

# ***IOWA HSEES***

## **Hazardous Substances Emergency Events Surveillance**

**Cumulative Report  
1993 – 1997**

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## Executive Summary

The federal Agency for Toxic Substances and Disease Registry (ATSDR) maintains an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) System and has since 1990. The system's purpose is to describe the public health consequences associated with the release of hazardous substances and to reduce morbidity and mortality resulting from these releases. Five state health departments participated in the pilot phase of the surveillance system and began data collection on January 1, 1990. Iowa was one of those five states.

Since 1990, the number of participating state health departments has increased. As of the year 2000, 15 states participate in the HSEES System program. This report summarizes the characteristics of the events reported to the surveillance system by Iowa and the 13 other participating states during the calendar years 1993 through 1997.

Information on all reported acute hazardous substances emergency events was collected. The types of data collected included general information on the event, substances released, victims, injuries, and evacuations.

Several data sources were used to obtain the maximum amount of information about each event. These sources include written records and oral reports of state environmental protection agencies, police and fire departments, and hospitals. The data obtained were

computerized using an ATSDR-provided data entry system and were sent to ATSDR on a quarterly basis.

The 14 participating states reported a total of 24,477 events for the five-year period 1993 through 1997. Of those total events, 19,605 (80.1%) occurred at fixed facilities, and 4,872 (19.9%) were transportation related. Iowa reported a total of 1,518 events for that time period with 1,007 (66.3%) occurring at fixed facilities and 511 (33.7%) having been transportation related. During this five-year reporting period, all participating states reported 9,631 victims, including 111 deaths, resulting from hazardous substances releases. During that same time period, Iowa reported 402 victims, including 9 deaths.

Overall, the findings regarding the distribution of the types of events, the number of events with victims and evacuations, and the injuries reported have been consistent since the inception of the HSEES System.

## **Introduction**

The Hazardous Substances Emergency Events Surveillance (HSEES) System is an ongoing, state-based surveillance program funded by the federal Agency For Toxic Substances and Disease Registry (ATSDR). The decision to initiate a surveillance system of this type was based on a 1988 study on the reporting of hazardous substances releases to three national databases. These were the National Response Center Database,

the Hazardous Materials Information System (HMIS), and the Acute Hazardous Events Database.<sup>1</sup>

A review of these databases indicated that they were limited because many events were missed through incomplete reporting (for example, HMIS did not include events involving intrastate carriers or fixed-facility events). Other missing information included the demographic characteristics of victims, the types of injuries received, and the number of persons evacuated. As a result of this review, ATSDR implemented the HSEES System to describe the public health consequences associated with the release of hazardous substances. The surveillance system has four goals:

- 1) To describe the distribution and characteristics of hazardous substances emergencies.
- 2) To describe the morbidity and mortality experienced by employees, emergency responders, and the general public as a result of hazardous substances releases.
- 3) To identify risk factors associated with morbidity and mortality.
- 4) To identify strategies that might reduce future morbidity and mortality resulting from the release of hazardous substances.

<sup>1</sup> Binder S. Death, injuries, and evacuation from acute hazardous material releases. *Am J Public Health* 1989; 79:1042-4

This report summarizes the characteristics of hazardous substances releases and the associated public health consequences of those events reported to the surveillance system during 1993 through 1997.

## **Methods**

In the five-year period from 1993 through 1997, 14 state health departments collected data for the HSEES System. The states include Alabama, Colorado, Iowa, Minnesota, Mississippi, Missouri, New Hampshire, New York, North Carolina, Oregon, Rhode Island, Texas, Washington, and Wisconsin. Information was collected on standardized data collection forms containing 68 questions. Information about the event, substances released, victims, injuries, and evacuations was collected.

Hazardous substances emergency events are defined as uncontrolled or illegal releases or threatened releases of hazardous substances or the hazardous by-products of those substances. Events involving exclusively petroleum products, animal waste, or food products such as corn syrup, milk and chocolate are not included. Events are included if:

- 1) the amount of the substance released, or that might have been released, needed (or would have needed) to be removed, cleaned up, or neutralized according to federal, state or local law; or

- 2) there is only a threatened release of a substance, but the threat led to an action such as evacuation that could have affected the health of employees, emergency responders, or the general public.

Fixed-facility events are defined as events occurring inside or outside of buildings or other structures on fixed-facility grounds. Events involving vehicles that are part of the operation of a fixed facility that occur within a fixed facility are coded as fixed-facility events. Examples of these types of events are industrial sites, businesses, farms, schools, private residences, or railroads that are meant to move items within a fixed facility.

Transportation-related events are those that involve hazardous substances that are being transported by ground including roadways and railroad, by air, by water, and by pipelines outside the boundaries of a fixed facility.

Victims are defined as those persons who had at least one injury or symptom and sought some type of medical treatment or died as a consequence of the event. When counting injuries, victims who had more than one injury type were counted more than once. If a person had no symptoms but still sought medical treatment or if a person had symptoms but did not seek any medical treatment, they are not included as a victim.

For purposes of analysis, the substances released are grouped into 11 chemical categories.

The category “mixtures” consists of mixtures of substances from different categories such as a combination of ammonia and cyanide. The category “other” consists of substances that could not be placed in one of the other 10 categories. The category “other

inorganic substances” comprises all inorganic substances except for acids, bases, ammonia, and chlorine.

Various data sources were used to obtain information about emergency or accidental releases. These sources included written records and oral reports of state environmental protection agencies, police and fire departments, and hospitals. Census data were used to estimate the number of residents in the vicinity where each of the events occurred. All of the data were computerized using an ATSDR-provided data entry system and were sent to ATSDR on a quarterly basis.

Reporting requirements vary from state to state. Iowa’s law states that any person manufacturing, storing, handling, transporting or disposing of a hazardous substance shall notify the Iowa Department of Natural Resources of the occurrence of a hazardous condition as soon as possible. A hazardous condition is defined as any situation involving the actual, imminent, or probable spillage, leakage, or release of a hazardous substance onto the land, into a water of the state, or into the atmosphere, which creates an immediate or potential danger to the public health or safety of the environment. Iowa law requires the reporting of all chemical spills as defined above, regardless of the quantity spilled or released.

Limitations within the Iowa system do exist. An example of this is the under reporting of releases due to a data collection system that is based on a passive system of event reporting.

**Results For 1993 - 1997**

A total of 24,477 events were reported from 1993 to 1997 to the HSEES System by the 14 participating health departments. Of these events, 1,518 occurred in Iowa (see Table 1).

