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# Surveillance of Hazardous Substances Emergency Events in North Carolina

**Data Summary  
1993 - 1997**

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Prepared by  
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February 2000

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Occupational and Environmental Epidemiology Branch  
Division of Public Health  
North Carolina Department of Health and Human Services

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5/00



## **Acknowledgments**

The author expresses appreciation and thanks to Ziya Gizlice at the North Carolina State Center for Health Statistics for his hard work in performing the data analysis. Without his efforts, this report would not be possible.

The North Carolina Hazardous Substances Emergency Events Surveillance (HSEES) Program is supported by a cooperative agreement, U61/ATU486399, from the Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia.

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# **Surveillance of Hazardous Substances Emergency Events in North Carolina**

## **Data Summary, 1993-1997**

### **INTRODUCTION**

In 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) established an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) System to describe the public health consequences associated with the release of hazardous substances. Five state health departments participated in the pilot phase of the surveillance system and began collecting data in January 1990. The North Carolina Division of Public Health, Occupational and Environmental Epidemiology Branch joined the federally funded project in 1991. This report describes the characteristics and public health consequences of hazardous substances emergency events reported to the North Carolina HSEES Program from January 1, 1993 through December 31, 1997. Data for 1991-1992 are not included as the HSEES case definition changed. Prior to 1993, data were limited to specific chemicals most often found at Superfund sites.

The objectives of the HSEES Program are to:

1. Describe the distribution and characterization of hazardous substances emergencies.
2. Describe the morbidity and mortality of employees, responders, and the general public as a result of hazardous substances releases.
3. Identify the risk factors associated with morbidity and mortality from the releases.
4. Identify or develop prevention strategies that may reduce or prevent future morbidity and mortality associated with hazardous substances emergency events.

## **METHODS**

Hazardous substances emergency events are reported to North Carolina HSEES staff by several sources. The primary notification sources are the Division of Emergency Management (DEM), Department of Crime Control and Public Safety; the National Response Center (NRC), U.S. Coast Guard; the Hazardous Materials Information System (HMIS), U.S. Department of Transportation; and the media. Secondary notification sources are the Division of Water Quality, Department of Environment and Natural Resources and the Department of Agriculture--Food and Drug Protection Division, Structured Pesticide Control Division, and Plant and Industrial Division. HSEES staff conduct telephone interviews with emergency responders, including local emergency management coordinators, firefighters, hazardous materials (HAZMAT) team responders, and environmental affairs representatives of private industries. Data about the event, substance(s) released, victims, injuries, and evacuations are recorded on a standardized form developed by ATSDR. Estimated population data for each surveyed event are assimilated with the assistance of the North Carolina Geographic Information System (GIS) laboratory personnel at the State Center for Health Statistics. Each event is given a unique record identification code for tracking purposes and entered into the HSEES database.

Hazardous substances emergency events are defined as uncontrolled, illegal releases or threatened releases of hazardous substances which need to be removed, cleaned up, or neutralized according to federal or state law. Events involving only petroleum products are excluded from the reporting system. A threatened release where emergency actions are taken to protect employees, responders, or the general public from potential hazards, such as evacuation or re-routing of traffic, also meet the definition of a reportable event.

## RESULTS

### Fixed-Facility and Transportation-Related Events

A total of 1,081 events were reported to the North Carolina HSEES Program from 1993 through 1997; of these events, 53 (4.9%) were threatened releases. There were 805 (74.5%) fixed-facility events and 276 (25.5%) transportation events. Table 1 shows the number of events by year and by type of event.

The areas most often involved in fixed-facility events included storage above ground (N = 212, 23.7%), process vessel (N = 174, 19.4%), piping (N=132, 14.7%), material handling (N = 118, 13.2%), and transportation within the fixed facility (N = 79, 8.8%) (Table 2). The remaining areas were storage below ground, dump waste area, ancillary process equipment, other, and unknown. In transportation events, 252 or 91.3% occurred during ground transport, and 19 or 6.9% involved transport by rail (Table 3). The remaining transportation events involved water, air, or other (N = 5, 1.8%).

Factors that most frequently contributed to the fixed-facility events were equipment failure (N = 148, 34.4%), operator error (N = 91, 21.2%), and unknown (N = 162, 37.7%) (Table 4). This information was not collected in 1993, 1994, and part of 1995.

The majority of events (N = 1019, 94.3%) involved the release of only one substance (Table 5). Two substances were released in 3.4% of the events, and the remainder involved the release of more than two substances. Most of the releases were either liquid spills (N = 773) or air emissions (N = 219). The remaining releases resulted from fires (N = 135) or other types of releases (N = 28). An event may have one or two release types, therefore the number of releases can exceed the total number of events. Additionally, a release type was not coded for threatened events. Information on type of release was missing for two events.

Events occurred primarily in July (N = 121, 11.2%), March (N = 111, 10.3%), or June (N = 109, 10.1%) (Figure 1). Fixed-facility events occurred most in July (N = 85, 10.6%) or March (N = 81, 10.1%); transportation events occurred most in April (N = 39, 14.1%). Events typically took place on weekdays (~84%) compared to weekends (~16%) (Figure 2). The majority of events took place between 12:00 noon and 6:00 pm (N = 386, 36.7%) or from 6:00 am to 12:00 noon (N = 382, 36.3%), which are typical work hours (Table 6). Information on time of event was missing for 28 events.

The counties with the highest number of events were Mecklenburg (N = 115, 10.6%), followed by Guilford (N = 83, 7.7%), Wake (N = 68, 6.3%), and Cumberland (N = 54, 5.0%). See Appendices 1 and 2 for maps of distribution of fixed-facility and transportation events, respectively, across North Carolina. See Appendix 3 for the total number of events by county.

## **Substances**

Of the 11 categories into which HSEES substances were grouped, the most commonly released were “other” substances which consisted of substances that could not be placed in one of the other ten substance categories (N = 310, 25.4%); “other inorganic substances” which comprised all inorganic substances except for acids, bases, ammonia, and chlorine (N = 186, 15.2%); acids (N = 168, 13.6%); pesticides (N = 128, 10.5%); and volatile organic compounds (N = 121, 9.9%) (Table 7). Specific examples of “other” included ethylene glycol, creosote, formaldehyde, etc.; “other inorganic substances” included ammonium nitrate, sulfur dioxide, carbon disulfide, aluminum, chromium, etc.; and volatile organic compounds included acetone, toluene, trichloroethylene, etc. The top 25 most frequently released chemicals are listed in Appendix 4. The top two chemicals released were ammonia (N = 70) and chlorine (N = 61).

## **Victims**

A total of 575 victims were involved in 182 events, which is 16.8% of all events (Table 8). Most victims (N = 458, 79.7%) were injured in fixed-facility events, which is similar to the proportion of fixed-facility events to total events. The average number of victims per fixed-facility event is 3.47 compared to 2.34 for transportation events. Of the events with victims, 81 events (44.5%) involved only one victim, and 115 events (63.2%) involved either one or two victims. Chlorine had the highest percentage of releases with victims (34.4%), followed by other inorganic substances (29.0%) (Table 9).

The population groups most often injured were employees (N = 433, 75.3%) and the general public (N = 63, 10.9%) (Table 10, Figure 3). Information on responder type was not collected until 1996. Of the responders who were injured in fixed-facility events, the majority were firefighters, unknown type, (N = 22, 37.3%); for transportation events, police officers were most often injured (N = 17, 28.8%).

