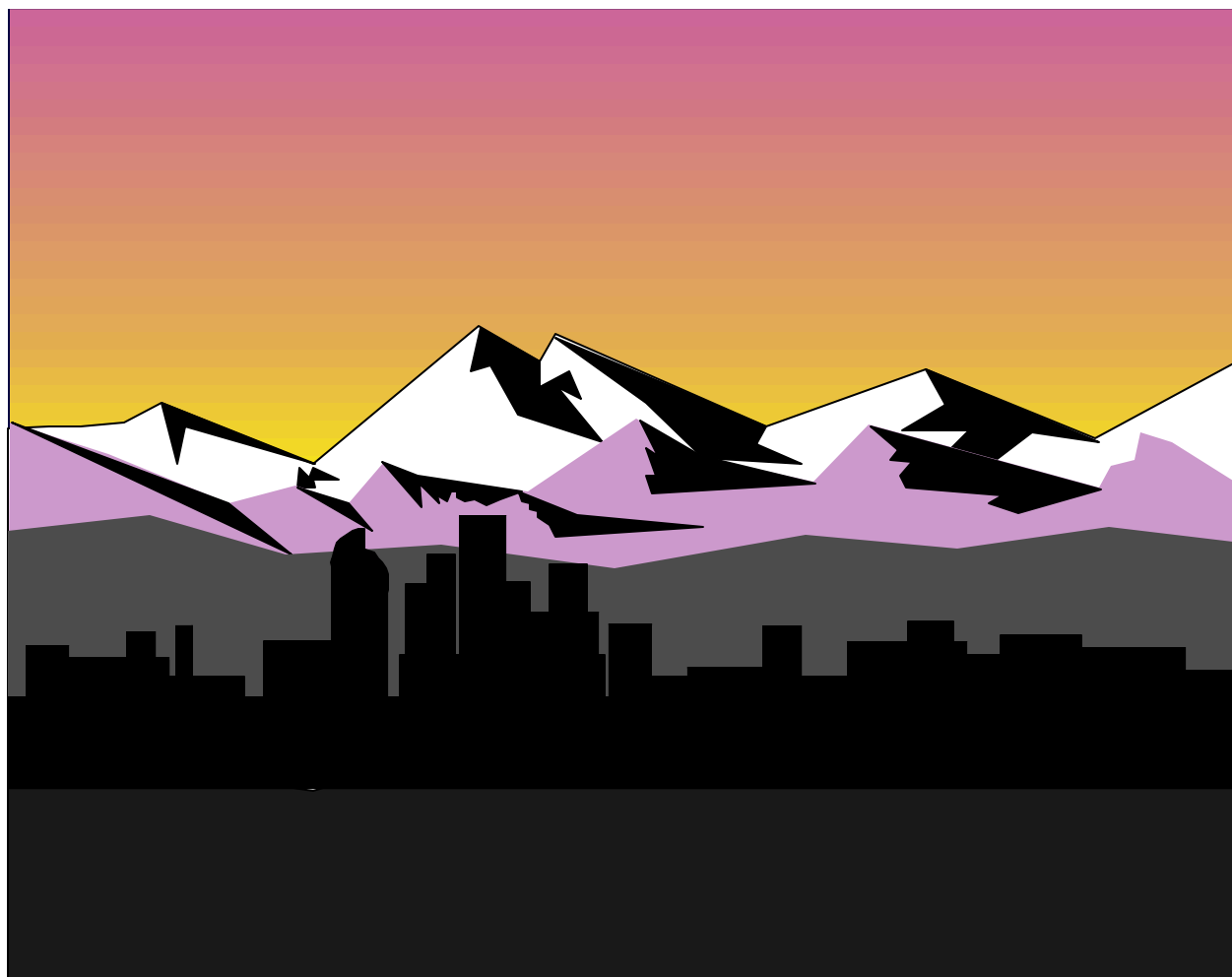


# COLORADO HAZARDOUS SUBSTANCES EMERGENCY EVENT SURVEILLANCE SYSTEM

CUMULATIVE REPORT, 1993-1997



Colorado Department  
of Public Health  
and Environment

**ATSDR**  
AGENCY FOR TOXIC SUBSTANCES  
AND HAZARDOUS WASTE



# BACKGROUND

In 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) implemented 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 (Colorado included) participated in the pilot phase of the surveillance system and began data collection on January 1, 1990. Since 1990, the number of participating state health departments has gradually increased to include Alabama, Colorado, Iowa, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Oregon, Rhode Island, Texas, Utah, Washington and Wisconsin.

Information on acute hazardous substances emergency events was collected on data collection forms designed by ATSDR. The types of items collected included general information on the event, substance(s) released, victims, injuries, and evacuations. Estimates have been made of the number of people at risk of exposure from a particular event. Several data sources were used to obtain the maximum amount of information about these events. These sources included, but were not limited to, records of federal, state and local agencies, first responder reports, hospital reports and communications with responsible parties. The data obtained were computerized using an ATSDR-provided data entry system, and were sent to ATSDR quarterly.

As a result of the Colorado Department of Public Health & Environment's (CDPHE) participation in HSEES for the past nine years, the CDPHE has become much more proactive in acquiring detailed information from other state, local and private entities regarding hazardous substance emergencies. Participation in HSEES has resulted in the acquisition of data on the distribution, frequency and cause of events within Colorado and on the types and causes of injuries to employees, responders and the general public associated with these events. In addition, this process of acquiring information has resulted in increased interaction between the CDPHE, other emergency planning and response agencies, private industry and the general public and has also led to the CDPHE playing a more productive and active role in hazardous materials training and incident response.

This report summarizes all project data collected in Colorado from January 1, 1993-December 31, 1997.

# OBJECTIVES

The Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division (CDPHE, HMWMD) has been gathering information on hazardous substance events occurring in Colorado for inclusion in the HSEES system since January 1990. The goals of this project are to:

- S Describe the distribution of hazardous substance emergencies within Colorado;
- S Describe the type and cause of morbidity and mortality experienced by employees, first responders and the general public as a result of selected hazardous substance emergencies;
- S Analyze and describe risk factors associated with the morbidity and mortality; and
- S Work with federal, state and local agencies and private industry to develop and propose strategies to reduce subsequent morbidity and mortality when comparable events occur in the future.

# METHODS

When the CDPHE is notified of a release, or a threatened release, of a hazardous substance, one of the first steps taken by the HSEES Manager is determining whether the event meets surveillance criteria for inclusion in the HSEES System. Events that would be captured for inclusion in the HSEES System are predefined by the following ATSDR guidelines:

- S The incident must be an uncontrolled or illegal release, or threatened release of one or more hazardous substances, and
- S The hazardous substances include ALL hazardous substances except petroleum products, and

- S The quantity of the hazardous substances which are released, or threatened to be released, need (or would need) to be removed, cleaned up, or neutralized according to federal, state or local law; or
- S There is only a threatened release of hazardous substances, but this threat leads to an action (e.g., evacuation) that can potentially impact the health of employees, responders or the general public.

A review of federal, state and local databases of events is also conducted, and media reports are investigated in an effort to identify which events the CDPHE has not been notified of.

Due to the fact that, by state statute, virtually any release of a hazardous substance in Colorado is required to be cleaned up, almost all hazardous substance releases qualify for inclusion. Guidance from ATSDR excludes some of these events based on quantity (i.e., stained packages) and specific substances and/or situations.

When the HSEES Manager determines that an event qualifies for inclusion, the HSEES Manager begins collecting the following detailed information on the event:

- S Name and address of the notification contact;
- S Date and time of the call and event occurrence;
- S Location of the event and type of area where the event occurred (industrial, residential, rural, etc.);
- S Source of the event (i.e., type of transportation or fixed-facility event);
- S Quantities of any substances released as a spill, vapor or consumed in a fire or explosion;
- S Detailed information on number of employees, responders and general public injured or killed as a result of the event, the type and severity of injuries, any personal protective equipment used by victims, the sex and age of the victims, and the distance of the victims from the source of the event;
- S Information on the number of people living and working within one mile of the event;
- S The extent of any evacuation that was ordered as a result of the event;
- S Information on agencies that responded to the site of the event and control actions taken to mitigate the event;

- S Information on any environmental sampling that was performed in the vicinity of the event;
- S Information on health actions taken as a result of the event;
- S The type of response plan followed by responding agencies, if any; and
- S When the emergency action was terminated.

