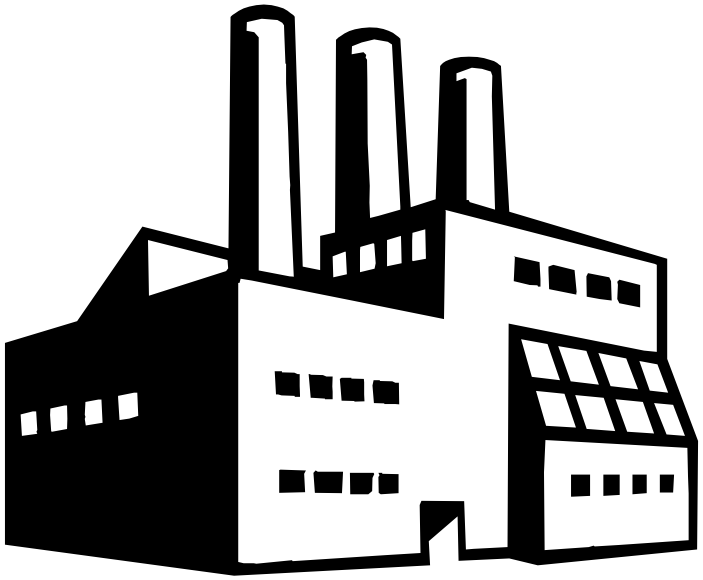
COLORADO HAZARDOUS SUBSTANCES EMERGENCY EVENTS SURVEILLANCE (HSEES) SYSTEM

2002-2005 REPORT FIXED FACILITY INCIDENTS



Colorado Department of Public Health and Environment

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

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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. This report summarizes the characteristics of fixed facility events reported to Colorado from 2002-2005. Information about acute events involving hazardous substances was collected, 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.

A total of 261 fixed facility events were reported. In 252 (96.6%) events, only one substance was released. The most commonly reported categories of substances released were other, other inorganic substances, volatile organic compounds, and acids. During this reporting period, 42 events (16.1% of all reported events) resulted in a total of 177 victims, of whom 2 (1.1%) died. The most frequently reported injury was respiratory system problems. An evacuation was ordered for 31 (11.9%) events. The most common primary factor involved in the releases was human error (109 [41.8%]). Improper filling, loading or packing was the most frequently reported secondary factor (32 [21.5%]).

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 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.

This report provides an overview of fixed facility events during 2002-2005 in Colorado, and summarizes the characteristics of these acute releases of hazardous substances and their associated public health consequences.

METHODS

In 2005, fourteen state health departments participated in HSEES: Colorado, Florida, Iowa, Louisiana, Michigan, Minnesota, New Jersey, New York, North Carolina, Oregon, Texas, Utah, Washington, and Wisconsin.

Beginning in 2002, a newly updated data-collection form, approved by the Office of Management and Budget, went into effect. Information was collected about each event, including substance(s) released, victims, injuries (adverse health effects and symptoms), and evacuations.

Various data sources were used to obtain information about these events. These sources included reports from responsible parties, federal, state and local agencies, media sources and the general public. Census data were used to estimate the number of residents in the vicinity of most of the events. All data were computerized using a Web-based data entry system provided by ATSDR.

HSEES defines hazardous substances emergency events as acute uncontrolled or illegal releases or threatened releases of hazardous substances. Events involving releases of **only petroleum** are excluded because of CERCLA legislation. Events are included for all hazardous substance incidents that are greater than or equal to one gallon or ten pounds and any quantity of an extremely hazardous substance or an HSEES Mandatory Substance. Threatened releases of qualifying amounts are included if the threat led to an action (e.g., evacuation) to protect the

public health. 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 were categorized into 16 groups. 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 grouped into one of the other existing categories.

Small differences between numbers in this report and those reported elsewhere may occur due to refinements in the data.

RESULTS

For 2002-2005, Colorado HSEES captured a total of 724 acute hazardous substances events. Of these, 261 (36.0%) events occurred in fixed facilities. The counties with the most frequent number of fixed-facility events were Adams (89 [34.1%]), Denver (25 [9.6%]), El Paso (23 [8.8%]) and Jefferson (22 [8.4%]) (Table 1).