The victims sustained a total of 987 injuries (Figure 4). Some victims had more than one injury. The most commonly reported injuries in fixed-facility events were respiratory irritation (39.2%), nausea and vomiting (16.3%), dizziness (11.5%), and headache (11.2%). In transportation events, trauma (42.3%), respiratory irritation (21.1%), and nausea and vomiting (10.6%) were reported most often. Trauma was reported in 42.3% of all transportation events compared to 0.6% of fixed-facility events. The trauma was typically a result of a motor vehicle crash and not necessarily by exposure to the hazardous chemical.

The sex of 75% of the victims was known. Of these victims, 325 (75.4%) were male and 106 (24.6%) were female. Age information was only available for 217 (37.7%) victims; the age

range was between 1 and 74 years. The majority of the victims (N = 393, 70.9%) were not wearing personal protective equipment. The personal protective equipment most frequently worn was eye protection (N = 49, 8.8%), gloves (N = 47, 8.5%), steel-toed shoes (N = 30, 5.4%), firefighter turnout gear (N = 29, 5.2%), and hard hats (N = 26, 4.7%). Over half of the victims (N = 306, 53.2%) were transported to the hospital for treatment and released ( Figure 5). There were 118 (20.5%) victims treated at the scene with first aid; 76 (13.2%) were transported to the hospital for observation; 49 (8.5%) were transported and admitted to the hospital; 13 (2.3%) were seen by a health care provider within 24 hours of the event; and 8 victims (1.4%) died.

Responders at the scene were decontaminated most often (N = 536, 80.1%) followed by employees at the scene (N = 108, 16.1%) (Table 11). Few individuals, whether employees, responders, or general public were decontaminated at a medical facility or at another location. Since victims could be decontaminated at both the scene and a medical facility, the numbers may be over-estimated.

### **Evacuations**

Evacuations were ordered in 241 (22.3%) events. The majority of the evacuations were the building itself or the affected part of the building (N = 167, 69.3%) (Table 12). The remaining evacuations were downwind/downstream (N = 33, 13.7%) or a circle or radius of the event site (N = 25, 10.4%). There were a total of 18,600 people evacuated; however, the majority of people were evacuated in fixed facility events (N = 15,984 or 85.9%).

### **Contingency Plans**

A contingency plan was followed by the incident commander in 98% (N = 1,060) of the events. The types of contingency or preparedness plans used during an event varied (Table 13).

The HAZMAT or response team's standard operating procedures were used most often (N = 623, 58.8%) followed by the company's operating procedures (N = 194, 18.3%). The type of plan was unknown in 16.4% of events.

## **SUMMARY**

Most events during 1993 to 1997 involved a single substance and occurred at fixed facilities (Table 14, Figure 6). Respiratory irritation has consistently been reported as the most common injury to victims. The percentage of events with victims has fluctuated over the years; for the five year period overall, 16.8% of all events have victims. Employees continue to be the most commonly reported victim in emergency events. Victims were usually transported to the hospital for treatment and released. Less than one-fourth of the events resulted in an evacuation. The HAZMAT or response team's standard operating procedures were followed for clean-up.

## **USE OF DATA**

The findings from the surveillance of hazardous substances emergency events in North Carolina are useful for prevention efforts. Interventions involving collaboration and partnerships with community groups are essential. Examples of interventions are:

- training and health education programs for people involved in hazardous substances emergency response,
- development of fact sheets specific to certain chemicals and/or industry groups, and
- outreach/awareness of the HSEES Program and its findings.

Fact sheets for chlorine and ammonia will be developed using actual case scenarios. They will be distributed to local emergency planning committees and emergency responders as well as to county and company personnel who are involved with these spills. Specific industry settings with a history of chlorine and ammonia spills will be targeted.

A quarterly update about HSEES events will be re-instituted. It will give the number of events, fixed and transportation, by quarter and total for the year. Information about the chemicals released, types of injuries with outcome, and other pertinent facts will be included along with a map indicating location of events. A case study approach will be explored if an interesting spill occurred in that quarter.

Presentations at state and local meetings are a good way to inform people about the North Carolina HSEES Program and findings from the 1993-1997 data summary. The local emergency planning coordinators in counties with the most events will be contacted to see if there is interest in a presentation about events occurring in their county.

Table 1: Distribution of Events by Type of Event and Year, NC HSEES, 1993-1997

Event Year	Type of Event				Total	
	Fixed Facility		Transportation			
	No.	%	No.	%	No.	%
1993	185	70.6	77	29.4	262	24.2
1994	190	77.9	54	22.1	244	22.6
1995	186	76.2	58	23.8	244	22.6
1996	128	74.0	45	26.0	173	16.0
1997	116	73.4	42	26.6	158	14.6
<b>Total</b>	<b>805</b>	<b>74.5</b>	<b>276</b>	<b>25.5</b>	<b>1081</b>	<b>100</b>

Table 2: Area of Fixed Facilities Involved in Events, NC HSEES, 1993-1997\*

Fixed Facility Area	Year of Event										Total	
	1993		1994		1995		1996		1997			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Transport within fixed facility	4	2.0	21	9.3	31	14.1	6	4.6	17	14.0	79	8.8
Process vessel	43	21.4	30	13.4	42	19.1	35	27.1	24	19.8	174	19.4
Piping	30	14.9	32	14.3	39	17.7	19	14.7	12	9.9	132	14.7
Material handling	26	12.9	27	12.1	37	16.8	15	11.6	13	10.7	118	13.2
Storage above ground	43	21.4	37	16.5	54	24.5	42	32.6	36	29.8	212	23.7
Storage below ground	4	2.0	2	0.9	0	0	1	0.8	0	0	7	0.8
Dump waste area	3	1.5	4	1.8	7	3.2	5	3.9	2	1.7	21	2.3
Ancillary process equipment	8	4.0	9	4.0	1	0.5	1	0.8	0	0	19	2.1
Transformer and capacitor	1	0.5	2	0.9	0	0	0	0	0	0	3	0.3
Other	34	16.9	60	26.8	8	3.6	4	3.1	16	13.2	122	13.6
Unknown	5	2.5	0	0	1	0.5	1	0.8	1	0.8	8	0.9
<b>Total†</b>	<b>201</b>	<b>100</b>	<b>224</b>	<b>100</b>	<b>220</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>121</b>	<b>99.9</b>	<b>895</b>	<b>99.8</b>

\* Number of areas exceeds number of events (N = 805) because one or two areas may be recorded for each event.

† Percentages may not equal 100% due to rounding.

Table 3: Distribution of Transportation-Related Events by Type of Transport and Year, NC HSEES, 1993-1997\*

Type of Transportation Event	Year of Event										Total	
	1993		1994		1995		1996		1997			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ground	70	90.9	52	96.3	54	93.1	38	84.5	38	90.5	252	90.0
Rail	5	6.5	2	3.7	3	5.2	6	13.3	3	7.1	23	8.2
Water	0	0	0	0	0	0	0	0	1	2.4	1	0.3
Air	1	1.3	0	0	1	1.7	1	2.2	0	0	3	1.1
Other	1	1.3	0	0	0	0	0	0	0	0	1	0.3
<b>Total†</b>	<b>77</b>	<b>100</b>	<b>54</b>	<b>100</b>	<b>58</b>	<b>100</b>	<b>45</b>	<b>100</b>	<b>42</b>	<b>100</b>	<b>280</b>	<b>99.9</b>

\* Total can exceed number of events because an event can be coded to one or two types of transport.

† Percentages may not equal 100% due to rounding.

