

# ProtectTexas™

## Texas Department of Health

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Commissioner of Health

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December 30, 2003

Ben Delgado  
Chief Operating Officer

Nicolas Curry, M.D., M.P.H.  
Executive Deputy Commissioner

Dear Interested Party:

Enclosed is a fact sheet entitled “Ammonia Facts” prepared by the Texas Department of Health, Hazardous Substances Emergency Events Surveillance (TxHSEES) system. This fact sheet contains a summary of the 735 TxHSEES ammonia events that occurred from 1993 through 2002. It also includes information on the safe handling and storage of ammonia and presents 5 case studies. HSEES is a federal project funded by the Agency for Toxic Substances and Disease Registry (ATSDR).

Texas is one of 15 state health departments participating in the HSEES surveillance system which collects information on hazardous substances releases. Aggregate information is analyzed, patterns are evaluated and possible intervention(s) to reduce injuries and deaths associated with emergency releases are identified.

We would like to acknowledge and express our appreciation for the many people who have assisted us in collecting these data. TxHSEES receives initial notifications from the National Response Center (NRC/EPA), the Texas Commission on Environmental Quality (TCEQ), the Hazardous Materials Information Systems (HMIS) database maintained by the Department of Transportation (DOT), local fire department’s Hazardous Materials units, and media reports. Additional information is gathered from industry contacts and other sources such as medical records.

If you have any questions about HSEES or would like additional copies of this fact sheet, please call Richard Harris at 512-458-7220. For more information about TxHSEES, you may also visit our website at <http://www.tdh.state.tx.us/epitox/hsees/default.htm>.

Sincerely,

John Villanacci, Ph.D.  
Director  
Environmental Epidemiology

## Overview

Since 1990, the Hazardous Substances Emergency Events Surveillance (HSEES) system, maintained by the Agency for Toxic Substances and Disease Registry (ATSDR), has actively collected information to describe the public health consequences associated with the release of hazardous substances. As many as 17 state health departments have contributed data to the system. The Texas Department of Health (TDH) has participated in this surveillance system since 1993.

The surveillance system has four goals:

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

From 1993 to 2002, TxHSEES investigated 23,139 events meeting the HSEES case definitions. Hazardous substances emergency events are defined by HSEES as uncontrolled or illegal releases or threatened releases of hazardous substances. Events involving petroleum only are not included. Events are included if (1) the amount of substance that was 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 was only a threatened release of a substance, but the threat led to an action (for example, evacuation) that could have affected the health of employees, emergency responders, or the general public. Victims are defined as persons who suffered at least one adverse health effect within 24 hours or died as a consequence of the event. Victims who receive more than one type of injury are counted once in each applicable injury type. Events are defined as transportation-related if they occurred during surface, air, pipeline, or water transport of hazardous substances. All other events are

considered fixed-facility events. Due to the large volume of spills and air releases in Texas, TxHSEES also adds the criteria that the spill or release must be greater than one gallon or greater than 10 pounds, unless the CERCLA reportable quantity is one pound.

Ammonia was involved in 735 (3%) of these actual or threatened events: 695 fixed-facility events and 40 transportation events. Of the top ten most frequently released chemicals ammonia (the fourth most frequently released chemical) caused the largest number of evacuations and was the most frequently identified chemical in events with victims (843 people in 41 events) (Table 1). It also was the chemical associated with the largest number of people (583) injured in a single event.

**Table 1. Summary of ammonia events reported to TxHSEES**

Number	Fixed Facility	Transportation	Total
Events	695	40	735
Evacuations	115	4	119
Shelter-in-place	8	1	9
People receiving emergency decontaminations	> 61	2	> 63
Events with victims	37	4	41
Victims	824	19	843

Evacuations were ordered in 119 events. The number of persons evacuated ranged from 1 to 3,500 people, with a median number of 30 people evacuated. The total number of people evacuated was unknown in six events. The length of evacuation ranged from 1 to 38 hours, with a median number of 2 hours. In four events, the length of evacuation was unknown.