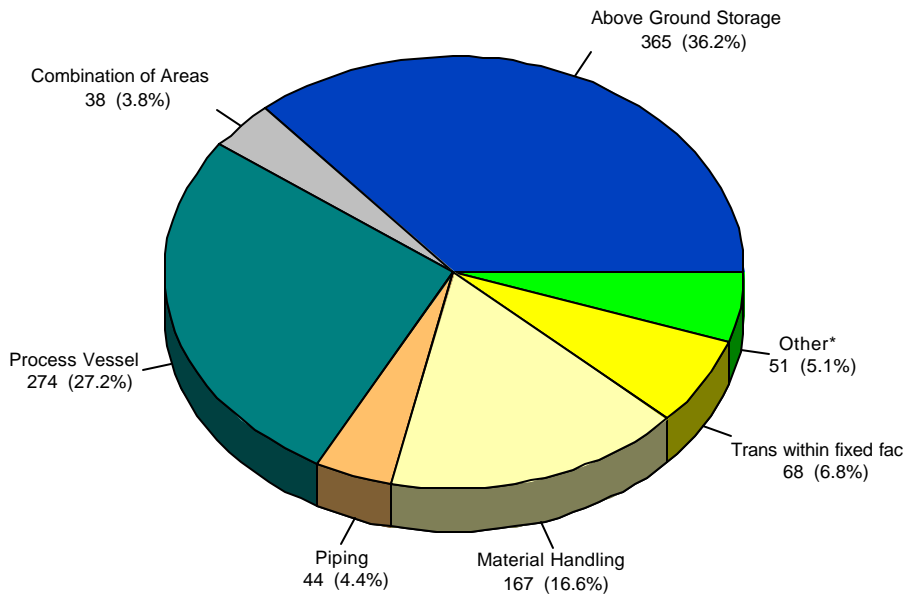
Table 1  
Number of Events Meeting the Surveillance  
Definition by State and Type of Event  
Years 1993-1997

State Reporting Event	Event Type				Total
	Fixed Facility		Transportation		
	# of Events	Percent	# of Events	Percent	# of Events
Alabama	685	80.8	163	19.2	848
Colorado	1,335	69.2	595	30.8	1,930
Iowa	1,007	66.3	511	33.7	1,518
Minnesota	611	76.9	184	23.1	795
Mississippi	241	68.5	111	31.5	352
Missouri	517	60.3	341	39.7	858
New Hampshire	152	84.0	29	16.0	181
New York	1,624	82.8	337	17.2	1,961
North Carolina	805	74.5	276	25.5	1,081
Oregon	673	72.3	258	27.7	931
Rhode Island	199	87.3	29	12.7	228
Texas	8,909	90.8	908	9.2	9,817
Washington	1,624	75.9	516	24.1	2,140
Wisconsin	1,223	66.6	614	33.4	1,837
Total	19,605	80.1	4,872	19.9	24,477

In Iowa, 1,007 (66.3%) events occurred at fixed facilities and 511 (33.7%) were transportation related. When compared to the other participating states, Iowa has the second highest percentage of transportation-related releases and the second lowest percentage of fixed-facility-related releases.

In Iowa, 365 (36.3%) of the fixed-facility events reported involved above ground storage, 274 (27.2%) involved a process vessel, and 167 (16.6%) involved material handling. The remaining fixed-facility events involved piping, transportation within the fixed facility, a combination of areas, or the category of “other” (see Figure 1).

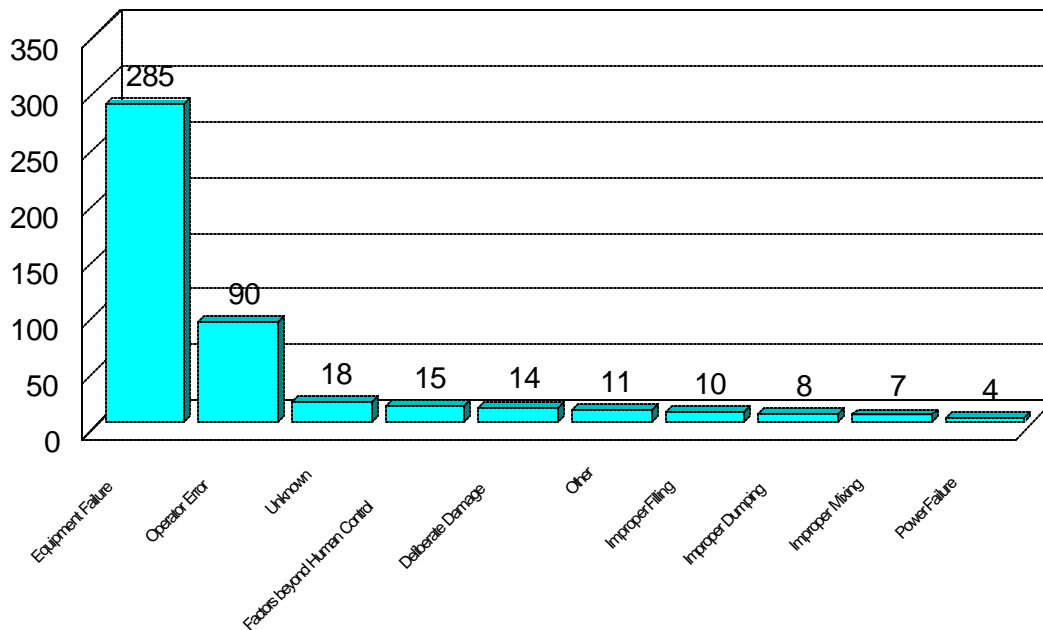
Figure 1  
Iowa  
Areas of Fixed Facilities Involved in Events  
Years 1993-1997



\* The category “other” includes transformers and capacitors, dump and/or waste areas, underground storage, and unknown.