For each fixed facility event, one or two types of area or equipment involved in the fixed facility where the event occurred could be selected. When combining the two types of areas involved in the event, of the 261 fixed facility events, 56 (20.0%) occurred in a storage area above ground, 49 (17.5%) occurred in a material handling area and 48 (17.1%) were caused by ancillary process equipment (Figure 1).

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Factors contributing to the events consisted of primary and secondary entries (Figure 2a & 2b). The most common primary factor involved in the releases was human error (109 [41.8%]). Improper filling, loading or packing was the most frequently reported secondary factor (32 [21.5%]).

More than 96.6% of all events involved the release of only one substance. Two substances were released in approximately 1.5% of the events, and one event involved the release of sixteen substances (Table 2).

Industries

The largest proportion of HSEES events were associated with the manufacturing (65 [25.1%]) and transportation and warehousing (63 [24.3%]) industries. The total number of victims was greatest in the manufacturing industry (57 [32.2%]) (Table 3).

Substances

A total of 290 substances were released in the events. The individual substances most frequently released were ammonia, mercury, sulfuric acid and nitrogen dioxide. Substances were grouped into 16 categories. The substance categories most commonly released were other (60 [20.7%]), other inorganic substances (53 [18.3%]), and volatile organic compounds (37 [12.8%]) (Table 4).

Two types of releases for each substance (e.g., spill and air) could be reported. Only one type of release was associated with the following: spills (176 [60.1%]), air releases (35 [12.1%]), fire (34 [11.7%]), explosion (2 [0.7%]) and radiation (3 [1.0%]). Forty events were combinations of release types.

Victims

A total of 177 victims were involved in 42 events (16.1% of all events). Of the 42 events with victims, 16 (38.1%) events involved only one victim and 6 (14.3%) involved greater than or equal to 8 victims (Table 5).

Employees (91 [51.4%]) constituted the largest proportion of the population groups injured followed by the general public (37 [20.9%]) and students (30 [16.9%]) (Figure 3).

Victims were reported to sustain a total of 295 injuries or symptoms (Table 6). Some victims had more than one injury or symptom. Of all reported injuries/symptoms, the most common were respiratory irritation (110 [37.3%]), trauma (46 [15.6%]) and eye irritation (43 [14.6%]).

The age of the victims ranged from 8─68 years. Of the 177 victims, 96 (54.2%) were males and 81 (45.8%) were females.

Of the 177 victims, most (90, 50.8%) were treated at the hospital but not admitted. Two (1.1%) deaths were reported (Figure 4). Seventy-seven (43.5%) of the victims were decontaminated.

Of the 91 employee injuries, about 50% were males and 50% were females. The majority (87 [95.6%]) were not wearing any form of personal protective equipment and 45 (49.5%) were treated at the hospital but not admitted. Twenty-nine (31.9%) of the employee-victims were decontaminated.

Nearby populations

The proximity of the event location in relation to selected populations was determined using geographic information systems (GIS) or health department records. Residences were within ¼ mile of 138 (52.9%) events, schools within ¼ mile of 27 (10.3%) events, hospitals within ¼ mile of 6 (2.3%) events, nursing homes within ¼ mile of 16 (6.1%) events, licensed daycares within ¼ mile of 47 (18.0%) events, industries or other businesses within ¼ mile of 227 (87.0%) events, and recreational areas within ¼ mile of 13 (5.0%) events.

The number of events at which persons were at risk of exposure was determined primarily using GIS. There were 184 (70.5%) events with persons living within ¼ mile of the event; 231 (88.5%) events with persons living within ½ mile; and 245 (93.9%) events with persons living within 1 mile.

Evacuations

An evacuation was ordered in 31 (11.9%) events. Of these evacuations, 71.0% were of the building(s) or the affected part of the building(s), 16.1% were a circle and downwind/downstream, 9.7% were a circle/radius and 3.2% were downwind/downstream of the event. The number of people evacuated was known for 30 (96.8%) events and ranged from 2 to 1,700 people. Evacuation lengths ranged from 1 to 48 hours.

Response

Information was collected on who responded to the event. The response team of the company responsible for the release responded most frequently to events (215 [40.6%]), followed by the fire department (89 [16.8%]), certified hazardous materials team (86 [16.3%]) and law enforcement agency (62 [11.7%]) (Table 7).