The industries most frequently associated with ammonia releases were chemical manufacturing (347, 47%), food preparation (149, 20%), petroleum refining (73, 10%), and transportation and warehousing (63, 9%). Seventy-six percent of all events in the food preparation industry were associated with ammonia releases. Although food preparation had the largest number of ammonia release events with victims (15 events with 100 victims), the chemical manufacturing industry had the largest total number of victims (667 victims in 10 events) (Table 2).

Twenty-one people were injured in two agricultural production events involving ammonia. Thirty-five people were injured in 7 wholesale/retail industry events involving ammonia (Table 2).

**Table 2. Number of events, events with victims, and victims by selected industries**

Industry	No. of events	No. of events w/victims and %	No. of victims
Chemical mfg.	347	10 (3%)	667
Food preparation	149	15 (10%)	100
Petroleum refining	73	0 (0%)	0
Transportation and warehousing	63	2 (3%)	3
Wholesale/Retail	37	7 (19%)	35
Mining & construction	15	0 (0%)	0
Agricultural production	6	2 (33%)	21
All other	45	5 (6%)	10
Total	735	41 (6%)	836

The food preparation industry had the largest number of evacuations (65, 55% of all evacuations), followed by chemical manufacturing (19, 16% of all evacuations) (Table 3).

**Table 3. Number of events with evacuations or shelter-in-place by selected industries**

Industry	No. of events	No. of evacuations and %	No. of shelter-in-place and %
Food preparation	149	65 (44%)	0 (0%)
Chemical mfg.	347	19 (5%)	5 (1%)
Transportation and warehousing	63	10 (16%)	1 (2%)
Wholesale/Retail	37	8 (22%)	0 (0%)
All other	139	17 (12%)	3 (2%)
Total	735	119 (16%)	9 (1%)

Sixty-three people received emergency decontamination in 16 events. Chemical manufacturing, followed by durable goods manufacturing, had the largest number of people who received emergency decontamination (26 and 24 people, respectively) (Table 4).

A summary of the injury data for events involving ammonia (Table 5) shows the majority of injured persons were members of the general public (678, 81%) and that their most frequent injuries were respiratory irritation, eye irritation, and gastrointestinal problems. For the 132 injured employees, respiratory irritation, eye irritation, and headaches were the most frequently reported injuries. The 32 responders most frequently reported respiratory irritation.

**Table 4. Number of events with emergency decontaminations by selected industries**

Industry	No. of ammonia release events	No. of events with emergency decontaminations	No. of people decontaminated
Chemical mfg.	347	7 (2%)	26
Food preparation	149	4 (3%)	10
Durable goods mfg.	13	2 (15%)	24
Wholesale/Retail	37	2 (5%)	2
Mining & construction	15	1 (7%)	1
All others	174	0 (0%)	0
Total	735	16 (2%)	63

**Table 5. Type of injuries by victim category**

	Employee	Responder	General public	Total *
No. of victims	132	32	678	842
<b>Type of injury</b>				
Trauma	7	0	5	12
Respiratory irritation	114	22	389	525
Eye irritation	58	8	285	351
Gastrointestinal problems	4	5	266	275
Heat stress	0	2	2	4
Chemical burns	5	5	1	11
Skin irritation	2	3	86	91
Dizziness/CNSH symptoms	0	8	50	58
Headache	43	4	170	217
Heart problems	0	0	55	55
Other	0	0	21	21
Total number of injuries <sup>†</sup>	233	57	1,330	1,620

\*The victim category was not identified for one victim who reported gastrointestinal problems.

H CNS = Central Nervous System

† The total number of injuries may exceed the total number of victims because some people reported more than one injury.

Three deaths occurred in events associated with ammonia releases; 13 people were admitted to the hospital, and 745 people were treated at a hospital and released. Fifty-two people were given first aid at the scene; 24 people obtained medical care from their private physicians or had their injuries reported by an official within 24 hours of the event; and 6 people were observed at a hospital, but did not receive treatment.

## Case Studies of Ammonia Releases in Texas

### Case Study 1

*Highlights: 583 victims*

During the startup of an industrial reactor unit, a hot-water makeup valve was inadvertently activated resulting in a temperature and pressure increase.