Table 4: Factors Contributing to Fixed Facility Events, NC HSEES, 1995-1997\*

Factors Contributing to Fixed Facility Events	Year of Event						Total	
	1995		1996		1997			
	No.	%	No.	%	No.	%	No.	%
Improper mixing	1	0.5	3	2.3	3	2.6	7	2.0
Equipment failure	49	26.4	59	46.1	40	34.5	148	42.5
Operator error	26	14.0	35	27.4	30	25.9	91	26.1
Improper overfill	1	0.5	4	3.1	5	4.3	10	2.9
Factors beyond control	0	0	0	0	3	2.6	3	0.9
Power failure/electrical problems	0	0	0	0	3	2.6	3	0.9
Deliberate damage	0	0	0	0	2	1.7	2	0.6
Other	0	0	0	0	4	3.4	4	1.1
Unknown	109	58.6	27	21.1	26	22.4	80	23.0
<b>Total</b>	<b>186</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>116</b>	<b>100</b>	<b>348</b>	<b>100</b>

\* Information was not collected for 457 events that occurred prior to 1995.

Table 5: Distribution of the Number of Chemicals Released by Type of Event, NC HSEES, 1993-1997

Number of Chemical Released	Type of Event						All Events		
	Fixed			Transport					
	No. of Events	%	No. of Substances	No. of Events	%	No. of Substances	No. of Events	%	No. of Substances
1	769	95.5	769	250	90.6	250	1019	94.3	1019
2	18	2.2	36	19	6.9	38	37	3.4	74
3	8	1.0	24	3	1.1	9	11	1.0	33
4	2	0.2	8	1	0.3	4	3	0.3	12
5	1	0.1	5	1	0.3	5	2	0.2	10
≥6	7	0.9	58	2	0.7	15	9	0.8	73
<b>Total*</b>	<b>805</b>	<b>99.9</b>	<b>900</b>	<b>276</b>	<b>99.9</b>	<b>321</b>	<b>1081</b>	<b>100</b>	<b>1221</b>

\* Percentages may not equal 100% due to rounding.

Table 6: Type of Event by Time of Day, NC HSEES, 1993-1997

Time of Day	Fixed Facility		Transportation		Total	
	No.	%	No.	%	No.	%
00:00 - 05:59	96	11.9	38	13.8	106	10.1
06:00 - 11:59	279	34.7	103	37.3	382	36.3
12:00 - 17:59	282	35.0	104	37.7	386	36.7
18:00 - 23:59	148	18.4	31	11.2	179	17.0
<b>Total*</b>	<b>805</b>	<b>100</b>	<b>276</b>	<b>100</b>	<b>1053</b>	<b>100.1</b>

\* Percentages may exceed 100% due to rounding.

Table 7: Distribution of the Number of Chemical Substances Released by Substance Category and Event Type, NC HSEES, 1993-1997

Chemicals Released	Total					
	Fixed		Transport		All Events	
	No.	%	No.	%	No.	%
Acids	116	12.9	50	15.6	166	13.6
Ammonia	77	8.6	5	1.6	82	6.7
Bases	34	3.8	15	4.7	49	4.0
Chlorine	57	6.3	4	1.2	61	5.0
Mixtures*	32	3.6	7	2.2	39	3.2
Other	223	24.8	87	27.1	310	25.4
Other inorganic substances	144	16.0	42	13.1	186	15.2
Paints & dyes	29	3.2	26	8.1	55	4.5
Pesticides	74	8.2	54	16.8	128	10.5
Polychlorinated biphenyls	20	2.2	4	1.2	24	2.0
Volatile organic compounds	94	10.4	27	8.4	121	9.9
<b>Total</b>	<b>900</b>	<b>100</b>	<b>321</b>	<b>100</b>	<b>1221</b>	<b>100</b>

\* Mixtures of substances from different categories.

Table 8: Distribution of the Number of Victims by Type of Event, NC HSEES, 1993-1997

Number of Victims	Total								
	Fixed			Transport			All Events		
	No. of Events	%	No. of Victims	No. of Events	%	No. of Victims	No. of Events	%	No. of Victims
1	54	40.9	54	27	54.0	27	81	14.1	81
2	23	17.4	46	11	22.0	22	34	11.8	68
3	23	17.4	69	7	14.0	31	30	15.6	90
4	7	5.3	28	2	4.0	8	9	6.3	36
5	7	5.3	35	1	2.0	5	8	7.0	40
≥ 6	18	13.6	226	2	4.0	34	20	45.2	260
<b>Total*</b>	<b>132</b>	<b>99.9</b>	<b>458</b>	<b>50</b>	<b>100</b>	<b>117</b>	<b>182</b>	<b>100</b>	<b>575</b>

\* Percentages may not equal 100% due to rounding.

Table 9: Number of Chemicals Released in All Events and Events with Victims, by Substance Category, NC HSEES, 1993-1997

Chemicals Released	Releases		Releases with Victims		Percent of Releases with Victims
	No.	%	No.	%	
Acids	166	13.6	32	14.0	19.3
Ammonia	82	6.7	10	4.4	12.2
Bases	49	4.0	11	4.8	22.4
Chlorine	61	5.0	21	9.2	34.4
Mixtures*	39	3.2	9	3.9	23.1
Other	310	25.4	38	16.6	12.3
Other inorganic substances	186	15.2	54	23.6	29.0
Paints and dyes	55	4.5	4	1.7	7.3
Pesticides	128	10.5	20	8.7	15.6
Polychlorinated biphenyls	24	2.0	0	0	0
Volatile organic compounds	121	9.9	30	13.1	24.8
<b>Total</b>	<b>1221</b>	<b>100</b>	<b>229</b>	<b>100</b>	<b>18.8</b>

\* Mixtures of chemicals from different categories.

Table 10: Distribution of Victims by Population Group and Type of Event, NC HSEES, 1993-1997

Victim Category	Total					
	Fixed		Transport		All Events	
	No.	%	No.	%	No.	%
Employee	379	82.8	54	46.1	433	75.3
Responder (unknown type)	15	3.3	5	4.3	20	3.5
General public	35	7.6	28	23.9	63	11.0
Professional firefighter *	1	0.2	1	0.9	2	0.3
Firefighter (unknown type) *	22	4.8	0	0	22	3.8
Police officer *	2	0.4	17	14.5	19	3.3
EMT personnel *	2	0.4	1	0.9	3	0.5
Student	2	0.4	11	9.4	13	2.3
<b>Total†</b>	<b>458</b>	<b>99.9</b>	<b>117</b>	<b>100</b>	<b>575</b>	<b>100</b>

\* Data on responder type were not collected until 1996.

† Percentages may not equal 100% due to rounding.

Table 11: Number of People Decontaminated during Events by Year, NC HSEES, 1993-1997

People Decontaminated	1993		1994		1995		1996		1997		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Employees at scene	37	19.7	15	6.3	15	14.7	34	32.7	7	20.0	108	16.1
Responders at scene	138	73.4	225	93.7	82	80.4	64	61.5	27	77.1	536	80.1
General public at scene	0	0	0	0	2	2.0	0	0	0	0	2	0.3
Employees at medical/ other facility	3	1.6	0	0	3	2.9	6	5.8	1	2.9	13	1.9
Responders at medical/ other facility	4	2.1	0	0	0	0	0	0	0	0	4	0.6
General public at medical/ other facility	6	3.2	0	0	0	0	0	0	0	0	6	0.9
<b>Total*</b>	<b>188</b>	<b>100</b>	<b>240</b>	<b>100</b>	<b>102</b>	<b>100</b>	<b>104</b>	<b>100</b>	<b>35</b>	<b>100</b>	<b>669</b>	<b>99.9</b>

\* Percentages may not equal 100% due to rounding.