Suggestions

Data indicates that the main factors involved in releases are human error and improper filling, loading or packing. It is also known that the majority of these releases occur due to improper filling, loading or packing at the origination point of the shipments prior to arrival in Colorado. It is suggested that facilities in Colorado coordinate training and/or education with their shipment originators to decrease the number of releases that are occurring enroute to their facilities.

The majority of employees who were injured (87 [95.6%]) were not wearing any form of personal protective equipment (PPE). It is suggested that facilities consider providing potentially impacted employees with PPE when in situations where an exposure has the potential to occur.

Incidents of Interest

The longest evacuation of 48 hours occurred when an unknown perpetrator sprayed mace into heat ducts at a local high school; 10 students and 7 employees were injured. All of the victims were decontaminated and treated at the hospital but not admitted.

The largest number of people evacuated (1,700) occurred when a science teacher was pouring nitric acid into a beaker and the chemical reacted and splashed a student and teacher. Another teacher and student were also exposed. Additionally, 17 other students complained of headaches and/or eye irritation. The school was evacuated until the following day.

The largest number of chemicals released (16) occurred when a fire destroyed a warehouse that contained numerous consumer commodities of a hazardous nature. Approximately 55 employees were evacuated for 24 hours. Four police officers experienced respiratory irritation and were treated at the hospital but not admitted.

The event with the largest number of victims (27) occurred when an employee of a printing equipment manufacturer mixed two chemicals together causing an air release of toxic fumes to be emitted throughout the building. The building was evacuated and 27 employees were either treated on scene or seen by private physicians after the incident.

REFERENCES

1. Centers for Disease Control and Prevention. Comprehensive plan for epidemiologic surveillance. Atlanta: US Department of Health and Human Services; 1986.

2. Binder S. Death, injuries, and evacuations from acute hazardous materials releases. Am J Public Health 1989;70:1042–4.

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Figure 1.- Areas of fixed facilities involved in events—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

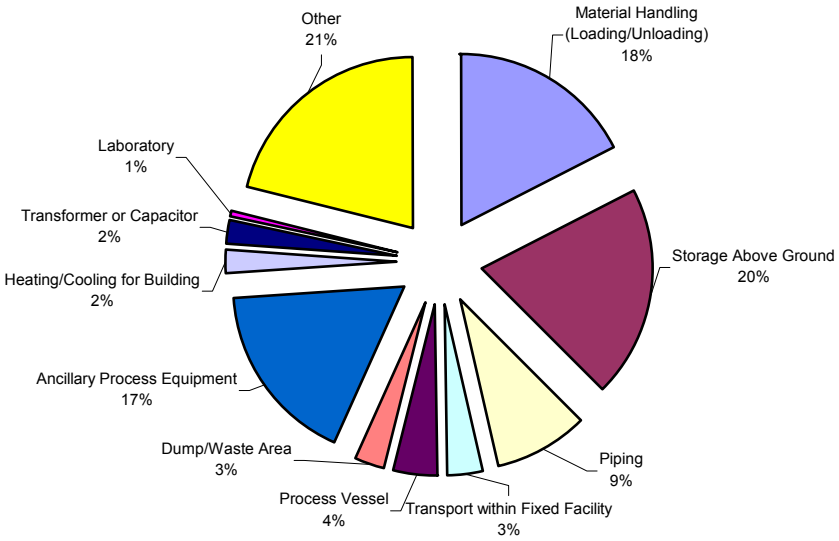

Figure 2a.-Primary factors reported as contributing to events—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