This, in turn, caused the pressure relief valve to open and caused an ammonia vapor release. Up to 3,000 pounds of ammonia vapor were released during 8 minutes. Sheltering-in-place was ordered, but there is no indication that instructions were given. Within 24 hours of the release, two employees, one person with an unknown victim category, and 580 members of the general public reported to local area hospitals and clinics alleging exposure to ammonia.

Additional victims presented to the local area hospitals and clinics in a time frame greater than 24 hours after the release. Reported symptoms included respiratory irritation (including sore throat and coughing), chest pain, shortness of breath, eye irritation, skin irritation, nausea, dizziness, and headache. Ages of the victims ranged from 1 year to 85 years with a mean age of 36 years. There were 238 males and 345 females.

### Case Study 2

*Highlights: 16 victims and an evacuation*

In a transportation-related event, an anhydrous ammonia fertilizer trailer overturned in the intersection of a highway as the truck pulling it under a highway overpass was making a left-handed turn. Four thousand pounds were released. One responder, a police lieutenant, and 14 members of the general public were treated at the hospital and released.

Members of the general public included six employees working in a bakery nearby and people who lived within 200 yards of the site of the event. The injured people ranged in age from 6 to 60, mean age 32 years. The victims included three children. The reported symptoms included respiratory, eye, and skin irritation, chest pain, nausea, dizziness, and headache. The police evacuated a local restaurant and convenience store. For about one hour, sheltering in place occurred at a large local retail store.

### Case Study 3

*Highlights: 25 victims, an evacuation, and closed highways*

During a loading/unloading operation at a fertilizer plant, a storage tank broke loose from its skids and the valves broke off, releasing 10,000 pounds of ammonia. The entire town with a population of 900 was evacuated for five hours and highways were closed. Twenty-five people, including 1 employee, 8 responders (including 2 firefighters and 1 Department of Public Safety (DPS) trooper), and 16 members of the general public were taken to the hospital.

Twenty-one victims were treated at a hospital and released and four were admitted to a hospital.

Reported symptoms included respiratory, eye, and skin irritation, headache, nausea, and dizziness. The 42-year-old male employee also received chemical burns. Ages of the victims ranged from 5 to 75, with a mean age of 28 years. Chemtrec and 10 fire departments responded to this event.

### Case Study 4

*Highlights: 1 fatality and an evacuation*

An ammonia compressor failed at a meat packing plant causing a release of 1,000 pounds of ammonia. This resulted in the death of a 57-year-old male employee from respiratory injuries. He did not have on any PPE at the time of the event. Thirteen people were evacuated from the building for two hours. Local fire and police responded. Power was secured to the area to prevent an explosion.

### Case Study 5

*Highlights: 3 victims; ammonia theft*

Police officers observed a suspect discharging ammonia from a 6,000 gallon ammonia tank into a large water cooler. The suspect ran from the scene and did not shut off the valve. It appeared the suspect had burglarized a lock and the chain was cut off a valve so the product could be stolen. The fire department estimated the release began around 4:30 a.m. and an unknown amount of ammonia leaked for about 50 minutes before the valve could be secured. Three police officers and one drug dog received inhalation injuries. The 3 police officers were transferred to the hospital. Two were treated and released and one was admitted to the intensive care unit.

# AMMONIA FACTS

*Texas Department of Health  
Hazardous Substances Emergency Events Surveillance (HSEES) System*

**Synonyms:**

Anhydrous ammonia, Aqueous ammonia, Ammonia gas

**CAS Number:** 7664-41-7

**DOT Numbers:**

UN1005 (anhydrous), UN2073 (solution), UN2672 (solution)

**Characteristics:**

- ◆ Colorless
- ◆ Pungent odor
- ◆ Water reactive
- ◆ Strongly alkaline, corrosive
- ◆ Containers may explode in a fire
- ◆ May cause frostbite or thermal burns by exposure from anhydrous liquid systems, containers, or cylinders.