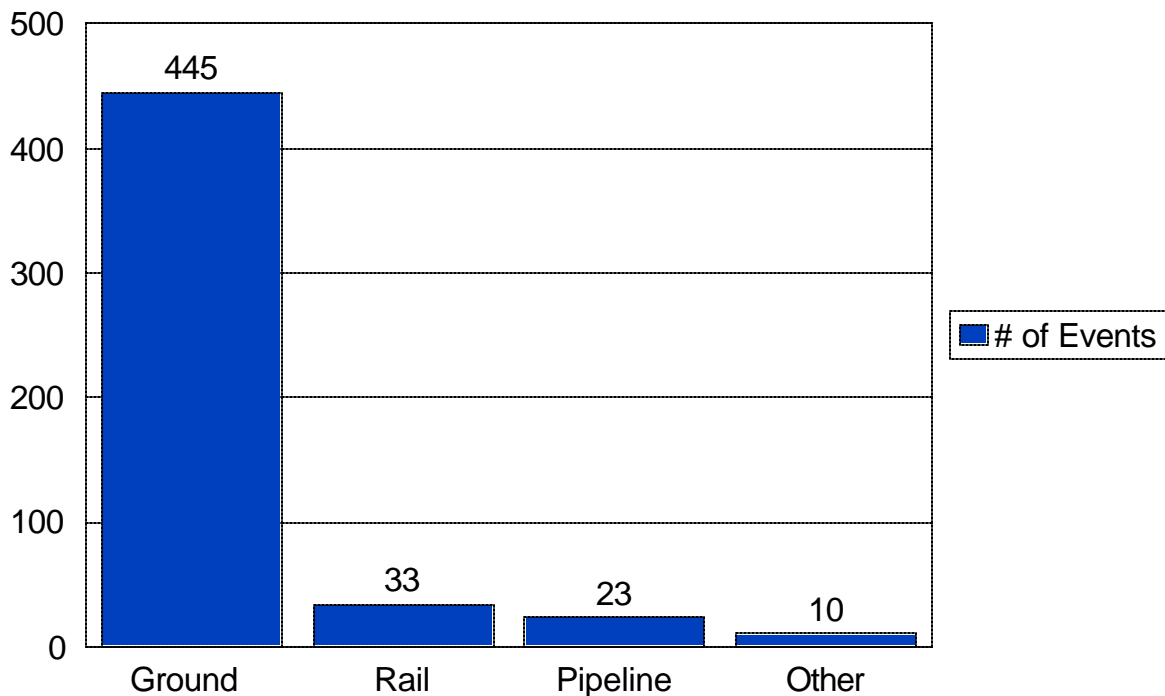
Beginning in August 1995, factors contributing to fixed-facility events were also reported (see Figure 2). Equipment failure and operator error were responsible for 81% of the releases.

Figure 2  
Iowa  
Factors Reported as Contributing to the  
Occurrence of Fixed-Facility Events  
August 1995 – December 1997



The majority of the 511 transportation events in Iowa involved motor vehicle ground transportation (see Figure 3). With two major interstates and the amount of agricultural chemicals being transported throughout the state, this may account for the higher number of transportation-related events when compared to other participating states.

Figure 3  
Iowa  
Types of Transportation Involved in Transportation Events  
Years 1993-1997



Attachment 1 is a county map that shows the number of releases per county for 1993-1997. The counties with hazmat teams are shaded. It is interesting to note that most counties where a hazmat team is located tend to have a higher number of spills reported than most counties where no hazmat team is present. Clinton and Lee Counties, however, had 48 and 31 releases with one company in each county responsible for 19 and 15 releases respectively.

The majority of events (1,452 or 95.6%) that occurred in Iowa involved the release of a single chemical (see Table 2).

Table 2  
Iowa  
Distribution of the Number of Chemicals Released By Type of Event  
Years 1993-1997

Number of Chemicals Released	Event Type						All Events		
	Fixed Facility			Transportation					
	# of Events		Total Chemicals	# of Events		Total Chemicals	# of Events		Total Chemicals
1 (One)	974	96.7	974	478	93.5	478	1452	95.6	1452
2 (Two)	18	1.8	36	17	3.3	34	35	2.3	70
3 (Three)	7	0.7	21	11	2.2	33	18	1.2	54
4 (Four)	3	0.3	12	4	0.8	16	7	0.5	28
5 (Five)	1	0.1	5	1	0.2	5	2	0.1	10
6 or more	4	0.4	50	0	0	0	4	0.3	50
Total	1007	100.0	1098	511	100.0	566	1518	100.0	1664

The most common types of releases occurring in Iowa are agricultural chemicals. There were 407 (24.5%) chemicals categorized as pesticides and 299 (18%) as ammonia.

Table 3  
Iowa  
Distribution of the Number of Substances Released by  
Substance Category and Type of Event  
Years 1993-1997

Chemical Category	Event Type				All Events	
	Fixed Facility		Transportation			
	N	Percent	N	Percent	N	Percent
Acids	84	7.6	35	6.2	119	7.1
Ammonia	238	21.7	61	10.8	299	18.0
Bases	23	2.1	14	2.5	37	2.2
Chlorine	24	2.2	0	0	24	1.4
Other Inorganic Substances	96	8.7	27	4.7	123	7.4
Paints & Dyes	23	2.1	14	2.5	37	2.2
Pesticides	200	18.2	207	36.6	407	24.5
PCBs	67	6.1	1	0.2	68	4.1
VOCs	60	5.5	33	5.8	93	5.6
Mixture Across Chemical Category	24	2.2	17	3.0	41	2.5
Other	259	23.6	157	27.7	416	25.0
Total	1098	100.0	566	100.0	1664	100.0

The top 10 chemicals released in Iowa and in all participating states are listed in Table 4 and Table 5 respectively. The HSEES chemical category “ammonia” is general and includes names such as “ammonia,” “ammonia-not otherwise specified (NOS),” “ammonium hydroxide” and a few mixtures (as shown in Table 3). In Table 4, the category of ammonia means that pure ammonia was released (no mixture).

Table 4  
Top Ten Chemicals Released in Iowa  
Years 1993-1997

<u>HSEES Chemical Name</u>	<u>Frequency</u>	<u>Percent</u>
Ammonia	292	17.5481
Nitrogen Fertilizer	108	6.4904
Polychlorinated Biphenyls	67	4.0264
NPK Fertilizer	45	2.0743
Hydrochloric Acid	45	2.0743
Sulfuric Acid	32	1.9231
Pendimethalin	30	1.8029
Paint or Coating NOS	28	1.6827
Ethylene Glycol	24	1.4423
Pesticide NOS	24	1.4423

Table 5  
Top Ten Chemicals Released in All Participating States  
Years 1993-1997

<u>HSEES Chemical Name</u>	<u>Frequency</u>	<u>Percent</u>
Ammonia	1742	6.32603
Sulfur Dioxide	1296	4.70640
Sulfuric Acid	929	3.37364
Ethylene Glycol	853	3.09765
Polychlorinated Biphenyls	715	2.59651
Sodium Hydroxide	705	2.56019
Hydrochloric Acid	699	2.53840
Chlorine	651	2.36409
Paint or Coating NOS	451	1.63780
Benzene	448	1.62690

With the exception of the agricultural chemicals, the types of chemicals most commonly released in Iowa are comparable to those released in other states.