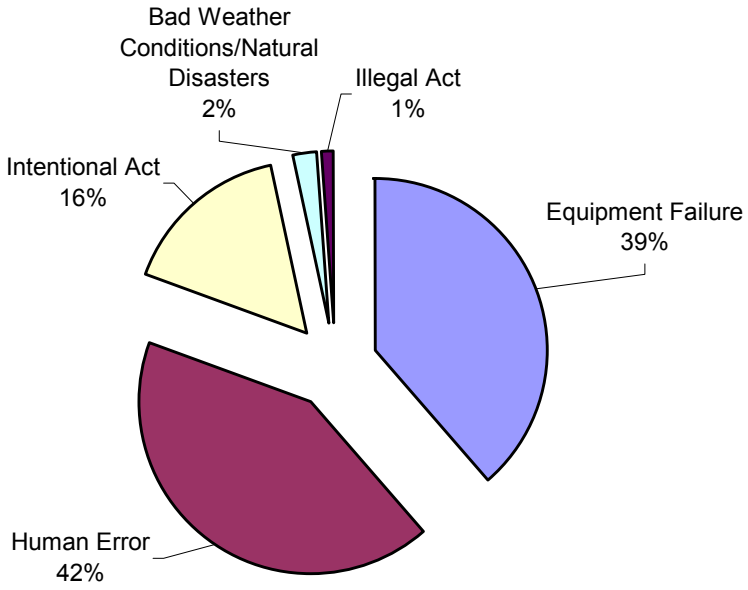

Figure 2b.-Secondary factors reported as contributing to events—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

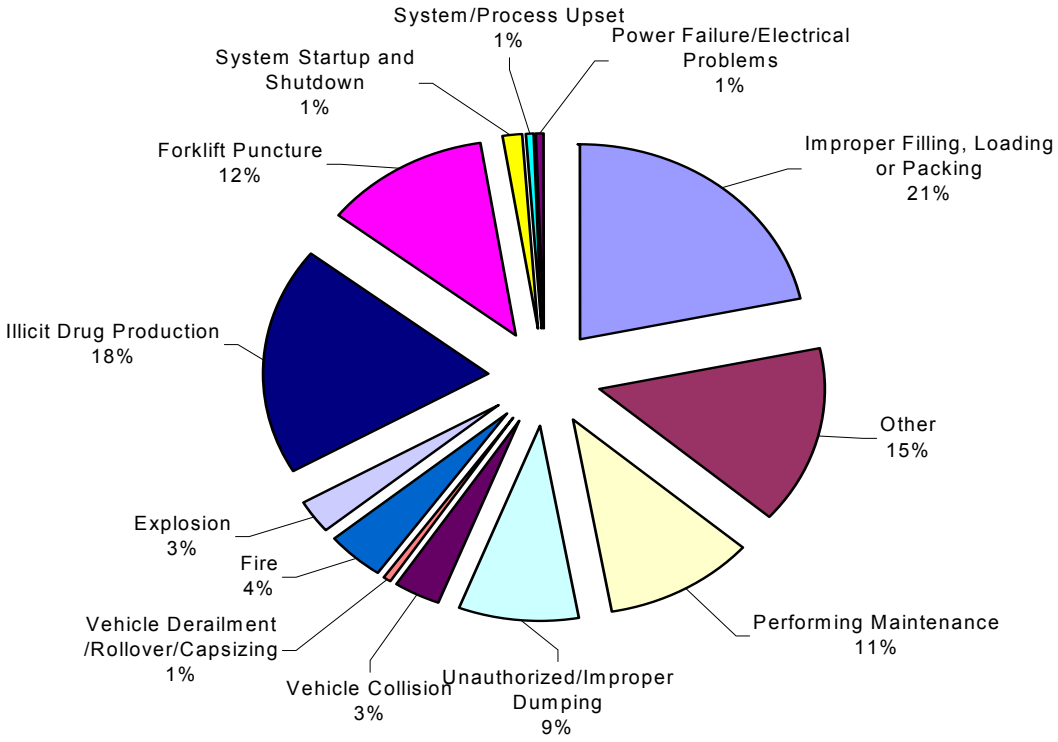

Figure 3.-Number of victims by population group—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