Table 12: Areas Evacuated during Events by Event Type, NC HSEES, 1993-1997

Area Evacuated	Total					
	Fixed		Transport		All Events	
	No.	%	No.	%	No.	%
No criteria	1	0.5	2	7.7	3	1.2
Circle/radius	16	7.4	9	34.6	25	10.4
Downwind/ downstream	28	13.0	5	19.2	33	13.7
Building/affected part of building	161	74.9	6	23.1	167	69.3
Circle and downwind	1	0.5	2	7.7	3	1.2
Unknown	8	3.7	2	7.7	10	4.1
<b>Total*</b>	<b>215</b>	<b>100</b>	<b>26</b>	<b>100</b>	<b>241</b>	<b>99.9</b>

\* Percentages may not equal 100% due to rounding.

Table 13: Type of Contingency Plan Followed During an Event, by Type of Event, NC HSEES, 1993-1997

Type of Contingency Plan Followed	Total					
	Fixed		Transport		All Events	
	No.	%	No.	%	No.	%
Ad hoc plan	16	2.0	7	2.6	23	2.1
SARA* Title III	3	0.4	3	1.1	6	0.6
Civil disaster	1	0.1	0	0	1	0.1
HAZMAT†/ response team SOP	420	53.1	203	75.5	623	58.8
RCRA‡ contingency	2	0.3	0	0	2	0.2
Company's operating procedures	173	21.9	21	7.8	194	18.3
Other	23	2.9	14	5.2	37	3.5
Unknown	153	19.3	21	7.8	174	16.4
<b>Total</b>	<b>791</b>	<b>100</b>	<b>269</b>	<b>100</b>	<b>1060</b>	<b>100</b>

\* SARA=Superfund Amendments and Reauthorization Act of 1986.

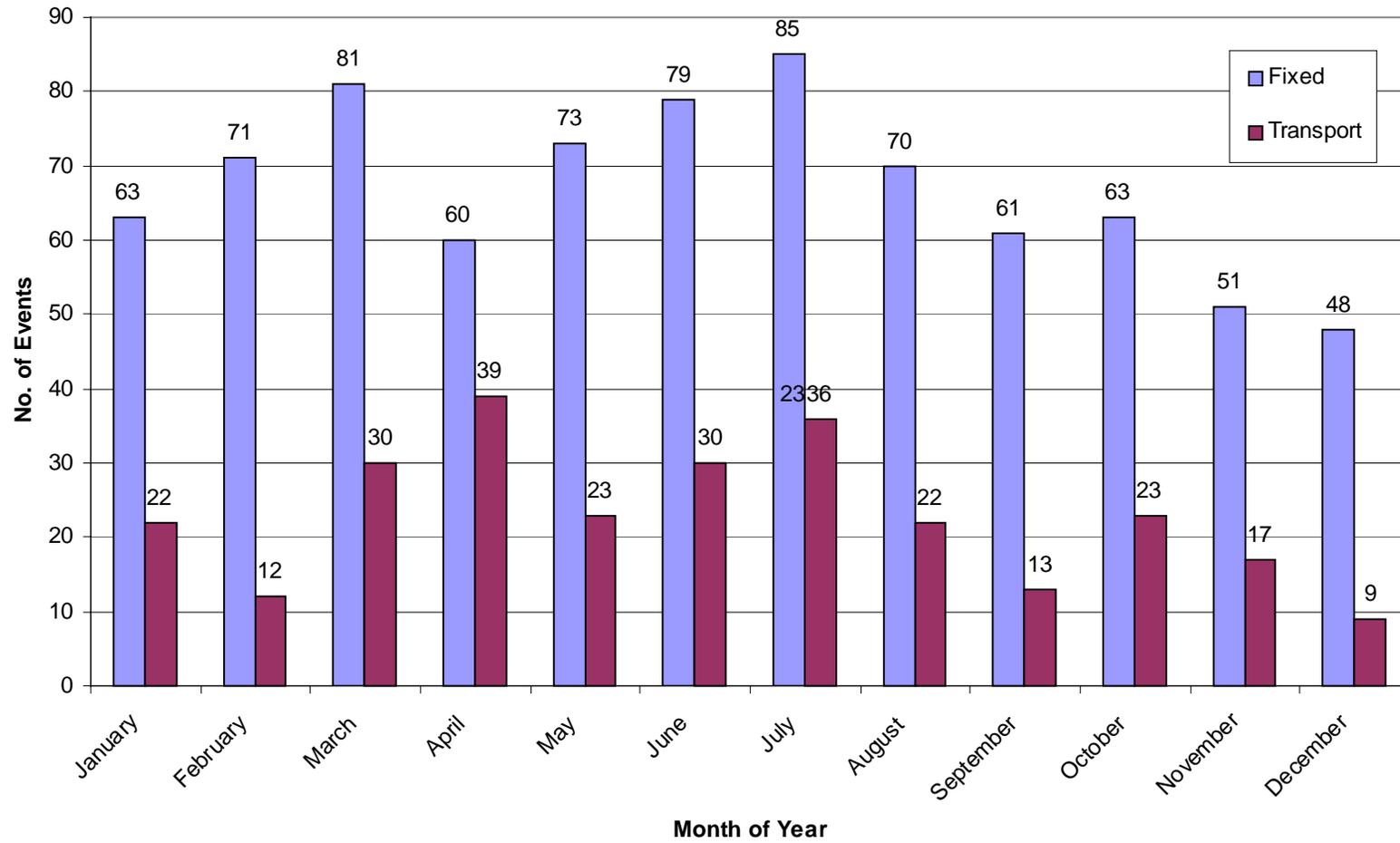
† HAZMAT=Hazardous Materials.

‡ RCRA=Resource Conservation and Recovery Act of 1976.

