responders should be offered prevention training and workshops and be provided with education materials. Sound knowledge of chemicals and their adverse effects can be useful when responding to a hazardous event. Effective communication with safety managers while responding to an event can also be very useful to reduce injuries and accident. Finally, to have optimal performance and response, stress management techniques should also be encouraged among responders who are usually involved in emergency and stressful situations.

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