Depending on the severity and/or importance of the event, other information may also be requested.

After the information on the event is gathered, it is then compiled and entered into the HSEES System. During each quarter of the year the Colorado data which has been entered is sent to ATSDR for review and analysis.

# RESULTS

During the five-year period 1993-1997, 1,930 hazardous substance events qualified for inclusion in the Colorado HSEES System. 1,335 (69.2%) of the events were at fixed facilities and 595 (30.8%) of the events were transportation related. A summary of all states is as follows:

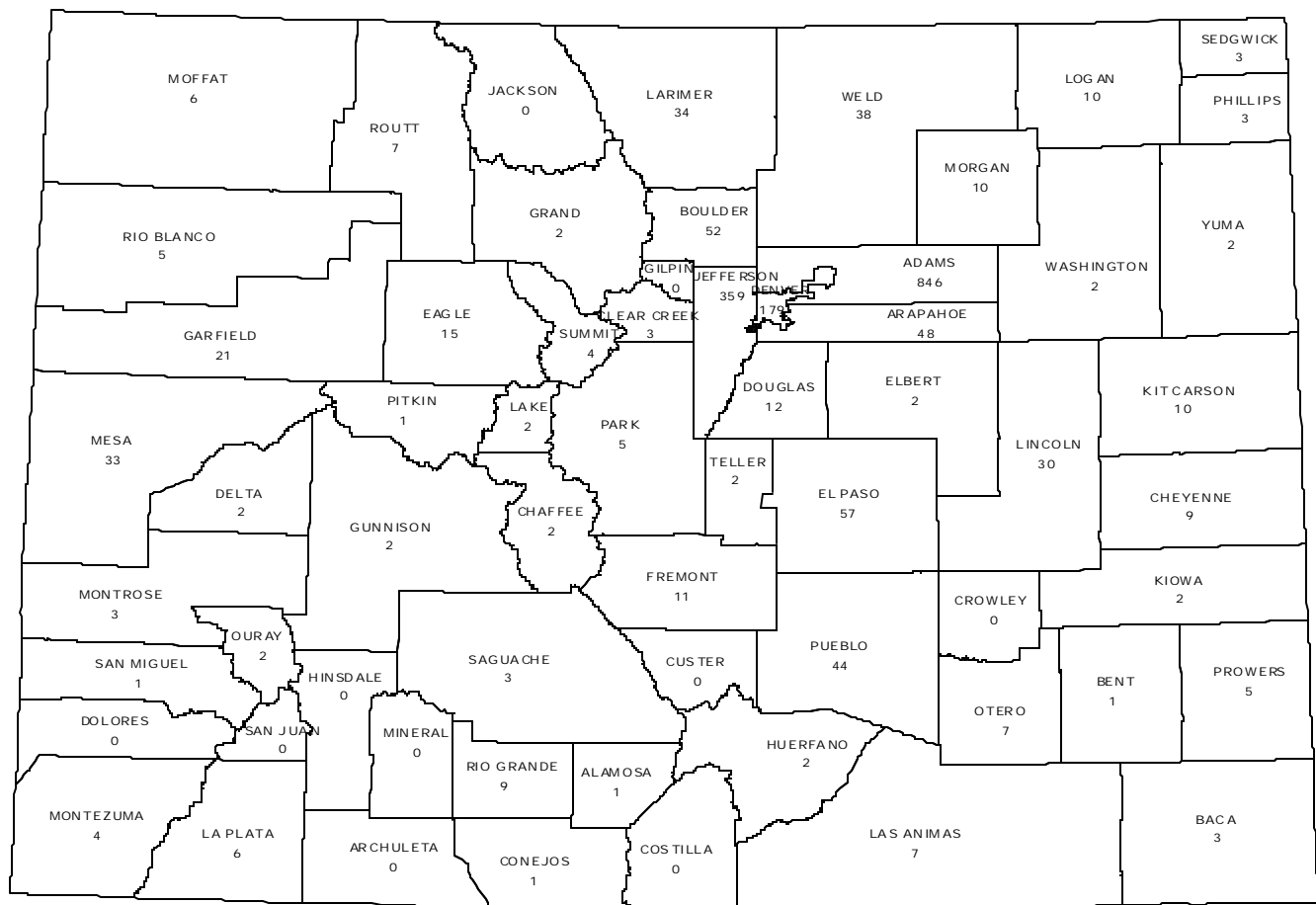
**TABLE 1: Cumulative Data for all States\***

State	Type of Event				Total
	Fixed-Facility		Transportation		
<b>Alabama</b>	685	(80.8%)	163	(19.2%)	848
<b>Colorado</b>	1335	(69.2%)	595	(30.8%)	1930
<b>Iowa</b>	1007	(66.3%)	511	(33.7%)	1518
<b>Minnesota</b>	611	(76.9%)	184	(23.1%)	795
<b>Mississippi</b>	241	(68.5%)	111	(31.5%)	352
<b>Missouri</b>	517	(60.3%)	341	(39.7%)	858
<b>New Hampshire</b>	152	(84.0%)	29	(16.0%)	181
<b>New York</b>	1624	(82.8%)	337	(17.2%)	1961
<b>North Carolina</b>	805	(74.5%)	276	(25.5%)	1081
<b>Oregon</b>	673	(72.3%)	258	(27.7%)	931
<b>Rhode Island</b>	199	(87.3%)	29	(12.7%)	228
<b>Texas</b>	8909	(90.8%)	908	(9.2%)	9817
<b>Washington</b>	1624	(75.9%)	516	(24.1%)	2140
<b>Wisconsin</b>	1223	(66.6%)	614	(33.4%)	1837
<b>Total</b>	19605	(80.1%)	4872	(19.9%)	24477

\*Not all states participated for the entire 1993-1997 time-frame

The geographic distribution of events by county (Figure 1) shows that the five counties with the highest incidence of releases from 1993-1997 were Adams (846), Jefferson (359), Denver (179), El Paso (57) and Boulder (52). These areas, which correspond to the more populated and industrialized areas of Colorado, accounted for 77.4% of the total qualifying events. The large number of events in Adams county is directly related to shipping industries located throughout the county. Many of these events were small quantity releases from loose caps, etc., in packaged materials. No qualifying events were reported in Archuleta, Costilla, Crowley, Custer, Dolores, Gilpin, Hinsdale, Jackson, Mineral or San Juan counties.

**Figure 1: Geographic Distribution of Events by County**



Fixed-facility events are defined as those events which occurred within or outside of buildings, but within the facility premises. Also included as fixed-facility events are situations such as offloading of transportation vehicles where an employee of the fixed-facility or transportation company drops a box or punctures a container with a forklift. Examples of fixed-facility events include, but are not limited to: industrial sites, farms, schools, private residences, hospitals, etc.

Transportation events are defined as those events which involve ground, rail, water, air or pipeline transport and occur outside the boundaries of a fixed-facility. Also included as transportation events are the releases which are discovered upon offloading at a fixed-facility, but occurred during transportation. A more specific analysis of the number of transportation and fixed-facility events by county, including the number of events which occurred within 1/4 mile of a residential area, is shown in Table 2.