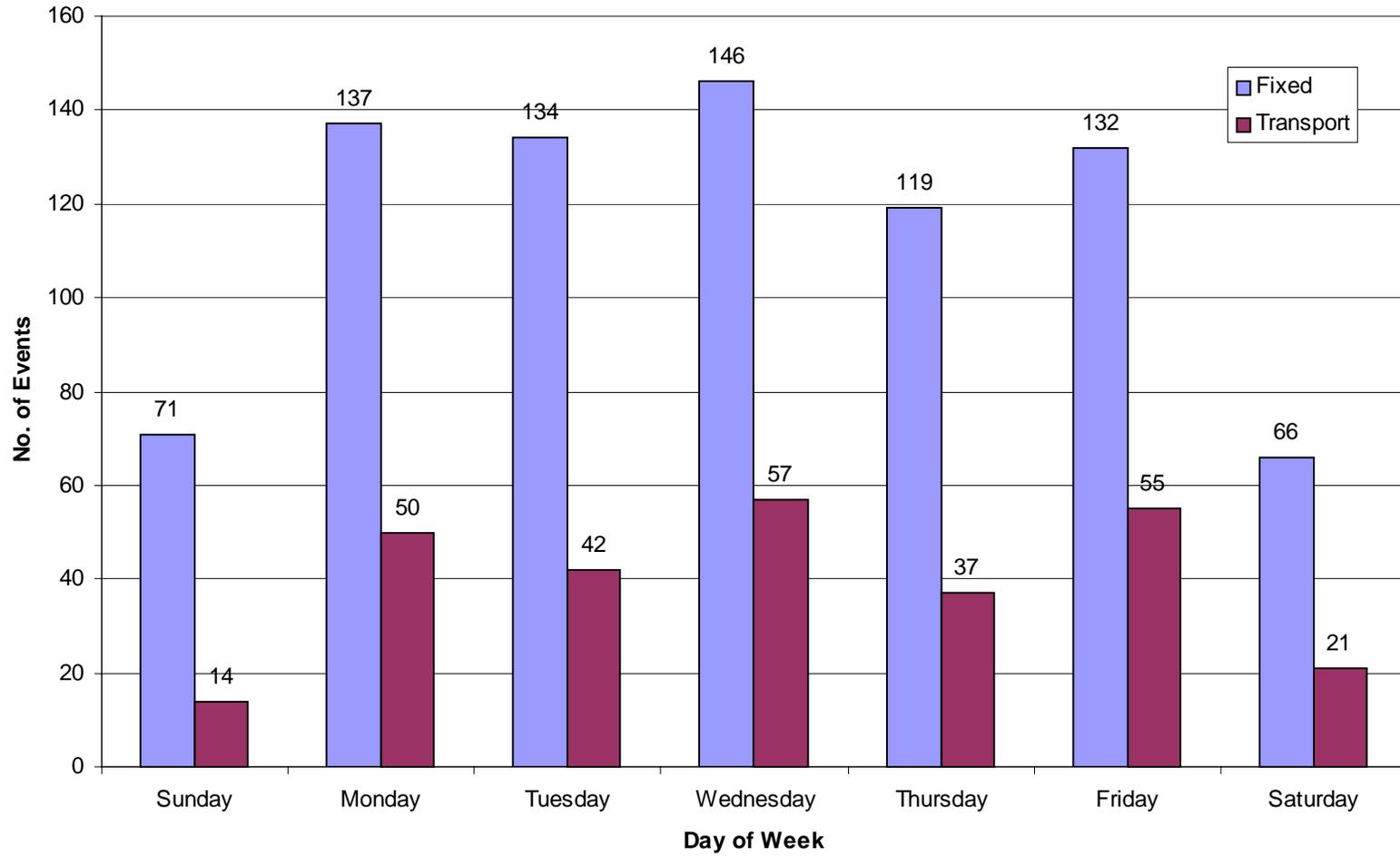
Table 14: Cumulative Data for NC HSEES Events, 1993-1997

Year	Event Type			No. Substances Released	No. Deaths	No. Victims	Events with Victims		No. Evacuations	No. People Evacuated
	Fixed	Transport	Total				No.	%		
1993	185	77	262	307	2	151	58	22.1	54	1631
1994	190	54	244	272	1	111	36	14.8	60	3320
1995	186	58	244	285	0	107	30	12.3	53	5430
1996	128	45	173	185	1	126	32	18.5	38	3473
1997	116	42	158	172	4	80	26	16.5	36	4746
<b>Total</b>	<b>805</b>	<b>276</b>	<b>1081</b>	<b>1221</b>	<b>8</b>	<b>575</b>	<b>182</b>	<b>16.8</b>	<b>241</b>	<b>18600</b>

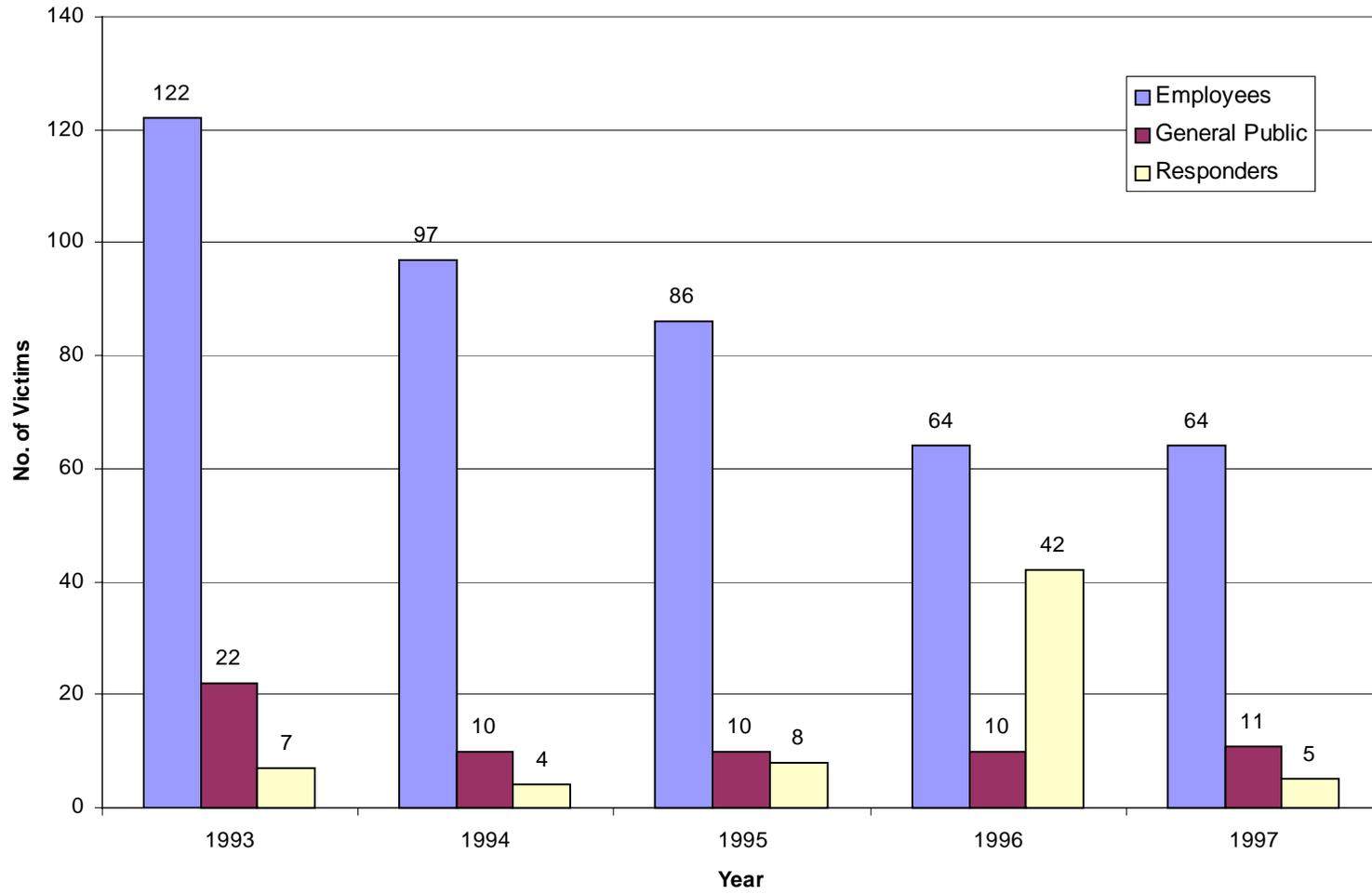
**Figure 1**  
**Distribution of Events by Month of Year,**  
**NC HSEES, 1993-1997**