Analysis of event data by month, day of the week, and time of the day are provided in Figures 4, 5, and 6. As would be anticipated because of Iowa's spring planting season, the highest number of events occurred in April, May and June (see Figure 4). The daily event cycles for fixed-facility and transportation events indicate the expected patterns with the highest number of reported events occurring Monday through Friday (see Figure 5) during the typical work hours of 6 a.m. to 6 p.m. (see Figure 6).

Figure 4  
Iowa  
Distribution of Events by Month  
Years 1993-1997

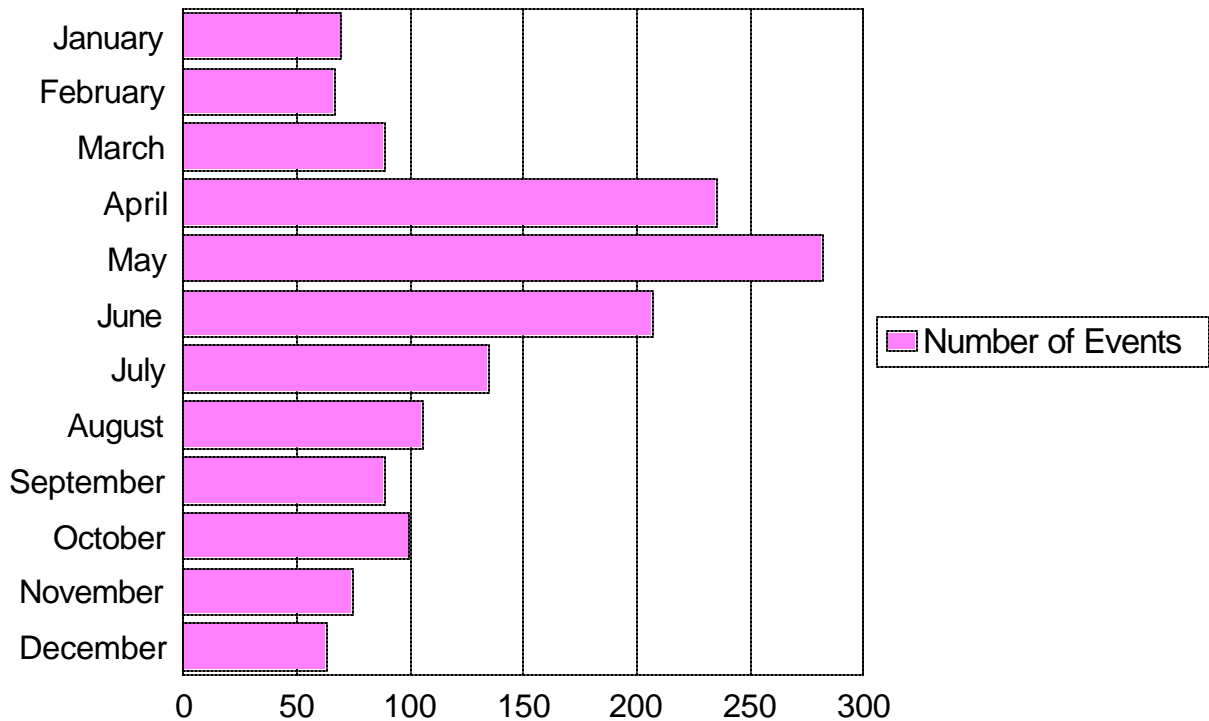


Figure 5  
Iowa  
Distribution of Events by Day of the Week  
Years 1993-1997

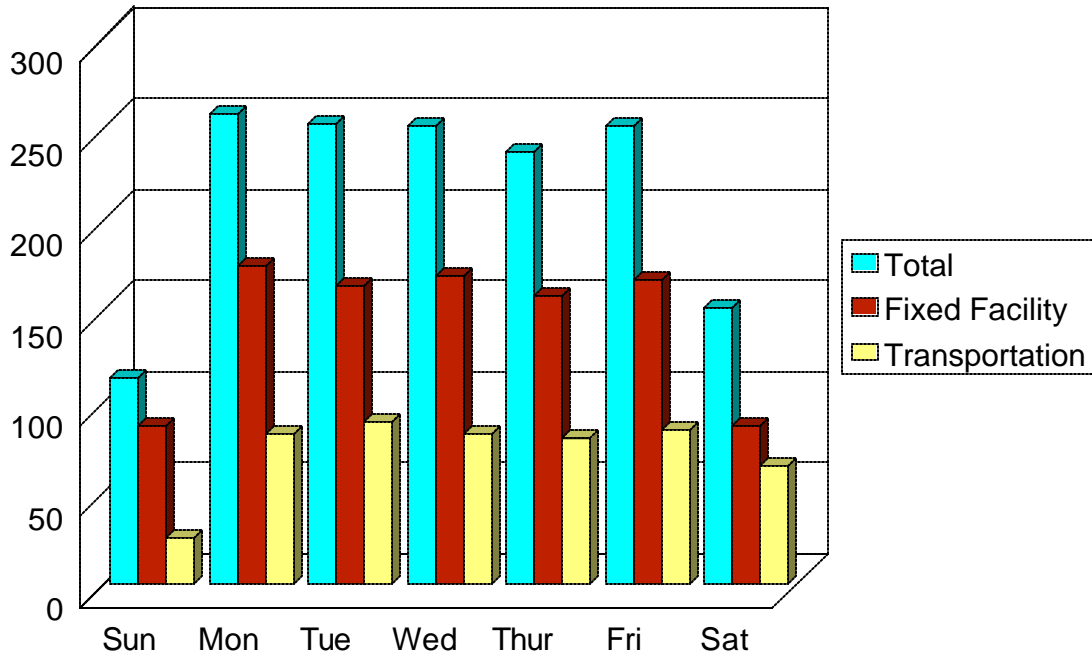
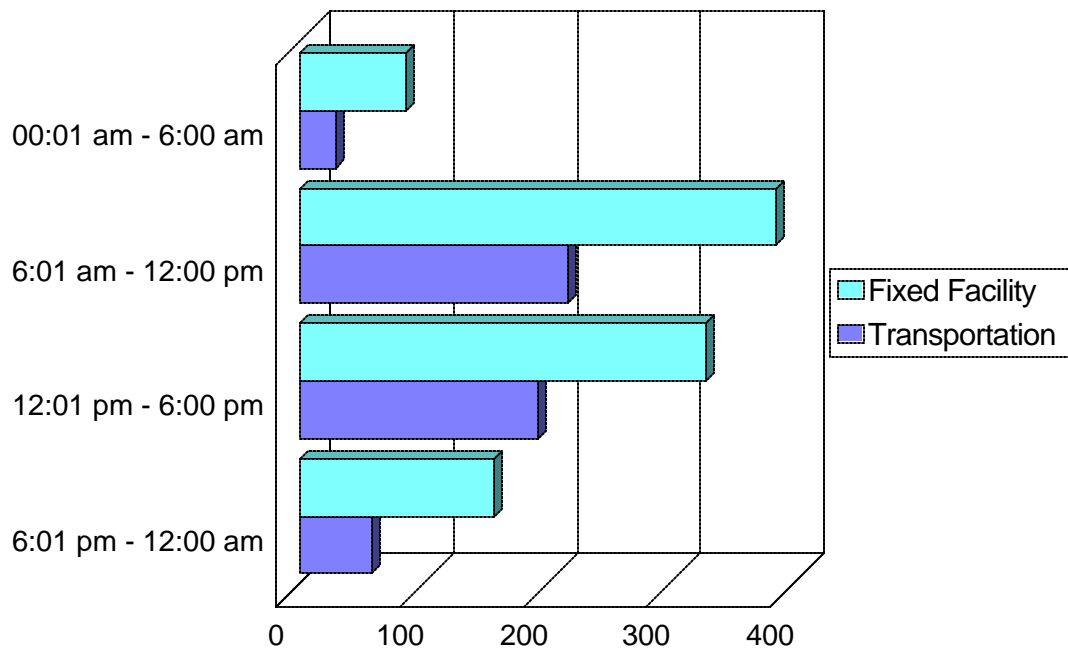
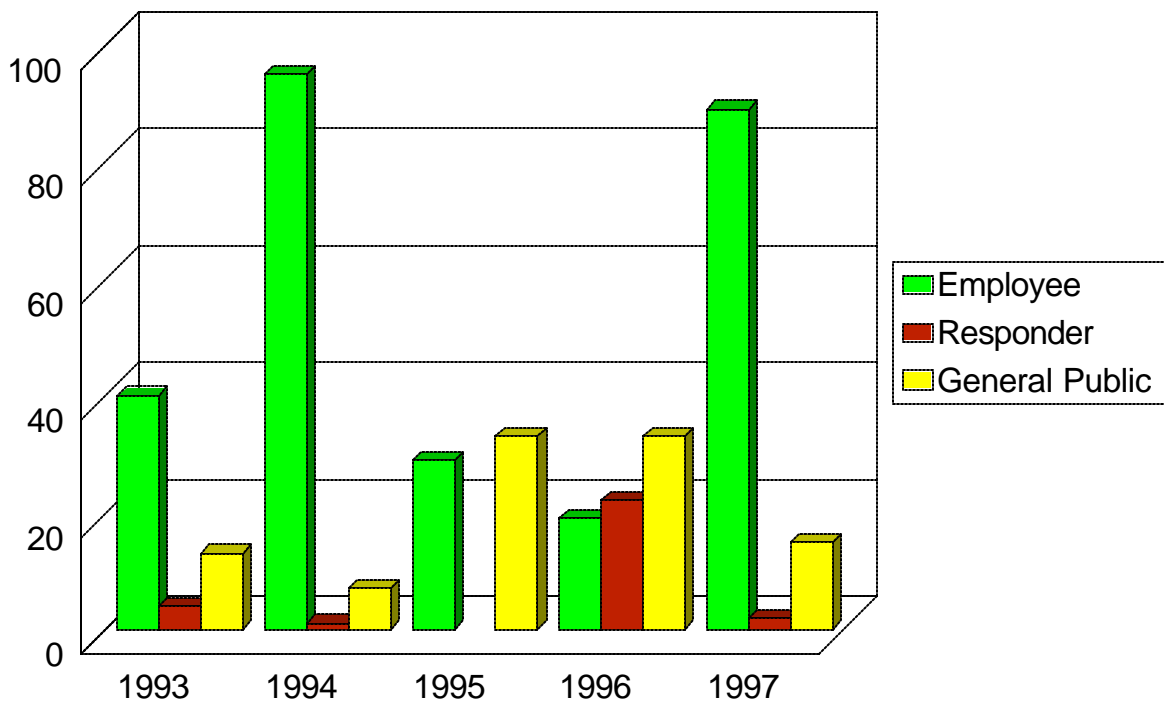


Figure 6  
Iowa  
Distribution of Events by Time of Day  
1993-1997



In Iowa, from 1993 through 1997, a total of 402 victims, 9 of whom died, were involved in 119 events (approximately 7.8 % of all events). An annual distribution of victims by victim category is provided in Figure 7.

Figure 7  
Iowa  
Annual Distribution of Victims by Victim Category  
Years 1993-1997



Of events with victims, 68.9% involved only one victim and the remainder involved two or more victims (see Table 6). Most victims (376 or 93.5%) were injured in fixed-facility events. See Table 7 which demonstrates distribution of the number of victims by type of event for all participating states. Iowa has a higher number of events with only one victim than other participating states. This may be due to the number of victims who are

employed in the agricultural field. When most agricultural suppliers or applicators are working with chemicals, the work is occurring in a single person setting.