**Table 2: Reported Events by County**

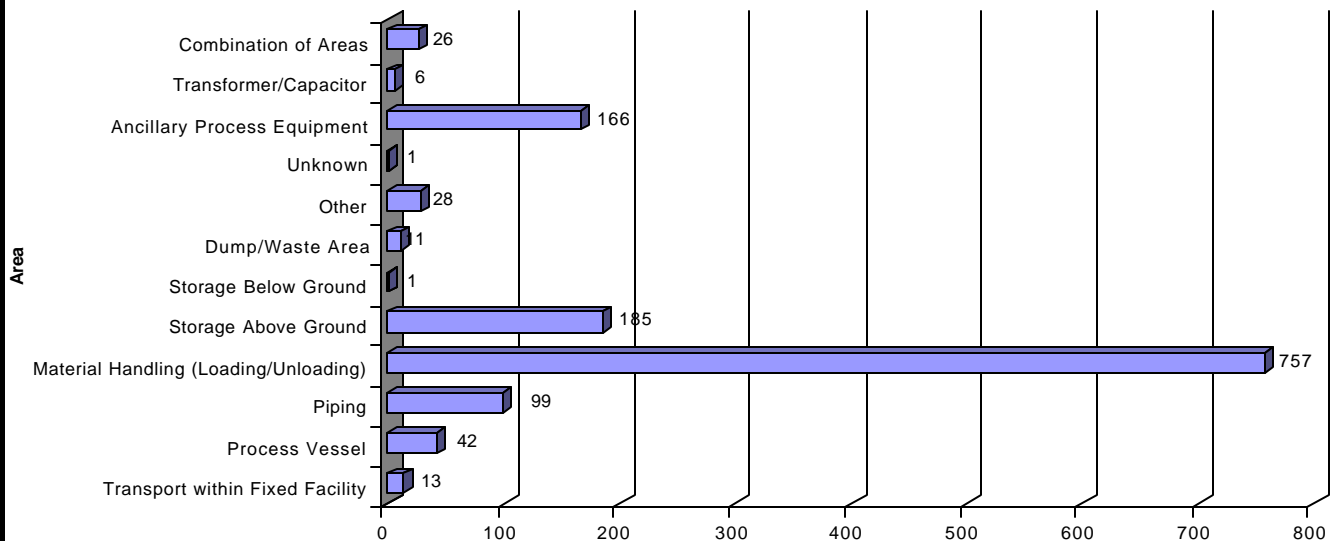
COUNTY	TOTAL NUMBER OF EVENTS & PERCENT OF TOTAL	NUMBER OF TRANSPORTATION EVENTS	NUMBER OF FIXED-FACILITY EVENTS	# OF EVENTS WITHIN 1/4 MILE OF RESIDENTIAL AREAS
ADAMS	846 (43.8%)	265	581	66
ALAMOSA	1 (.05%)	0	1	1
ARAPAHOE	48 (2.5%)	16	32	36
BACA	3 (.16%)	1	2	1
BENT	1 (.05%)	1	0	0
BOULDER	52 (2.7%)	10	42	28
CHAFFEE	2 (.10%)	2	0	1
CHEYENNE	9 (.47%)	5	4	0
CLEAR CREEK	3 (.16%)	0	3	0
CONEJOS	1 (.05%)	1	0	0
DELTA	2 (.10%)	1	1	0
DENVER	179 (9.3%)	68	111	89
DOUGLAS	12 (.62%)	1	11	4
EAGLE	15 (.78%)	6	9	5
EL PASO	57 (3.0%)	22	35	39
ELBERT	2 (.10%)	0	2	1
FREMONT	11 (.57%)	4	7	4
GARFIELD	21 (1.1%)	11	10	3
GRAND	2 (.10%)	2	0	1
GUNNISON	2 (.10%)	1	1	1
HUERFANO	2 (.10%)	0	2	0
JEFFERSON	359 (18.6%)	20	339	39
KIOWA	2 (.10%)	0	2	0
KIT CARSON	10 (.52%)	7	3	3
LA PLATA	6 (.31%)	2	4	1
LAKE	2 (.10%)	1	1	0
LARIMER	34 (1.8%)	16	18	11
LAS ANIMAS	7 (.36%)	5	2	2
LINCOLN	30 (1.6%)	25	5	5
LOGAN	10 (.52%)	5	5	8
MESA	33 (1.7%)	18	15	8



COUNTY	TOTAL NUMBER OF EVENTS & PERCENT OF TOTAL	NUMBER OF TRANSPORTATION EVENTS	NUMBER OF FIXED-FACILITY EVENTS	# OF EVENTS WITHIN 1/4 MILE OF RESIDENTIAL AREAS
MOFFAT	6 (.31%)	3	3	0
MONTEZUMA	4 (.21%)	1	3	1
MONTROSE	3 (.16%)	1	2	1
MORGAN	10 (.52%)	2	8	6
OTERO	7 (.36%)	4	3	0
OURAY	2 (.10%)	2	0	0
PARK	5 (.26%)	2	3	0
PHILLIPS	3 (.16%)	1	2	1
PITKIN	1 (.05%)	0	1	0
PROWERS	5 (.26%)	4	1	3
PUEBLO	44 (2.3%)	22	22	18
RIO BLANCO	5 (.26%)	0	5	0
RIO GRANDE	9 (.47%)	8	1	5
ROUTT	7 (.36%)	1	6	0
SAGUACHE	3 (.16%)	2	1	1
SAN MIGUEL	1 (.05%)	0	1	1
SEDGWICK	3 (.16%)	2	1	1
SUMMIT	4 (.21%)	3	1	1
TELLER	2 (.10%)	0	2	0
WASHINGTON	2 (.10%)	2	0	0
WELD	38 (2.0%)	18	20	16
YUMA	2 (.10%)	1	1	0

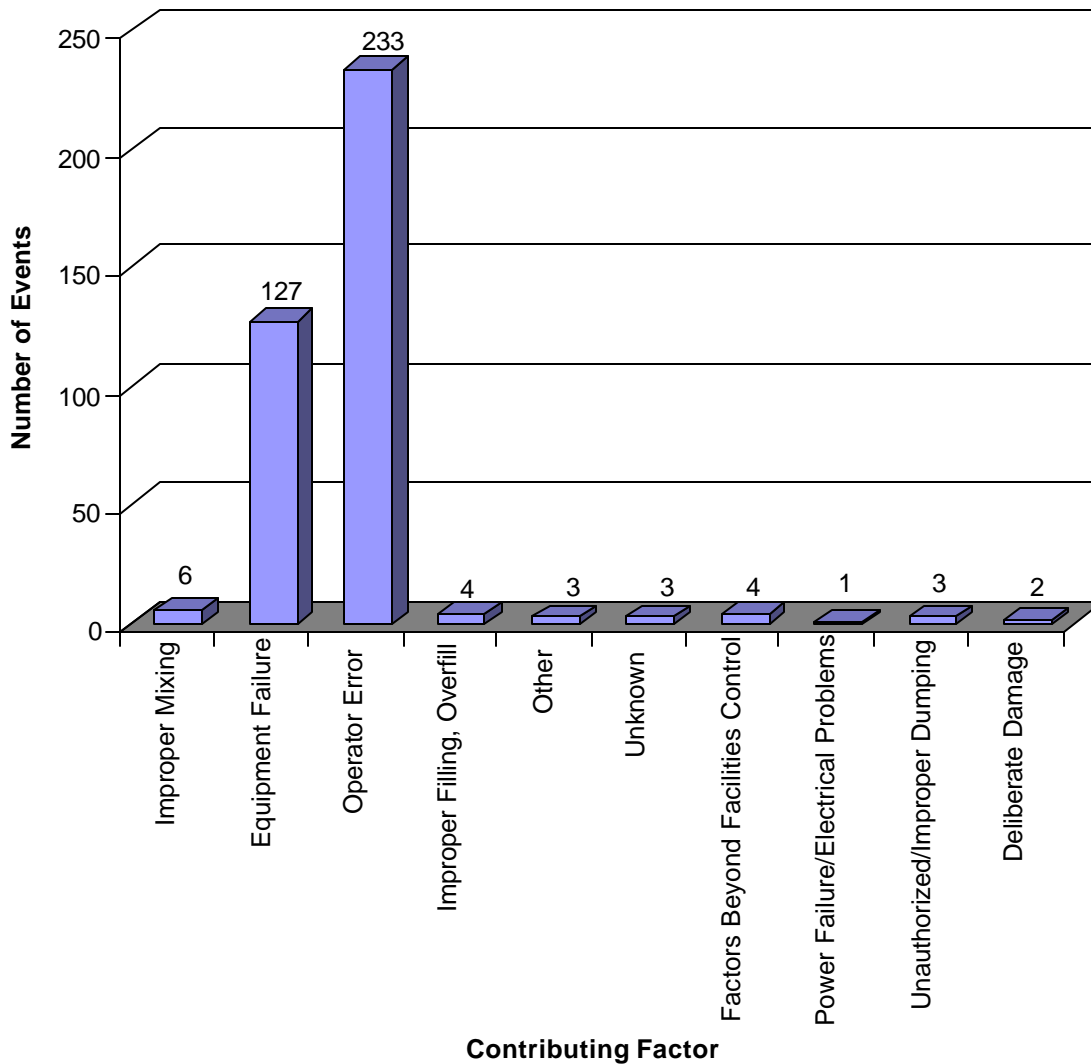
As stated earlier, 1,335 (69.2%) of the events in Colorado were at fixed facilities. The majority of fixed-facility events occurred during material handling (i.e., loading/offloading), followed second by storage above ground (Figure 2).