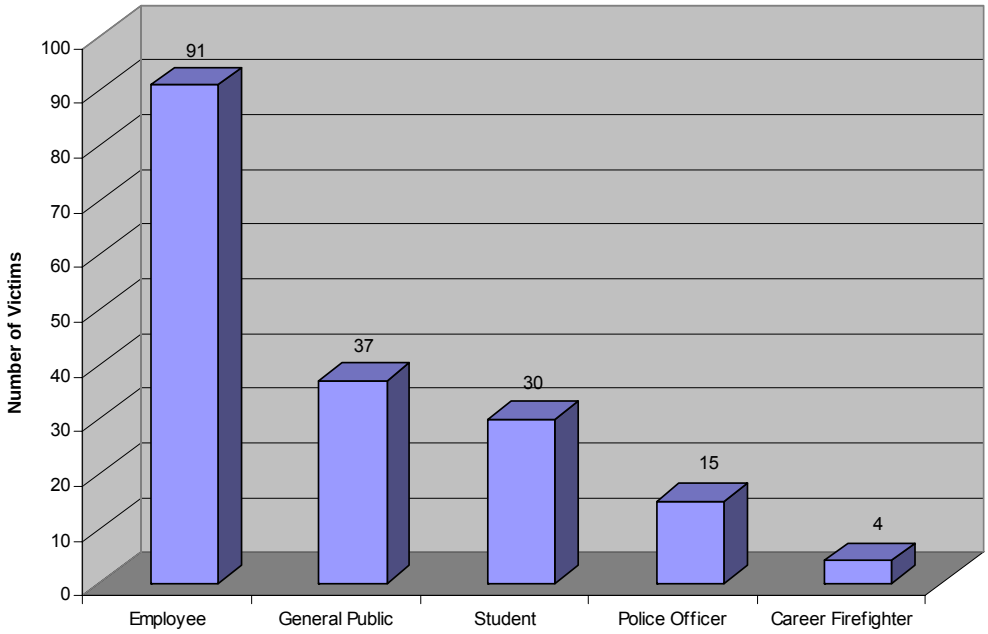

Figure 4.-Injury disposition—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

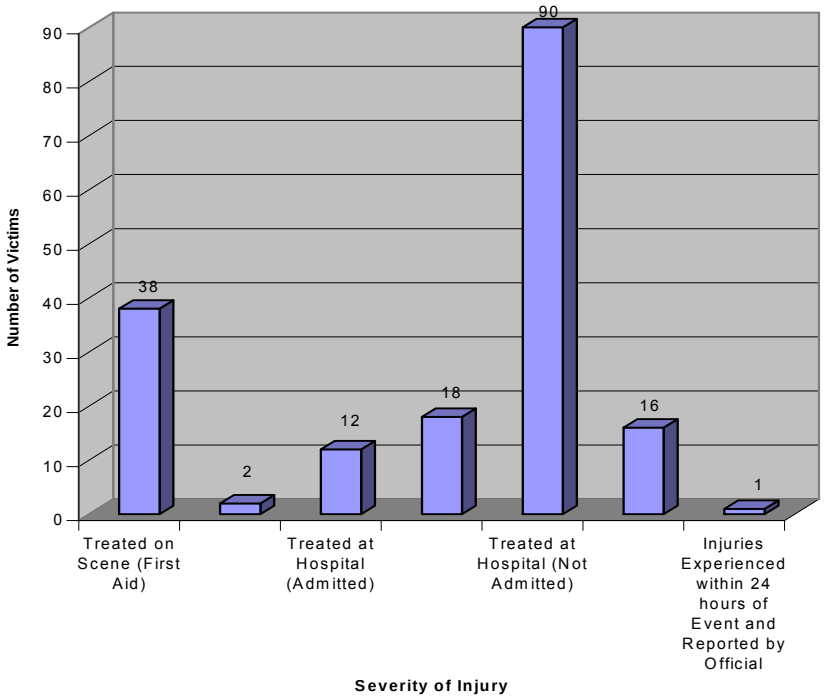

Table 1.—Number of fixed facility events meeting the surveillance definition, by county— Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

COUNTY	TOTAL NUMBER OF EVENTS
ADAMS	89 (34.1%)
ALAMOSA	1 (0.4%)
ARAPAHOE	13 (5.0%)
BACA	1 (0.4%)
BOULDER	12 (4.6%)
CHAFFEE	1 (0.4%)
DENVER	25 (9.6%)
DOUGLAS	9 (3.4%)
EAGLE	1 (0.4%)
EL PASO	23 (8.8%)
ELBERT	1 (0.4%)
FREMONT	3 (1.1%)
GARFIELD	4 (1.5%)
GRAND	1 (0.4%)
GUNNISON	1 (0.4%)
JEFFERSON	22 (8.4%)
KIOWA	1 (0.4%)
LA PLATA	6 (2.3%)
LARIMER	3 (1.1%)
MESA	6 (2.3%)
MOFFAT	1 (0.4%)
MONTROSE	2 (0.8%)
OTERO	1 (0.4%)
PITKIN	3 (1.1%)
PUEBLO	12 (4.6%)
RIO BLANCO	3 (1.1%)
ROUTT	1 (0.4%)
SAN MIGUEL	1 (0.4%)
SUMMIT	3 (1.1%)
WELD	11 (4.2%)
TOTAL	**261 (100.0%)**