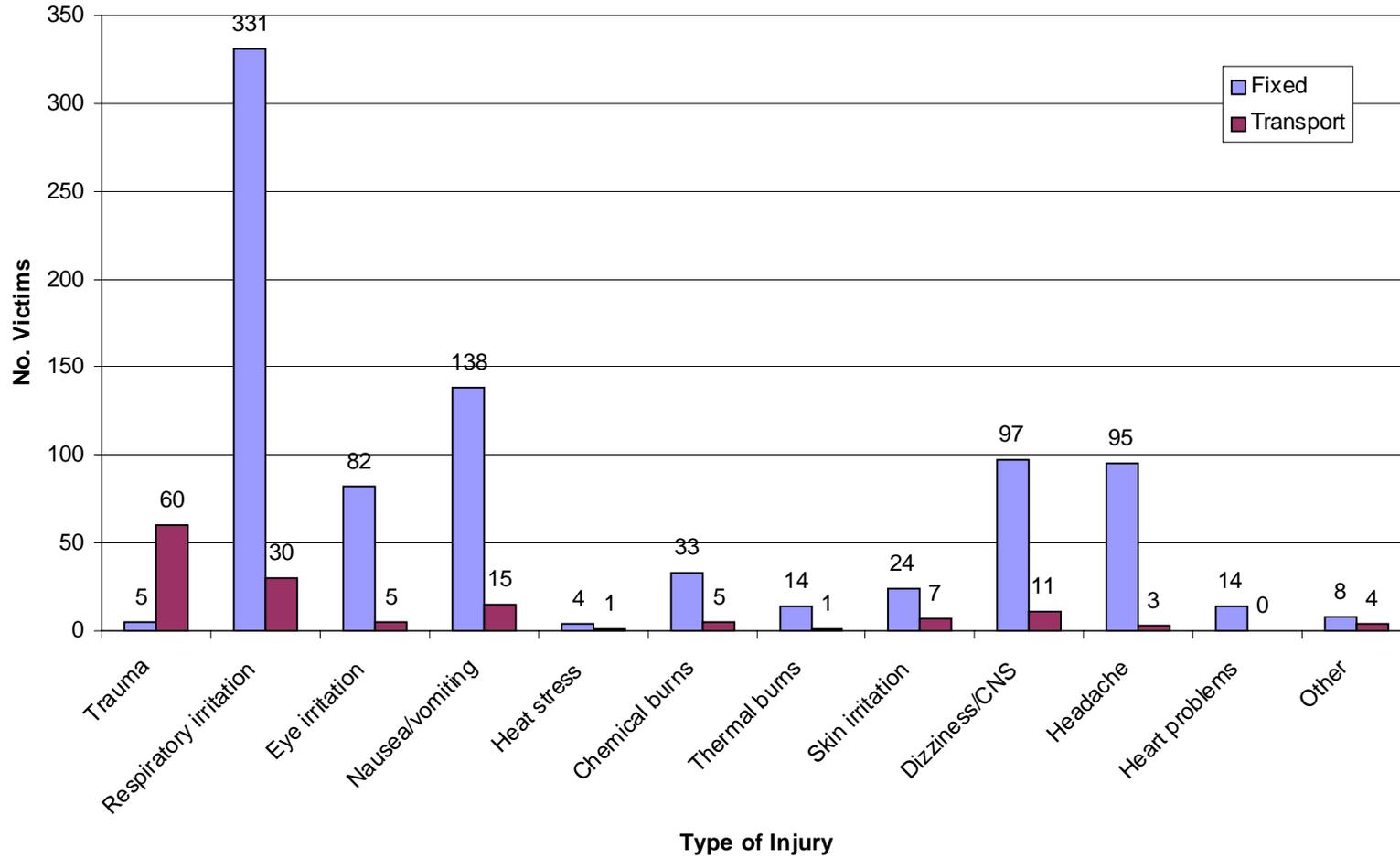
**Figure 2**  
**Distribution of Events by Day of Week,**  
**NC HSEES, 1993-1997**



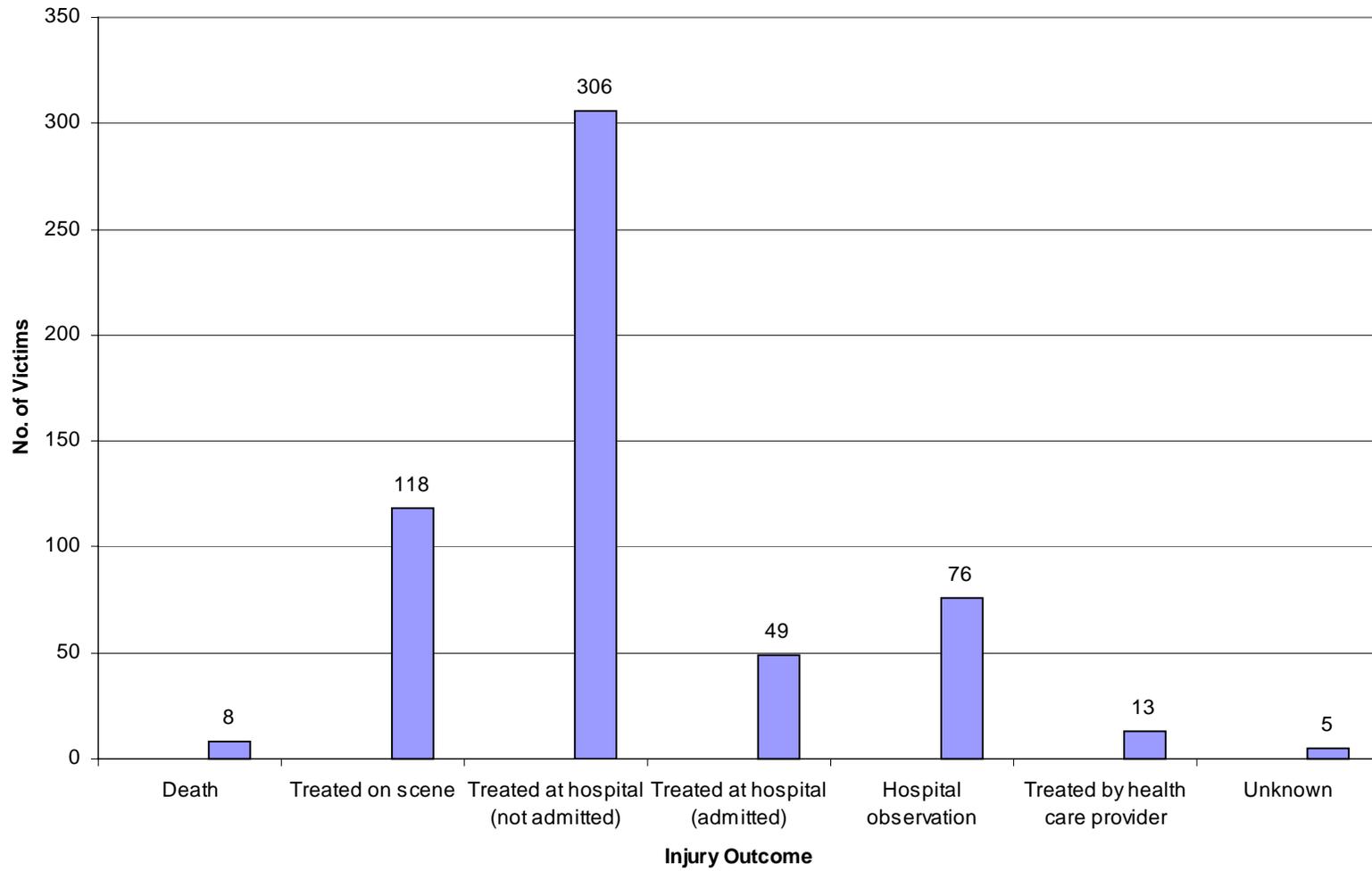
**Figure 3**  
**Distribution of Victims,**  
**NC HSEES, 1993-1997**