Figure 2: Areas of Fixed Facilities Involved in Events



Data on factors which contributed to the release (i.e., cause of the release) was not collected until mid 1995, therefore the information is limited. However, it is interesting to note that the most common factor which contributed to the release of substances at fixed-facility events was overwhelmingly operator error (60.4%), followed by equipment failure (32.9%), improper mixing (1.6%), etc., as shown in Figure 3.

**Figure 3: Factors Contributing to the Occurrence of Fixed Facility Events**



Analysis of the daily distribution (Figure 4) shows that the majority of events at fixed facilities occur Monday-Friday (89.0%), with Wednesday being the peak day for events (19.9%). The peak months for fixed-facility events are August and September, with a gradual increase in incidents beginning in March and declining in October (Figure 5). This appears to be due to the increased transportation and fixed-facility activities in the summer months.

Figure 4: Daily Distribution of Events

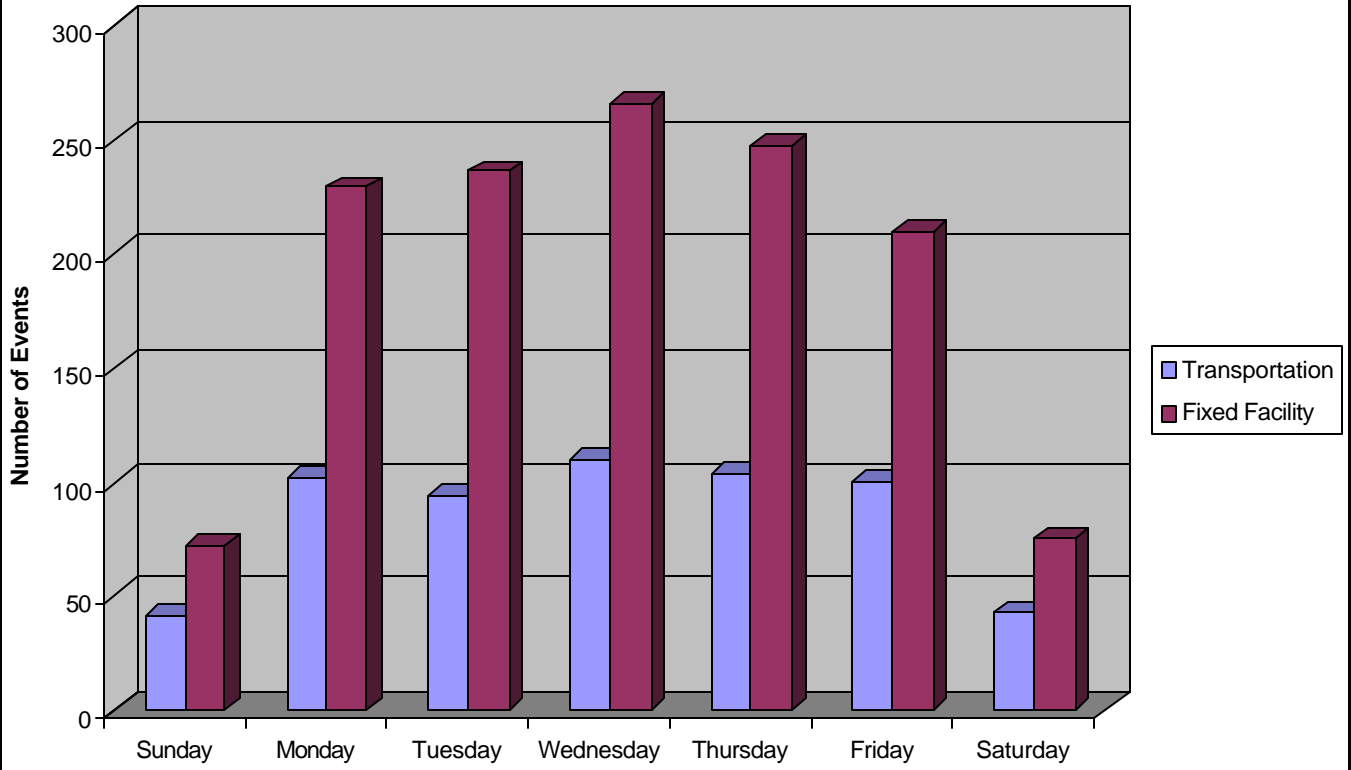
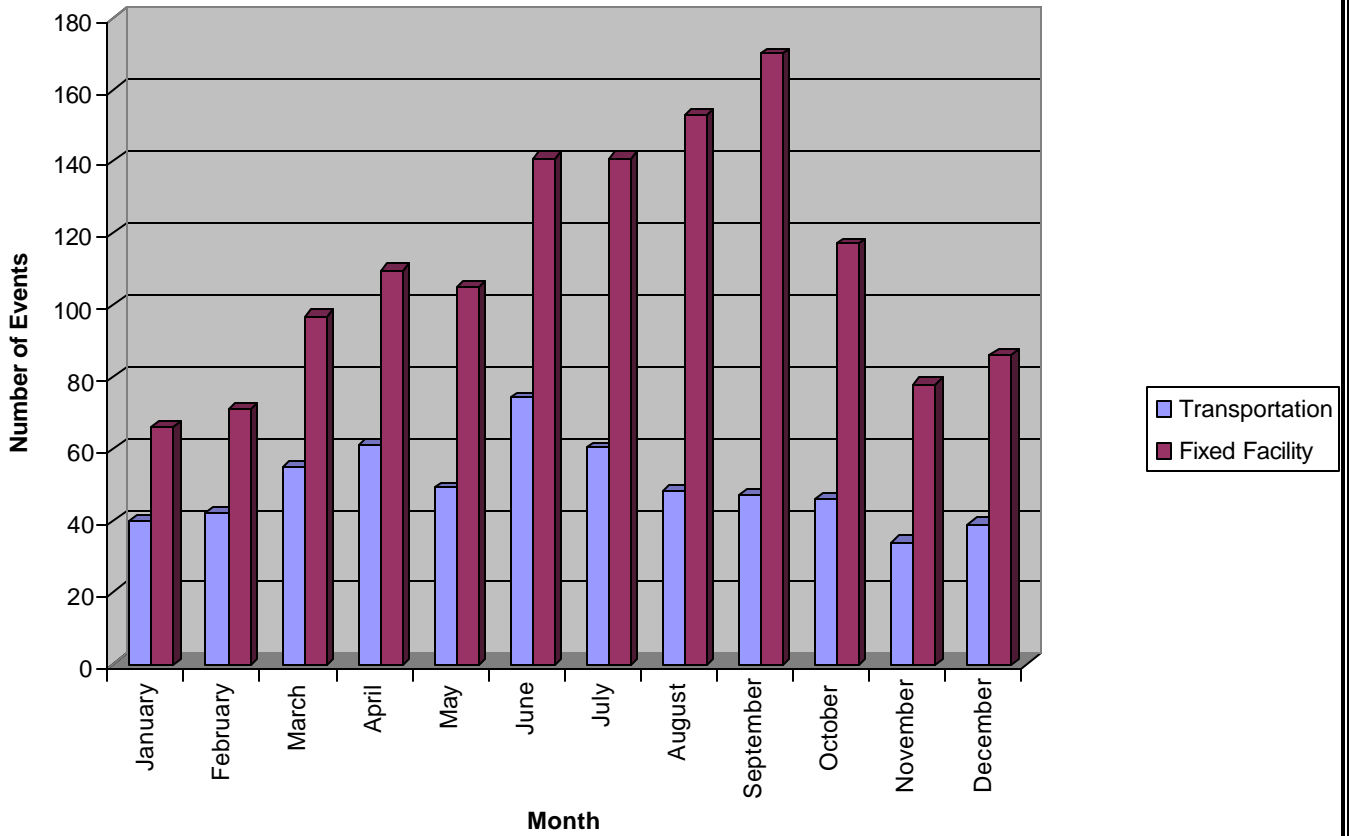
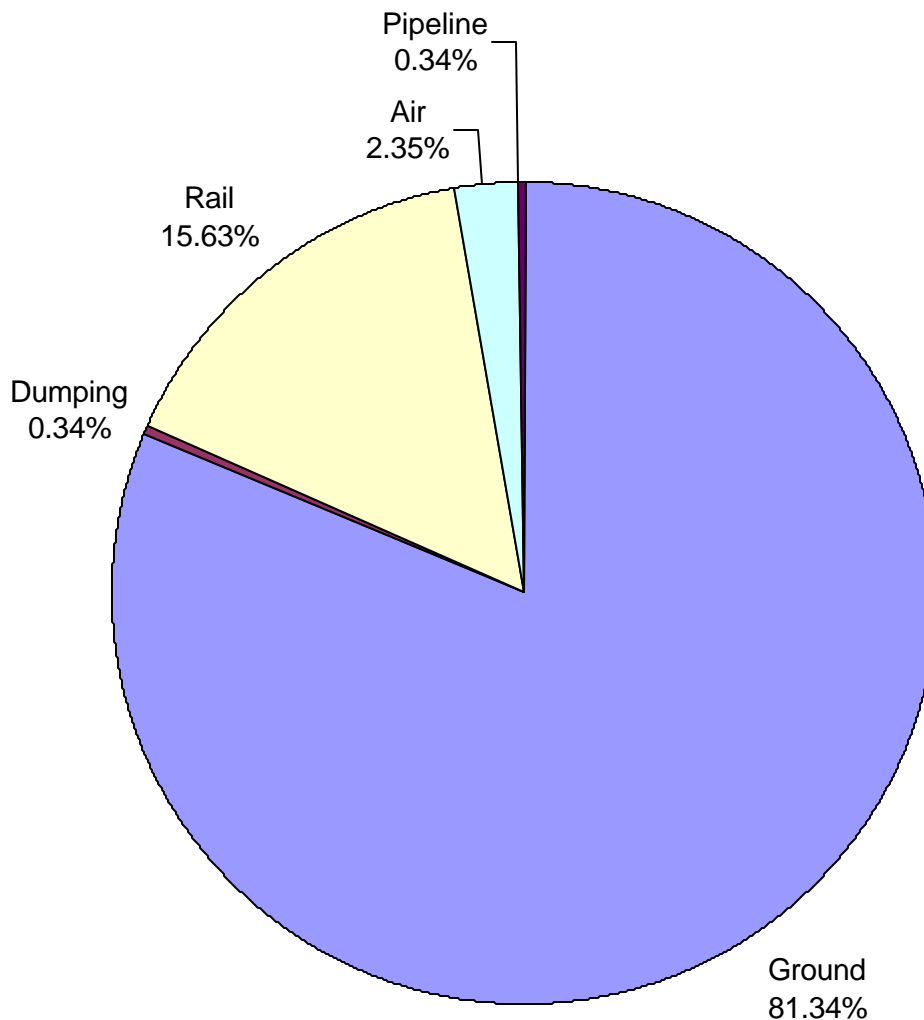