Table 2.—Number of substances involved per event—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

Number of Substances	Number of Events	%
1	252	96.6
2	4	1.5
3	2	0.8
4	2	0.8
16	1	0.4
Total	**261**	**100.0**

Table 3.—Industries involved in hazardous substance events, by category—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

Industry Category	Total Events	Events with Victims	Percentage of Events with Victims	Total no. Victims
Accommodation and Food Services	3	2	66.7	15
Administrative and Support and Waste Management and Remediation Services	3	0	0.0	0
Agriculture, Forestry, Fishing and Hunting	5	3	60.0	17
Arts, Entertainment and Recreation	2	0	0.0	0
Construction	9	2	22.2	3
Educational Services	11	5	45.5	45
Health Care and Social Assistance	2	0	0.0	0
Information	2	0	0.0	0
Manufacturing	65	7	10.8	57
Mining	19	0	0.0	0
Not an Industry	23	15	65.2	25
Other Services	7	2	28.6	2
Professional, Scientific and Technical Services	4	0	0.0	0
Public Administration	13	0	0.0	0
Real Estate and Rental and Leasing	1	0	0.0	0
Retail Trade	3	0	0.0	0
Transportation and Warehousing	63	4	6.3	11
Utilities	13	0	0.0	0
Wholesale Trade	6	0	0.0	0
Total∞	**259**	**40**		**177**

Table 4.—Number of substances involved, by substance category—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

Substance category	No. substances	%
Acids	23	7.9
Ammonia	16	5.5

Substance category	No. substances	%
Bases	17	5.9
Chlorine	5	1.7
Formulations	1	0.3
Hetero-organics	4	1.4
Hydrocarbons	7	2.4
Mixture*	9	3.1
Other†	60	20.7
Other inorganic substances‡	53	18.3
Oxy-organics	22	7.6
Paints and dyes	11	3.8
Agricultural Chemicals & Pesticides	16	5.5
Polychlorinated biphenyls	6	2.1
Polymers	3	1.0
Volatile organic compounds	37	12.8
Total	**290**	**100.0**

* Substances from different categories that were mixed or formed from a reaction before the event.
† Not belonging to one of the existing categories.
‡ All inorganic substances except for acids, bases, ammonia, and chlorine.

Table 5.—Number of victims per event—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

No. Victims	No. Events	%	Total Victims
0	219	84.0	0
1	16	6.1	16
2	9	3.4	18
3	5	1.9	15
4	4	1.5	16
7	2	0.8	14
≥8	6	2.3	98
Total	**261**	**100.0**	**177**

Table 6.─Frequencies of injuries/symptoms—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

Injury/symptom	No. injuries	%
Chemical/Thermal burns[↓]	22	7.5
Dizziness/central nervous system symptoms	23	7.8
Eye irritation	43	14.6
Gastrointestinal system problems	2	0.7
Headache	20	6.8
Respiratory irritation	110	37.3
Shortness of breath	3	1.0
Skin irritation	26	8.8
Trauma[†]	46	15.6
Total[‡]	**295**	**100.0**

*The number of injuries is greater than the number of victims because a victim could have had more than one injury.
[†] Six of the trauma related injuries were not chemical-related
[↓] Of the burn related injuries, 4 were chemical-related, 1 was thermal related,, two were non-chemical related, 13 were both chemical and thermal related and 2 were unknown.

Table 7.—Distribution of personnel who responded to the event—Colorado Hazardous Substances Emergency Events Surveillance, 2002-2005

Responder category	No.	%
Certified HazMat team	86	16.3
Emergency medical services	31	5.9
Environmental agency/EPA[†] response team	6	1.1
Fire department	89	16.8
Health department/health agency	13	2.5
Hospital personnel/Poison Control Center	2	0.4
Law enforcement agency	62	11.7
Other	3	0.6
Company's response team	215	40.6
Dept. of works/utilities/transportation	6	1.1
State, County or local emergency managers/coordinators/planning committees	1	0.2
Third party cleanup contractors	14	2.6
Total	**529**	**100.0**

[†]Environmental Protection Agency.