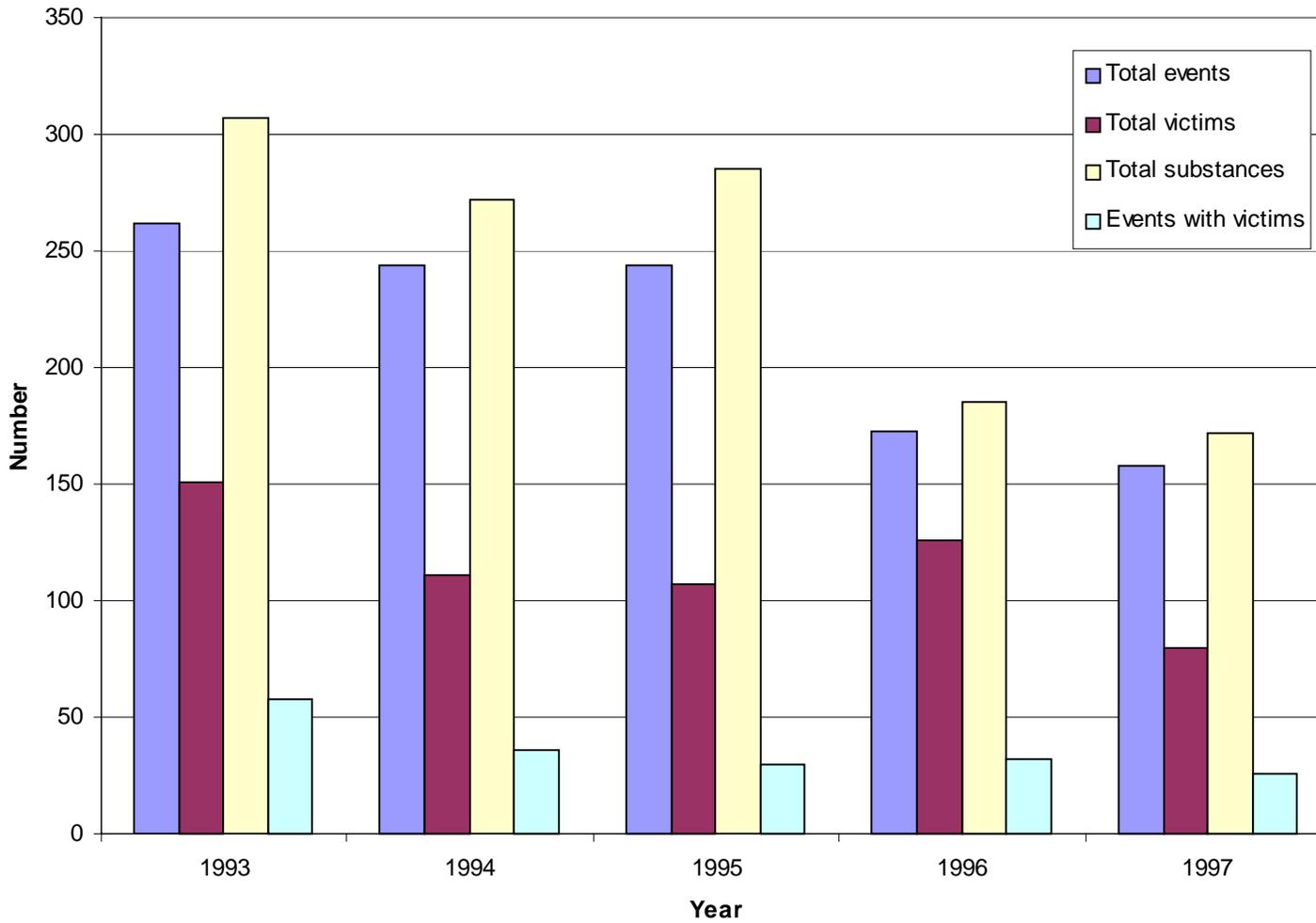
**Figure 4**  
**Types of Injuries by Type of Event,**  
**NC HSEES, 1993-1997**



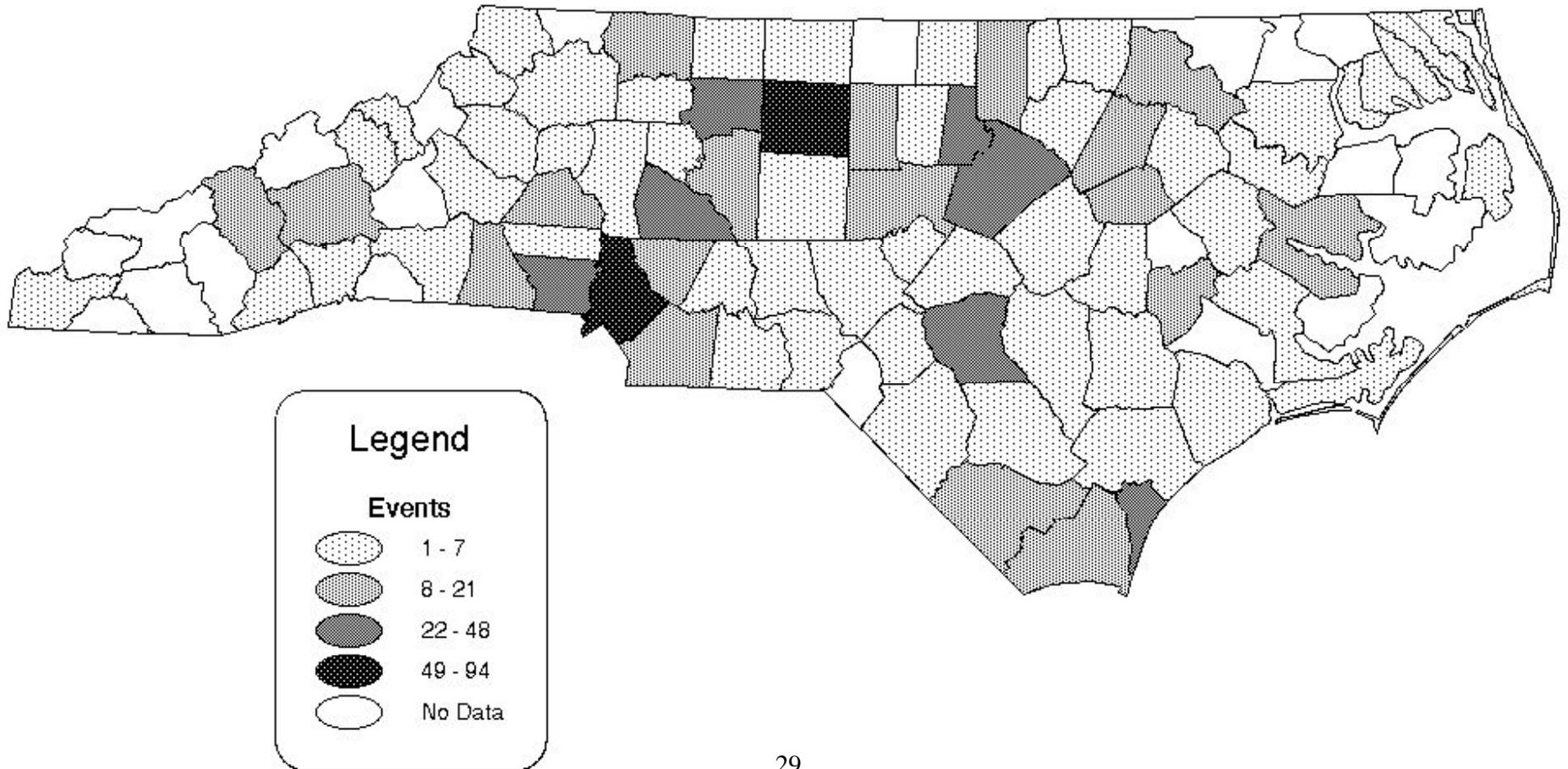
**Figure 5**  
**Injury Outcome,**  
**NC HSEES, 1993-1997**