Figure 5: Monthly Distribution of Events



The majority of transportation-related events in Colorado occur during ground transport (81.34%), followed by rail transport (15.63%) and air transport (2.35%) (Figure 6). Analysis of the daily distribution (Figure 4) shows that the majority of transportation events occur Monday-Friday (85.7%), with Wednesday being the peak day for events (19.9%). The peak months for transportation events are April and June, with a gradual increase in incidents beginning in March and declining in October (Figure 5). This appears to be due to the increased transportation and fixed-facility activities in the summer months.

**Figure 6: Distribution of Transportation Events, by Type of Transport**



## ***SUBSTANCES***

Ninety-seven percent of the events in Colorado involved the release of only one substance. Two substances were released in approximately 1% of the events, and the remainder involved the release of more than two substances (Table 3).

The majority of the releases in Colorado were liquid spills (83%), followed by air releases (6.4%), fire releases (4.3%), threatened releases (3.3%), combinations of releases (2.7%), and explosions (0.28%).

**Table 3: Distribution of Number of Substances Released By Type of Event**

Number of Substances Released	Type of Event				All Events	
	Fixed-Facility		Transportation			
	Number of Events	Number of Substances	Number of Events	Number of Substances	Number of Events	Number of Substances
1	1309 (98.1%)	1309	571 (96.0%)	571	1880 (97.4%)	1880
2	15 (1.1%)	30	9 (1.5%)	18	24 (1.2%)	48
3	4 (0.3%)	12	10 (1.7%)	30	14 (0.7%)	42
4	1 (0.1%)	4	3 (0.5%)	12	4 (0.2%)	16
5	1 (0.1%)	5	1 (0.2%)	5	2 (0.1%)	10
\$6	5 (0.4%)	147	1 (0.2%)	6	6 (0.3%)	153
Total	1335	1507	595	642	1930	2149

The substances released are categorized into eleven groups. The category “mixtures” consists of mixtures of substances from different categories, and the category “other” consists of substances that could not be placed in one of the other ten substance categories. The category “other inorganic substances” comprised all inorganic substances except for acids, bases, ammonia and chlorine. Of the eleven categories into which HSEES substances were grouped, the category of substances most commonly released in fixed-facility and transportation events was “other substances” (34.6% and 30.8% , respectively). These substances usually consist of chemicals such as ethylene glycol, corrosives (not otherwise specified), adhesives (not otherwise specified), asbestos, cyanide, epoxy, fertilizers, flammable liquids (not otherwise specified), formaldehyde, methyl methacrylate, resins and radioactive compounds. The second most commonly released substances were “volatile organic compounds” for fixed-facility (17.4%)

and transportation (17.9%) events (Table 4).