Table 6  
Distribution of Number of Victims by Type of Event in Iowa  
Years 1993-1997

Number of Victims	Event Type						All Events		
	Fixed Facility			Transportation					
	# of Events		Total Victims	# of Events		Total Victims	# of Events		Total Victims
	N	Percent	N	N	Percent	N	N	Percent	N
1 (one)	68	68.0	68	14	73.7	14	82	68.9	82
2 (two)	11	11.0	22	3	15.8	6	14	11.8	28
3 (three)	2	2.0	6	2	10.5	6	4	3.3	12
4 (four)	2	2.0	8	0	0	0	2	1.7	8
5 (five)	2	2.0	10	0	0	0	2	1.7	10
6 or more	15	15.0	262	0	0	0	15	12.6	262
Total	100	100.0	376	19	100.0	26	119	100.0	402

Table 7  
 Distribution of Number of Victims by Type of Event for All Participating States  
 Years 1993-1997

Number of Victims	Event Type						All Events		
	Fixed Facility			Transportation					
	# of Events		Total Victims	# of Events		Total Victims	# of Events		Total Victims
	N	Percent	N	N	Percent	N	N	Percent	N
1 (one)	692	43.9	692	317	65.8	317	1009	49.0	1009
2 (two)	310	19.6	620	81	16.8	162	391	19.0	782
3 (three)	159	10.1	477	29	6.0	87	188	9.1	564
4 (four)	83	5.3	332	15	3.1	60	98	4.8	392
5 (five)	52	3.3	260	10	2.1	50	62	3.0	310
6 or more	282	17.9	6034	30	6.2	540	312	15.1	6574
Total	1578	100.0	8415	482	100.0	1216	2060	100.0	9631

The substances released most often in Iowa are not necessarily the most likely to result in victims (see Table 8). For example, chlorine was released in only 24 events, but 7 of those events (29.2%) resulted in injury. Although pesticides were released in 407 events, only 26 (6.4%) of those resulted in injury.

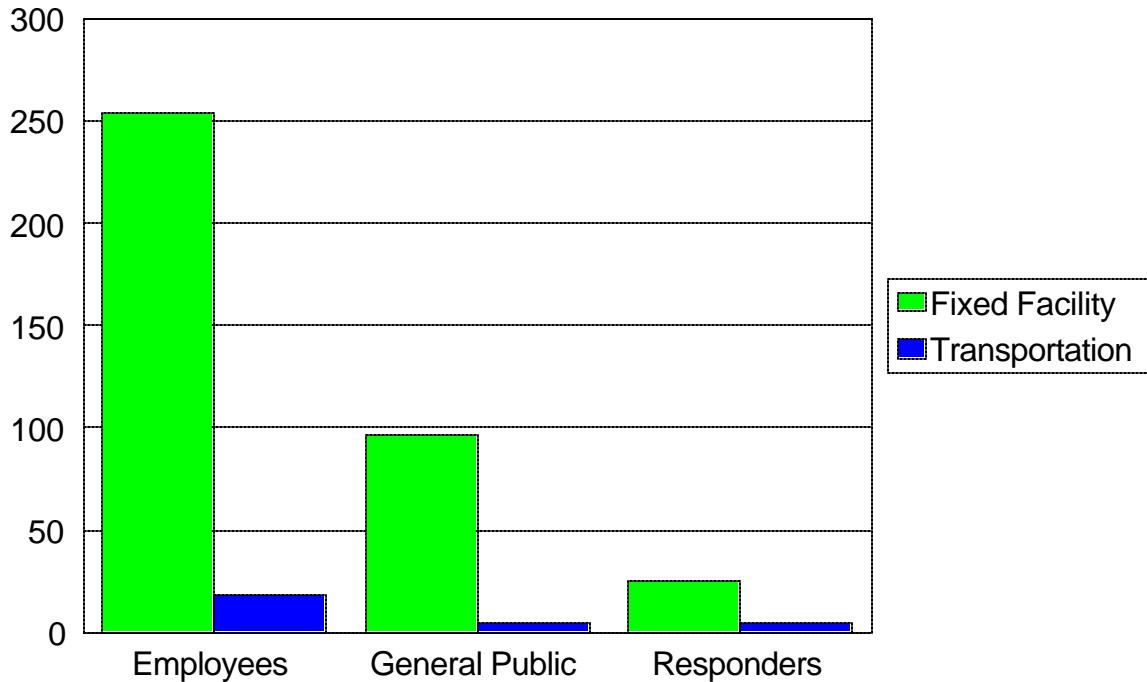
Table 8  
Iowa  
Distribution of Chemical Category Releases in all Events  
Compared with Events with Victims  
Years 1993-1997

Chemical Category	Number of Releases		Number of Releases with Victims		Percent of Releases with Victims
	N	Percent	N	Percent	
Acids	119	7.2	13	9.2	10.9
Ammonia	299	18.0	42	29.8	14.0
Bases	37	2.2	2	1.4	5.4
Chlorine	24	1.4	7	5.0	29.2
Other Inorganic Substances	123	7.4	16	11.3	13.0
Paints & Dyes	37	2.2	1	0.7	2.7
Pesticides	407	24.5	26	18.4	6.4
PCBs	68	4.1	0	0.0	0.0
VOCs	93	5.6	6	4.3	6.5
Mixture Across Chemical Category	41	2.5	3	2.1	7.3
Other	416	25.0	25	17.7	6.0
Total	1664	100*	141	100*	

\* Percentage may not add up to 100 due to rounding.

The population groups most often injured were employees (67.7%) followed by members of the general public (25.1%) and emergency responders (7.2%). Figure 8 shows the distribution of victims by population group and type of event.

Figure 8  
 Iowa  
 Number of Victims by Population Group and Type of Event  
 Years 1993-1997.