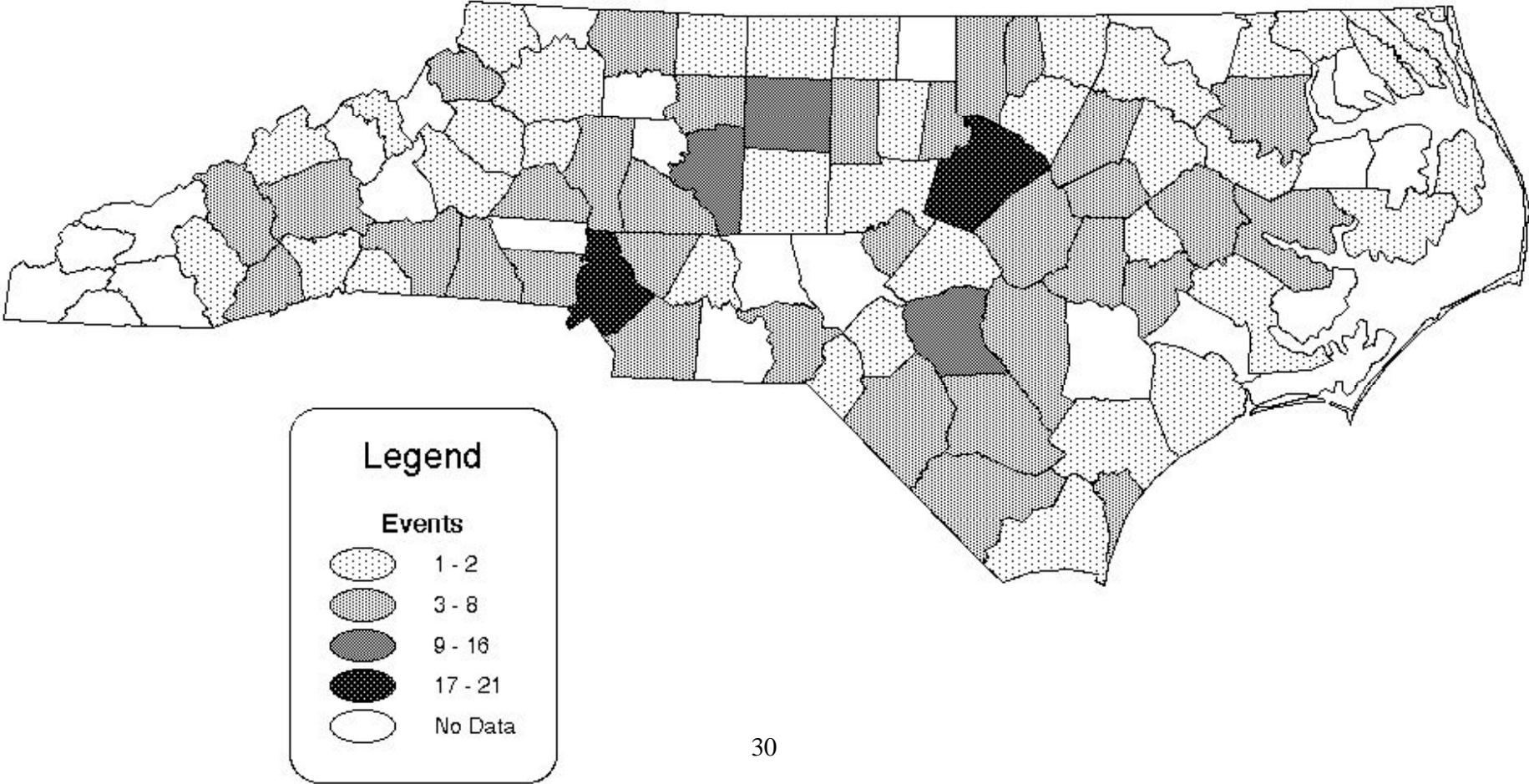
**Figure 6**  
**Cumulative Data,**  
**NC HSEES, 1993-1997**



# Geographical Distributions of Fixed Facility Events During 1993-97 in North Carolina



# Geographical Distributions of Transportation Events During 1993-97 in North Carolina



Appendix 3  
Distribution of Events by County, NC HSEES, 1993-1997

<u>County</u>	<u>Freq.</u>	<u>County</u>	<u>Freq.</u>	<u>County</u>	<u>Freq.</u>
Alamance	15	Forsyth	46	Onslow	7
Alexander	3	Franklin	2	Orange	3
Anson	2	Gaston	35	Pasquotank	3
Ashe	3	Gates	1	Pender	6
Beaufort	13	Granville	12	Perquimans	1
Bertie	6	Greene	2	Person	2
Bladen	5	Guilford	83	Pitt	7
Brunswick	23	Halifax	9	Polk	2
Buncombe	25	Harnett	3	Randolph	4
Burke	7	Haywood	16	Richmond	6
Cabarrus	14	Henderson	7	Robeson	10
Caldwell	6	Hertford	1	Rockingham	7
Camden	2	Hoke	4	Rowan	37
Carteret	3	Hyde	1	Rutherford	6
Caswell	2	Iredell	10	Sampson	5
Catawba	11	Jackson	2	Scotland	1
Chatham	12	Johnston	6	Stanly	5
Cherokee	2	Lee	6	Stokes	5
Chowan	2	Lenoir	21	Surry	16
Cleveland	16	Lincoln	5	Transylvania	6
Columbus	23	Madison	1	Union	17
Craven	5	Martin	7	Vance	4
Cumberland	54	McDowell	6	Wake	68
Currituck	4	Mecklenburg	115	Warren	2
Dare	2	Mitchell	4	Watauga	6
Davisdon	24	Montgomery	1	Wayne	10
Davie	1	Moore	5	Wilkes	3
Duplin	5	Nash	12	Wilson	17
Durham	46	New Hanover	46	Yadkin	2
Edgecombe	2	Northampton	3	Yancey	1
				Unknown	2

Appendix 4  
Top 25 Most Frequently Released Chemicals, NC HSEES, 1993-1997

<u>Standardized Substance Name</u>	<u>Frequency</u>
1. Ammonia	70
2. Chlorine	61
3. Ethylene glycol	56
4. Sulfuric acid	49
5. Hydrochloric acid	47
6. Paint or coating NOS	39
7. Sodium hydroxide	39
8. Polychlorinated biphenyls	23
9. Formaldehyde	21
10. Phosphoric acid	19
11. Chlorpyrifos	18
12. Nitrogen fertilizer	16
13. Carbon monoxide	15
14. Diphenyl	15
15. Perchloroethylene	14
16. Sodium hypochlorite	14
17. Sulfur dioxide	13
18. Xylene	13
19. Acetic acid	12
20. Hydrogen peroxide	12
21. Nitric acid	12
22. Ammonium hydroxide	11
23. Dowtherm	11
24. Diazinon	10
25. Toluene	10