**Table 4: Distribution of the Number of Substances Released, by Substance Category and Type of Event**

Substance Category	Type of Event		All Events
	Fixed-Facility	Transportation	
	Number of Substances	Number of Substances	Number of Substances
Acids	186 (12.3%)	92 (14.3%)	278 (12.9%)
Ammonia	67 (4.4%)	34 (5.3%)	101 (4.7%)
Bases	91 (6.0%)	53 (8.3%)	144 (6.7%)
Chlorine	19 (1.3%)	1 (0.2%)	20 (0.9%)
Other inorganic substances	199 (13.2%)	82 (12.8%)	281 (13.1%)
Paints & Dyes	37 (2.5%)	19 (3.0%)	56 (2.6%)
Pesticides	76 (5.0%)	28 (4.4%)	104 (4.8%)
Polychlorinated biphenyls	23 (1.5%)	6 (0.9%)	29 (1.3%)
Volatile organic compounds	262 (17.4%)	115 (17.9%)	377 (17.5%)
Mixtures of substance categories	25 (1.7%)	14 (2.2%)	39 (1.8%)
Other substances	522 (34.6%)	198 (30.8%)	720 (33.5%)
Total	1507	642	2149

The top ten substances spilled in Colorado are as follows:

**Table 5: The Top Ten Substances Spilled in Colorado**

HSEES Standard Substance Name	Number of Events	Percent
Ethylene glycol	205	9.5%
Ammonia	91	4.2%
Sulfuric acid	84	3.9%
Sodium hydroxide	77	3.6%
Mercury	70	3.3%
Hydrochloric acid	70	3.3%
Corrosive, NOS	68	3.2%
Ethanol	59	2.7%
Phosphoric acid	51	2.4%
Methanol	45	2.1%

The large number of ethylene glycol events is directly attributable to the previous inclusion of motor vehicle radiator events in the HSEES. These events are no longer included in the system. The other most commonly released substance is Ammonia, which is due to its common agricultural use as a fertilizer and its industrial use as a refrigerant. Sulfuric acid and sodium hydroxide are two of the most commonly used substances in industry. The majority of the mercury releases are attributed to broken thermometers and barometers and the release of mercury by school age children.

## ***VICTIMS***

Victims were defined as those individuals who suffered at least one injury, or died, as a consequence of the event. In counting injuries, victims may have been counted more than once if they had more than one injury. A total of 351 victims were involved in 116 events (6% of all events). Of the events with victims, 55.2% involved only one victim, and 71.6% involved either one or two victims. 70% of the victims were injured in fixed-facility events, compared with 30% in transportation events (Table 6).

**Table 6: Distribution of the Number of Victims by Type of Event**

Number of Victims	Event Type				All Events	
	Fixed-Facility		Transportation			
	Number of Events	Number of Victims	Number of Events	Number of Victims	Number of Events	Number of Victims
<b>1</b>	28 (43.1%)	28	36 (70.6%)	36	64 (55.2%)	64
<b>2</b>	14 (21.5%)	28	5 (9.8%)	10	19 (16.4%)	38
<b>3</b>	10 (15.4%)	30	4 (7.8%)	12	14 (12.1%)	42
<b>4</b>	3 (4.6%)	12	3 (5.9%)	12	6 (5.2%)	24
<b>5</b>	1 (1.5%)	5	1 (2.0%)	5	2 (1.7%)	10
<b>\$6</b>	9 (13.8%)	143	2 (3.9%)	30	11 (9.5%)	173
<b>Total</b>	65	246	51	105	116	351

The substances released most often were not necessarily the most likely to result in victims. For example, volatile organic compounds were released during 377 events; however, only 17 (4.5%) of these events resulted in injury. Although chlorine was released in only 20 events, 6 (30%) of these events resulted in injury, indicating its greater potential for immediate harm. The substance with the second highest percentage of releases with victims is ammonia (Table 7). Both substances have severe inhalation hazards associated with them.



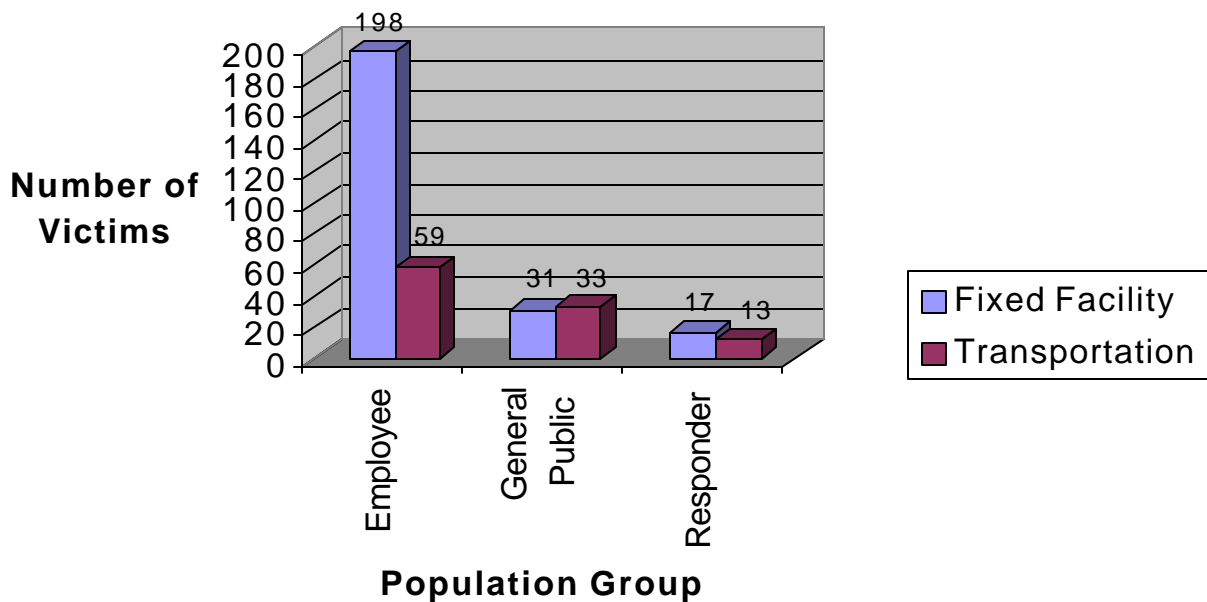
**Table 7: Number of Substances Released in all Events and Events with Victims, by Substance Category**

<b>Substance Category</b>	<b>Total Number of Releases</b>	<b>Total Number of Releases with Victims</b>	<b>Percentage of Releases with Victims</b>
<b>Acids</b>	278 (12.9%)	24 (15.8%)	8.6%
<b>Ammonia</b>	101 (4.7%)	13 (8.6%)	12.9%
<b>Bases</b>	144 (6.7%)	6 (3.9%)	4.2%
<b>Chlorine</b>	20 (0.9%)	6 (3.9%)	30.0%
<b>Other inorganic substances</b>	281 (13.1%)	28 (18.4%)	10.0%
<b>Paints &amp; Dyes</b>	56 (2.6%)	4 (2.6%)	7.1%
<b>Pesticides</b>	104 (4.8%)	8 (5.3%)	7.7%
<b>Polychlorinated biphenyls</b>	29 (1.3%)	3 (2.0%)	10.3%
<b>Volatile organic compounds</b>	377 (17.5%)	17 (11.2%)	4.5%
<b>Mixtures of substance categories</b>	39 (1.8%)	3 (2.0%)	7.7%
<b>Other substances</b>	720 (33.5%)	40 (26.3%)	5.6%
<b>Total</b>	2149*	152	7.1%

\*Total exceeds total number of events (1,930) because events at which more than one substance was released were counted more than once.