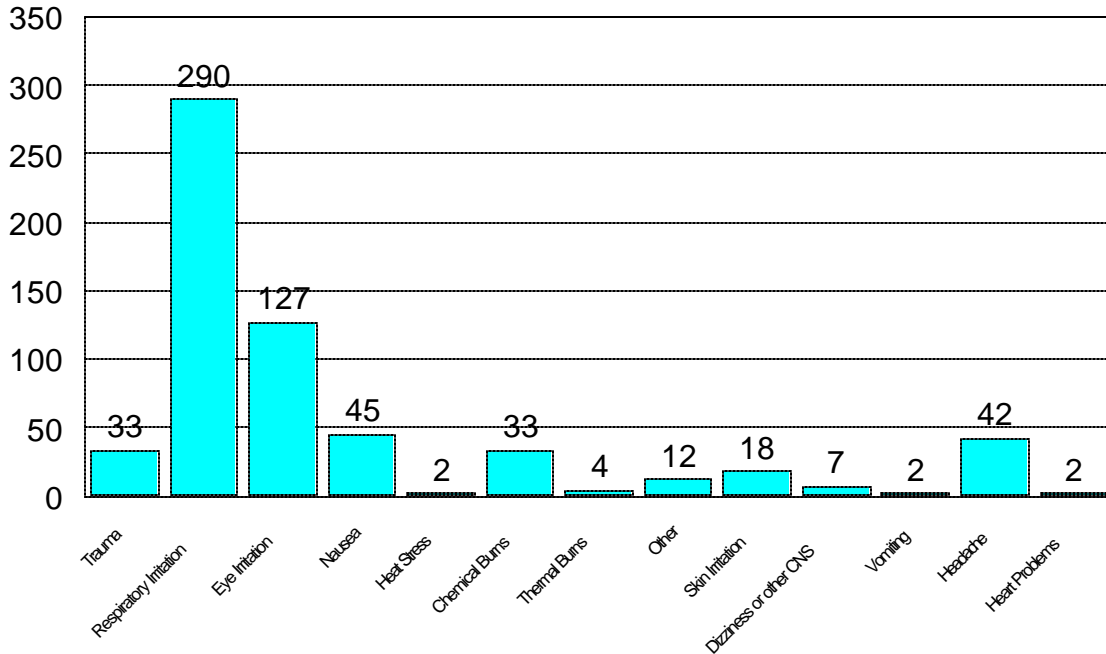
The types of injuries sustained by victims are shown in Table 9 and Figure 9. The 402 victims sustained a total of 617 injuries. Some victims may have had more than one injury (for example respiratory irritation and skin irritation). The most commonly reported injuries in fixed-facility events were respiratory irritation (47.6%) and eye irritation (21.4%). In transportation-related events, trauma (44.8%) and respiratory irritation (34.5%) were reported most often. The trauma injuries may have been caused by the sequence of events such as a car accident which lead to the release of a hazardous substance and not necessarily by exposure to the hazardous substance per se.

Table 9  
Iowa  
Distribution of Type of Injury by Type of Event  
Years 1993-1997.

Injury Type	Event Type				All Events	
	Fixed Facility		Transportation			
	N	Percent	N	Percent	N	Percent
Trauma	20	3.4	13	44.8	33	5.3
Respiratory Irritation	280	47.6	10	34.5	290	47.0
Eye Irritation	126	21.4	1	3.4	127	20.6
Nausea	44	7.5	1	3.4	45	7.3
Heat Stress	2	0.3	0	0	2	0.3
Chemical Burns	32	5.4	1	3.4	33	5.3
Thermal Burns	3	0.5	1	3.4	4	0.6
Other	12	2.0	0	0	12	1.9
Skin Irritation	17	2.9	1	3.4	18	2.9
Dizziness or other CNS	6	1.0	1	3.4	7	1.1
Vomiting	2	0.3	0	0	2	0.3
Headache	42	7.1	0	0	42	6.8
Heart Problems	2	0.3	0	0	2	0.3
Total	588	100*	29	100*	617	100*

\* Percentage may not add up to 100 due to rounding.

Figure 9  
Iowa  
Distribution of Type of Injury for all Events  
Years 1993-1997



A review of the data indicated that while most (approximately 82%) of the people who were injured were transported to a hospital, only 9% had injuries severe enough to be admitted. Officials reported only one person who received injuries but did not seek medical treatment (see Table 10 and Figure 10). During the five-year period, nine people died as a result of a hazardous substances release (see Table 10 and Figure 10). Of the releases that involved deaths, trauma was the most common cause (55.5%). One event involved a semi truck and car accident where the chemicals released were toilet bowl cleaner and paint. Two members of the general public were killed in this accident as a result of the trauma received. In another event, there was an explosion at a fertilizer manufacturing plant involving ammonia, nitrogen and nitric acid. In this event, four

employees died. Three died as a result of the trauma received from the explosion itself, and the fourth suffered a trauma-related injury and then died from subsequent exposure to the chemicals released. In a separate incident, an employee of a farm equipment manufacturer died from thermal burns received during an explosion and fire involving paint thinner. During a release of ammonia at a meat processing plant, one employee died from chemical burns. In a separate transportation-related event that also involved ammonia, an employee died after being exposed to the ammonia fumes.

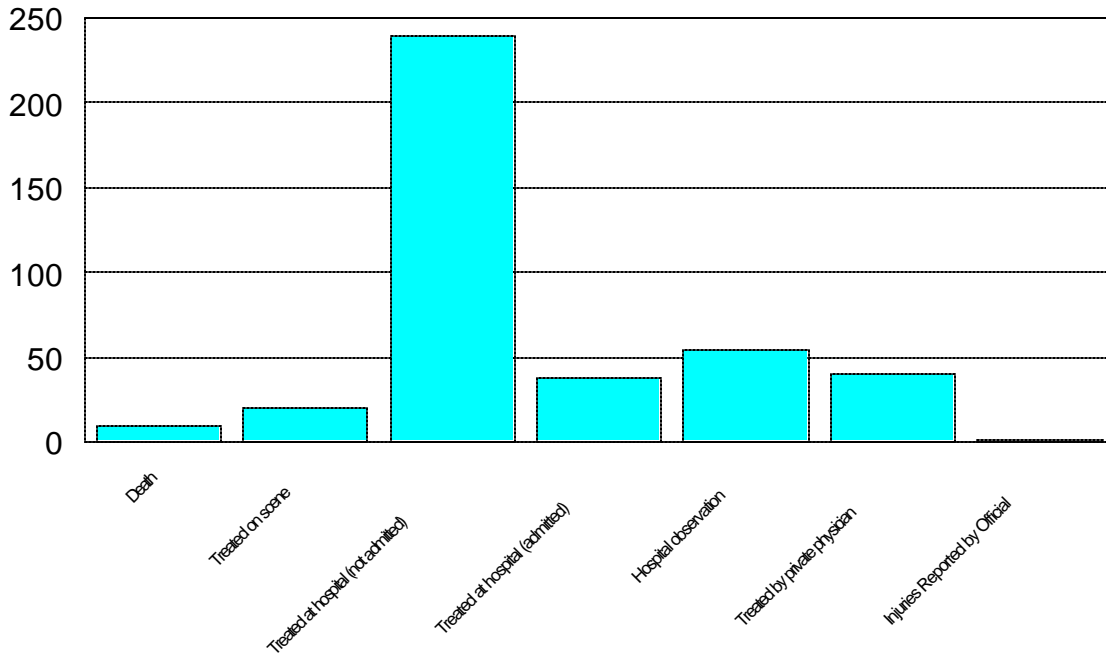
Table 10  
Iowa  
Distribution of Severity by Victim Category  
Years 1993-1997

Severity	Victim Category						All Victims	
	Employee		Responder		General Public			
	N	Percent	N	Percent	N	Percent	N	Percent
Death	7	2.583	0	0	2	1.980	9	2.245
Treated on scene (first aid)	18	6.642	0	0	2	1.980	20	4.990
Transported to and treated at hospital ( not admitted)	165	60.886	24	82.759	50	49.505	239	59.601
Transported to and treated at hospital (admitted)	32	11.808	3	10.345	3	2.971	38	9.477
Transported to hospital for observation; no treatment	43	15.867	2	6.896	9	8.911	54	13.467
Seen by private physician within 24 hours	6	2.214	0	0	34	33.663	40	9.975
Injury reported by an Official	0	0	0	0	1	.990	1	.003
Total	271	100.000	29	100.000	101	100.0	401*	100.0**

\* One victim was coded with severity “unknown” bringing the total victims to 402.