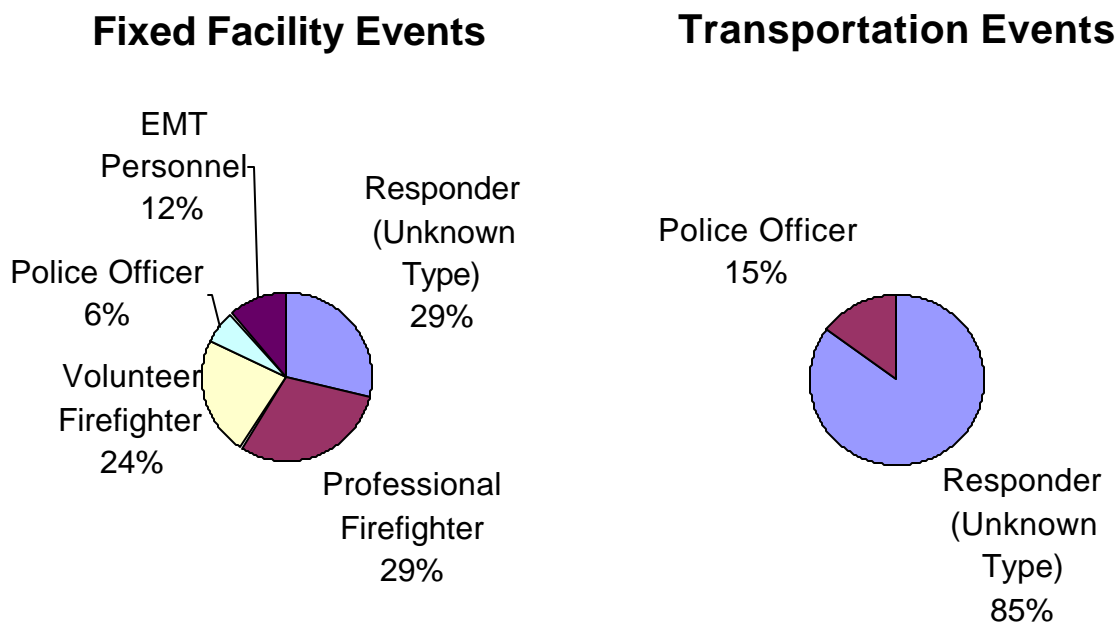
The population groups most often injured were employees, followed by the general public (Figure 7). The large number of employee victims is directly attributable to two specific incidents. The first occurred in 1993 where 64 employees of a hospital were exposed to methylene chloride fumes from a cooling system and the second occurred in 1997 when a broken battery caused the exposure of 23 employees to sulfuric acid fumes.

**Figure 7: Distribution of Victims by Population Group & Type of Event**



Of the responders who were injured in fixed-facility events, the affiliation was unknown for 29%; of the remainder, 29% were professional firefighters, 24% were volunteer firefighters, 12% were emergency medical technicians and 6% were police officers. In transportation events 85% of the responders' affiliation was unknown and 15% of the injured responders were police officers. Much of the data shows unknown affiliation due to the fact that data collection on specific type of responder was not begun until mid-1995 (Figure 8).

**Figure 8: Distribution of Responder Victims by Population Group and Type of Event\***



\*Data collection on specific type of responder was not begun until mid-1995.

## ***INJURIES***

Victims in events sustained a total of 526 injuries, 378 in fixed-facility events and 148 in transportation events. Some victims had more than one injury. The most commonly reported injuries in fixed-facility events were respiratory irritation (37.3%), nausea (15.6%), headache (11.6%) and dizziness or other central nervous system symptoms (10.8%). In transportation events the most commonly reported injuries were respiratory irritation (41.9%), trauma (20.9%), eye irritation (18.9%) and dizziness or other central nervous system symptoms (5.4%) (Table 8 and Figure 9). Trauma injuries may or may not be related to direct substance exposure.

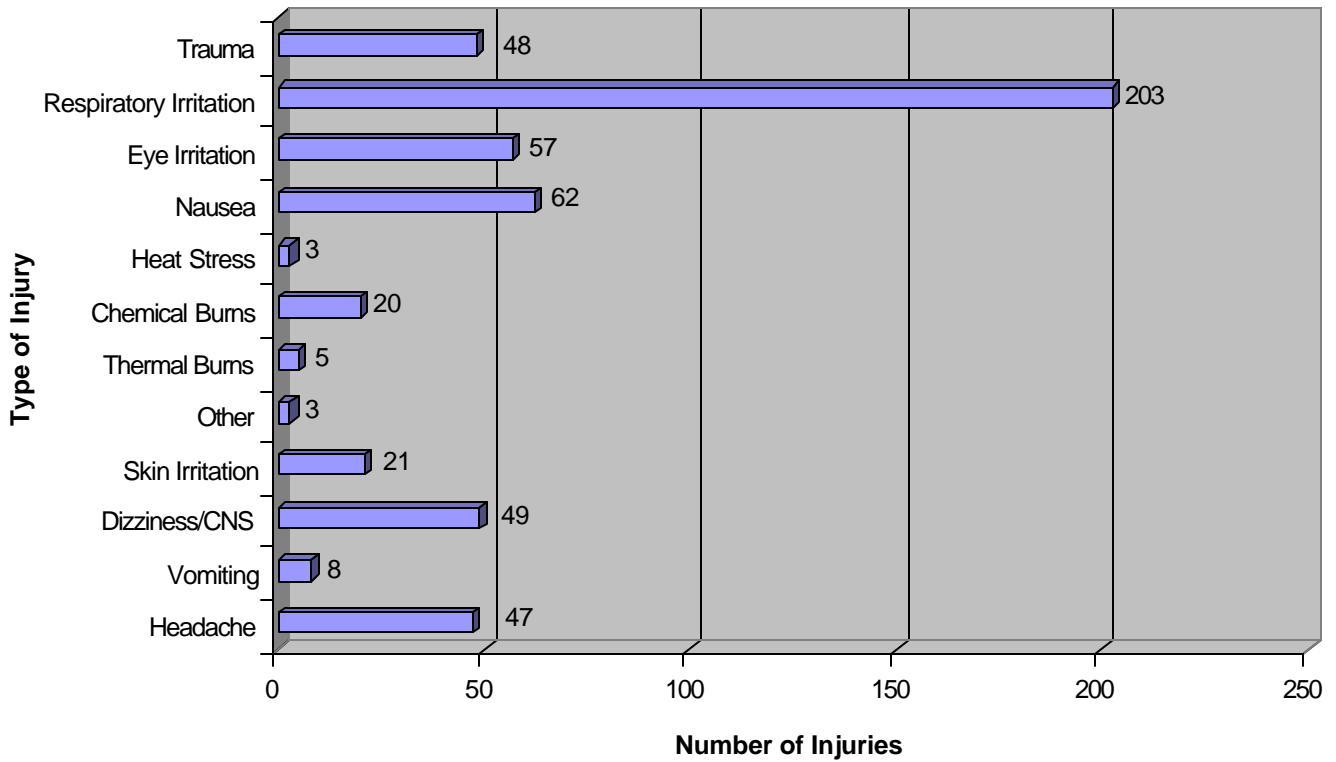
**Table 8: Distribution of Type of Injury by Type of Event\***

Type of Injury	Type of Event		All Events
	Fixed-facility	Transportation	
	Number of Injuries	Number of Injuries	Number of Injuries
Headache	44 (11.6%)	3 (2.0%)	47 (8.9%)
Vomiting	7 (1.9%)	1 (0.7%)	8 (1.5%)
Dizziness/CNS <sup>^</sup>	41 (10.8%)	8 (5.4%)	49 (9.3%)
Skin irritation	14 (3.7%)	7 (4.7%)	21 (4.0%)
Other	2 (0.5%)	1 (0.7%)	3 (0.6%)
Thermal burns	5 (1.3%)	0 (0%)	5 (1.0%)
Chemical burns	16 (4.2%)	4 (2.7%)	20 (3.8%)
Heat stress	3 (0.8%)	0 (0%)	3 (0.6%)
Nausea	59 (15.6%)	3 (2.0%)	62 (11.8%)
Eye irritation	29 (7.7%)	28 (18.9%)	57 (10.8%)
Respiratory irritation	141 (37.3%)	62 (41.9%)	203 (38.6%)
Trauma	17 (4.5%)	31 (20.9%)	48 (9.1%)
<b>Total</b>	<b>378</b>	<b>148</b>	<b>526</b>

\*The number of injuries is greater than the number of victims because a victim could have had more than one injury.

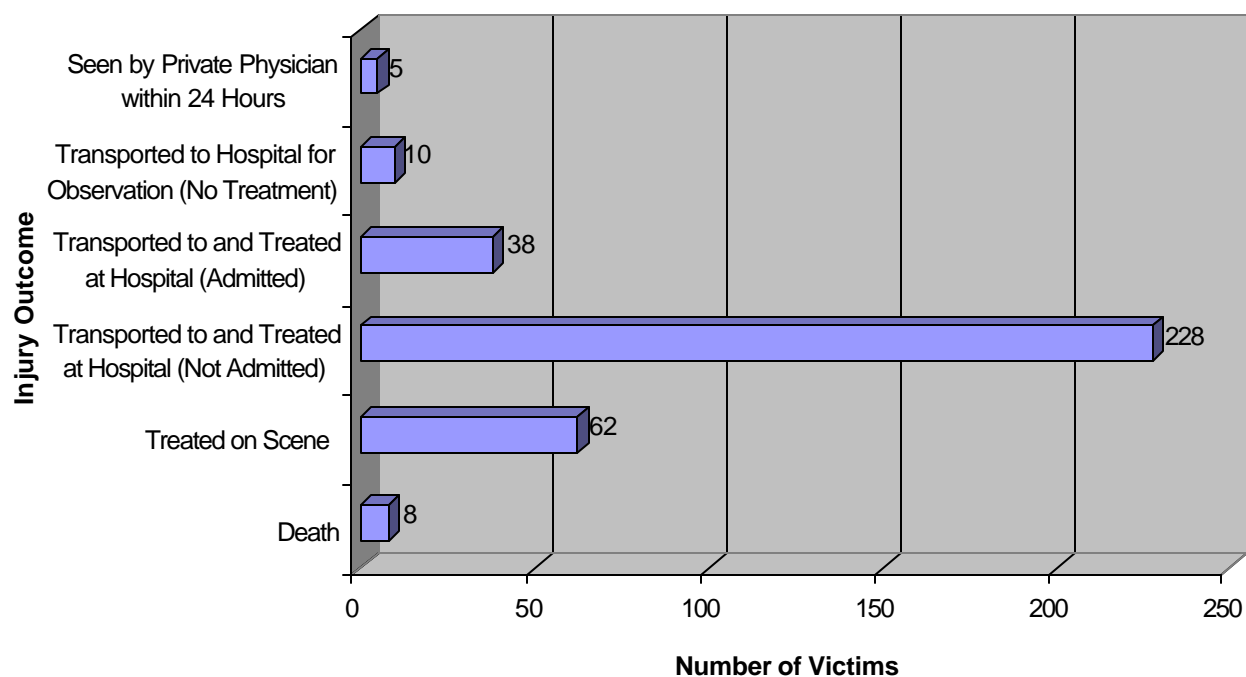
<sup>^</sup>Central Nervous System.

**Figure 9: Distribution of Type of Injury for all Events**



The majority of victims (65%) were transported to and treated at a hospital, but not admitted, 17.7% were treated on scene, 10.8% were transported, admitted and treated at a hospital, 2.8% were transported to a hospital for observation but did not receive any treatment, 2.3% died and 1.4% were seen by a private physician within 24 hours (Figure 10). Seven of the eight deaths were directly attributable to trauma caused by a transportation accident, and the other death was caused by operator error on an above ground storage tank at a fixed-facility. The top substances released for events where people were injured are multi chemical releases (13.8%), ammonia (11.2%), chlorine (5.2%) and sulfuric acid (5.2%) (Table 9).

**Figure 10: Injury Outcome**



**Table 9: Top Ten Substances Released for Events where People were Injured**

HSEES Standard Substance Name	Number of Events	Percent
Multi chemical release	16	13.8%
Ammonia	13	11.2%
Chlorine	6	5.2%
Sulfuric acid	6	5.2%
Nitric acid	5	4.3%
Hydrochloric acid	4	3.4%
Sodium hydroxide	4	3.4%
Perchloroethylene	3	2.6%
Polychlorinated biphenyls	3	2.6%
2,4-Dichlorophenoxyacetic acid	2	1.7%

## ***EVACUATIONS***

Evacuations were ordered in 185 events. Eighty-one percent of the evacuations were of a building or the affected part of a building. Fourteen percent were of a defined circle or radius around an event, three percent were based on potential downwind or downstream dispersion and two percent were based on a circle and downwind or downstream dispersion. The average number of people evacuated was 47, with a minimum of one and a maximum of 2,080. The 2,080 person evacuation was the evacuation of high school due to a mercury release. In-place sheltering was only ordered once, when a rail car released more than 1,000 gallons of hydrochloric acid. Mercury and ammonia are the top two substances released where an evacuation was ordered (Table 10).

**Table 10: Top Ten Substances Spilled for Events where an Evacuation was Ordered**

<b>HSEES Standard Substance Name</b>	<b>Number of Events</b>	<b>Percent</b>
<b>Mercury</b>	<b>24</b>	<b>13.0%</b>
<b>Ammonia</b>	<b>21</b>	<b>11.4%</b>
<b>Chlorine</b>	<b>9</b>	<b>4.9%</b>
<b>Multi chemical release</b>	<b>7</b>	<b>3.8%</b>
<b>Sodium hydroxide</b>	<b>7</b>	<b>3.8%</b>
<b>Hydrochloric acid</b>	<b>6</b>	<b>3.2%</b>
<b>Phosphoric acid</b>	<b>6</b>	<b>3.2%</b>
<b>Freon, NOS</b>	<b>5</b>	<b>2.7%</b>
<b>Asbestos</b>	<b>4</b>	<b>2.2%</b>
<b>Ethanol</b>	<b>4</b>	<b>2.2%</b>

## ***SUMMARY OF DATA ANALYSES 1993-1997***

During the five-year period of Colorado's participation in the HSEES project, data collection results have remained fairly consistent. Of the 1,930 hazardous substance events which qualified for inclusion in the Colorado HSEES:

- Most of the events occurred at fixed facilities (69.2%) and most involved a single substance (97.4%). The majority of fixed-facility events occurred during material handling (i.e., loading/offloading), and the most common factor which contributed to the release was operator error;
- The majority of transportation events occurred during ground transport;
- The most common injury to victims was respiratory irritation;
- The substances with the highest percentage of releases with victims were ammonia and chlorine;
- Although eight deaths occurred during this five year period, seven of the deaths were directly attributable to trauma caused by a transportation accident and the other death was caused by operator error on an above ground storage tank at a fixed-facility.

Continued data collection and analysis will provide useful information regarding risk factors related to the occurrence of emergency events and the associated morbidity and mortality. This information can be used to develop training and health education programs for persons involved in hazardous substances emergency response and planning and for manufacturers and transporters of hazardous materials.

Future plans for the Colorado HSEES project include, but are not limited to, design of a web site where information can be easily accessed by interested parties, fact sheets designed to assist private industry in the prevention of hazardous substance emergency events, substance specific fact sheets to assist private industry and first responders in the safe and efficient response to hazardous substance incidents, and coordination with local government emergency planning agencies to ensure plans are adequate to protect public health and the environment.



*The Colorado HSEES is interested in receiving any information on hazardous materials events in Colorado to ensure data accuracy and completeness. If you or your agency has information that would be helpful to this project, please contact the project manager at the number below.*

*This report will be distributed to all agencies that submitted reports to the project manager, the Colorado Emergency Planning Commission, Local Emergency Planning Committees, hazardous materials teams and other interested parties. If you would like further information specific to your county or area, or would like a presentation on the data contained in this report, please feel free to contact the project manager. Due to the fact that this is the initial summary on this project, we encourage comments and suggestions from everyone interested.*

*This project is supported by funds from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) trust fund provided to the Colorado Department of Public Health and Environment under Cooperative Agreement Number U61/ATU896969 from the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services*

*Contact:*

*Chrystine Kelley  
Colorado Department of Public Health & Environment  
Hazardous Materials and Waste Management Division  
4300 Cherry Creek Dr. S.  
Denver, Colorado 80246*

*(303) 692-3442*