\*\*Percentage may not add up to 100 due to rounding.

Figure 10  
 Iowa  
 Injury Outcome  
 Years 1993-1997



Of the 1,518 events reported in Iowa from 1993 through 1997, an official evacuation order was reported for 102 events with a known type of evacuation. Fifty-eight of the evacuations (56.9%) were of a building or the affected part of a building, twenty-six (25.5%) were based on actual or anticipated downwind dispersion, fourteen (13.7%) were of a defined circular area around an event, and four (3.9%) were reported as having been ordered without evacuation criteria. The highest number of people reported in a single evacuation was 1,200. The median number of people evacuated during a hazardous substance release was 42.

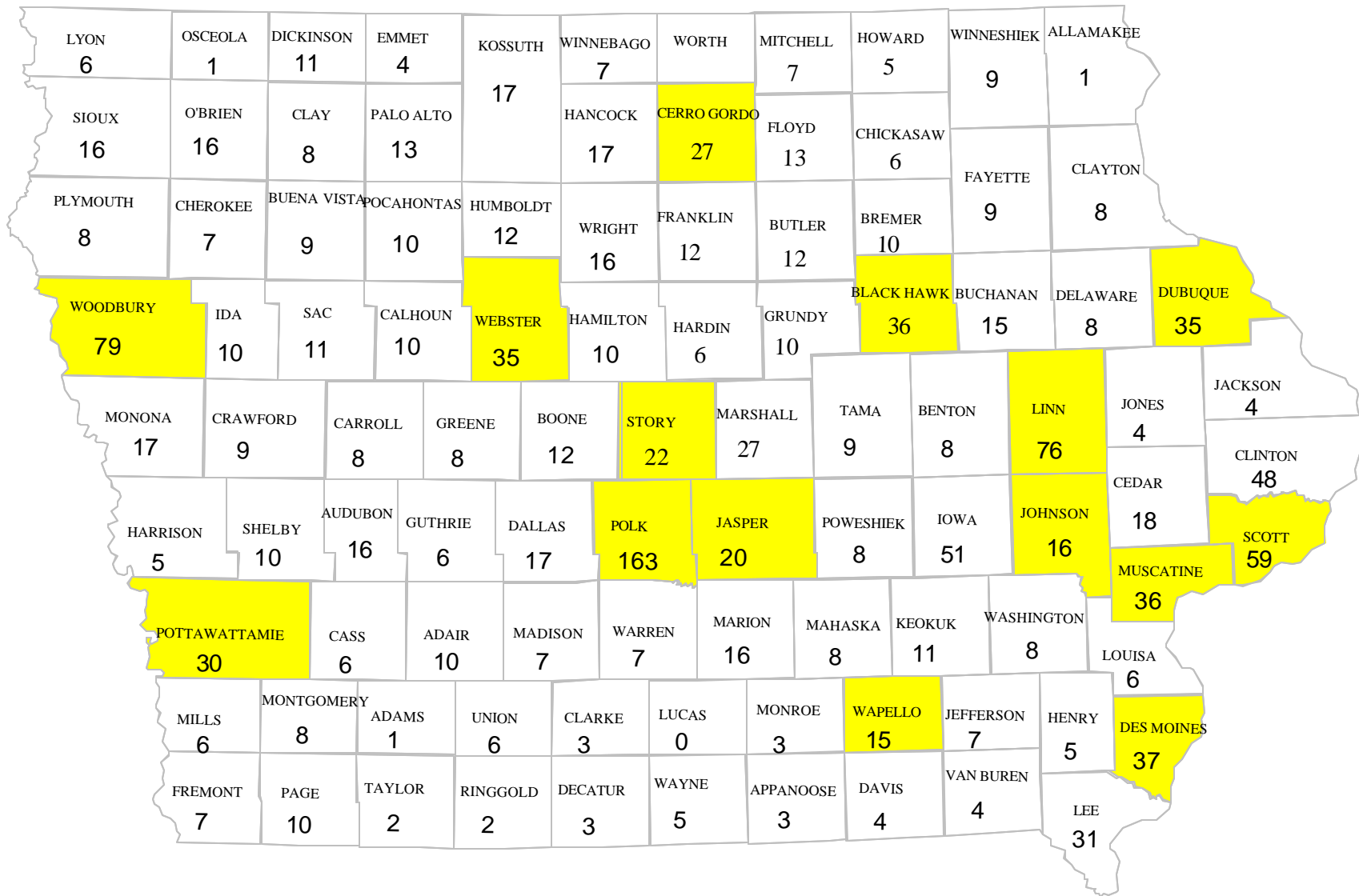
## **Public Presentations**

To increase public awareness of the HSEES System, the Iowa Department of Public Health (IDPH) is interested in sharing the HSEES System data via oral presentations at professional and/or governmental meetings and with other interested public or private groups. In order to reach the goal of reducing morbidity and mortality resulting from hazardous substances releases, IDPH seeks to be actively involved in public awareness activities and in sharing information with all interested parties.

IDPH is grateful to the many people who have contributed their assistance in conducting the HSEES System investigations. Most notable are staff at the Iowa Department of Natural Resources, Emergency Response Bureau, who have consistently provided IDPH with timely access to their spill reports. Special thanks also to Jude Igbokwe of the Iowa Department of Public Health who provided support and assistance in the completion of this report. Numerous other people and agencies have also provided assistance during follow-up investigations. They include plant owners, managers and employees, local, county and state emergency response personnel (such as firefighters and police officers), and hazmat teams. To all that have assisted IDPH with time and information – thank you.

# Attachment 1

## Hazardous Substances Emergency Events In Iowa 1993 – 1997



\* Counties with HazMat teams are shaded.