**Uses and Potential Exposures:**

- ◆ Refrigerant in petroleum refining, chemical manufacturing, and food processing and storage.
- ◆ Used in industry as a control technology process “scrubber” for smoke stack effluents.
- ◆ Used in the manufacturing of nitric acid, sodium carbonate, synthetic urea, synthetic fibers, dyes, and plastics.
- ◆ Used in the production of drugs and pesticides.
- ◆ Used in common household cleaning products.
- ◆ Used in production of ammonium sulfate and ammonium nitrate for fertilizers.
- ◆ Stored in large quantities in agricultural chemical supply stores and applied directly from fertilizer tanks to agricultural land.

**Recommended and permissible occupational exposure limits for ammonia:**

Concentration	Recommendations
25 ppm	<i>Threshold Limit Value – Time Weighted Average (TLV-TWA)<sup>®</sup></i> * the time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Concentration	Recommendations
35 ppm	<i>Threshold Limit Value - Short-Term Exposure Limit (TLV-STE<sup>®</sup>L)</i> * is defined as a 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the TLV-STE <sup>®</sup> L should not be longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures in this range.
50 ppm	<i>Permissible Exposure Limit (PEL)<sup>†</sup></i> The permissible airborne contaminant concentration weighted over an 8-hour work day, as determined from breathing-zone air samples, over which the employee may not be exposed.

\*ACGIH=American Conference of Governmental Industrial Hygienists  
†OSHA=Occupational Safety and Health Administration

**Ammonia exposure levels and associated health impact in acute (< 15 minutes) exposure situations:**

Concentration	Health Effects
5 ppm	Least perceptible odor
20 – 50 ppm	Readily detectable odor
50 – 100 ppm	No discomfort or chronic impairment of health
150 – 200 ppm	Visible cloud with general discomfort and tearing, normally no lasting effect with short term exposure
<b>300 ppm</b>	<b>Immediately dangerous to life and health</b>
400 – 700 ppm	Severe irritation of mucus membranes in eyes, ears, nose, and throat, normally no lasting effect if exposure is short in duration
1,700 ppm	Choking and coughing upon inhalation with difficult and labored breathing that may last a few hours
2,000 – 3,000 ppm	Dangerous level at which less than ½ hour exposure may be fatal
5,000 – 10,000 ppm	Serious edema, strangulation, asphyxia, rapidly fatal
> 10,000 ppm	Immediately fatal

**Personal Protective Equipment Guidelines:**

- ◆ Wear appropriate protective equipment (i.e., gloves, eye protection) to prevent skin and eye contact.
- ◆ Responders should wear rubber, neoprene, or polyvinyl protective equipment and self-contained breathing apparatus in emergency situations.

## NIOSH respirator recommendations:

Concentration (ppm)	Recommendations
Emergency or planned entry into unknown concentrations > 300 ppm IDLH <sup>1</sup>	Self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand mode.
Escape	Air-purifying, full-facepiece respirators (gas mask) with a chin-style, front or back-mounted ammonia vapor canister; or appropriate escape-type, self-contained breathing apparatus.
Up to 300 ppm	Negative air purifying respirators with a full facepiece; or air-purifying, full-facepiece respirators (gas mask) with a chin-style, front or back-mounted ammonia vapor canister; or supplied-air respirator with a full facepiece; or self-contained breathing apparatus with full facepiece.
Up to 250 ppm	Negative air purifying respirators with an ammonia vapor cartridge/canister; or any supplied-air respirator.

<sup>1</sup>IDLH = Immediately dangerous to life or health

## Spills and Emergencies:

- ✓ Evacuate endangered area.
- ✓ Restrict persons not wearing appropriate personal protective equipment from the areas of spills or leaks until the affected area is safe to reoccupy.
- ✓ Remove all ignition sources.
- ✓ Effectively ventilate the area of the spill or leak.
- ✓ Stop the leak. If the source of the leak is a cylinder and cannot be stopped, remove the leaking cylinder to a safe place in the open air. Repair the leak or allow the cylinder to empty.

## Emergency First Aid Measures:

### Eye Contact

1. Immediately flush with large amounts of water.
2. Continue for at least 30 minutes, occasionally lifting upper and lower lids
3. Seek medical attention immediately.

### Skin Contact

1. Quickly remove contaminated clothing.
2. Immediately wash skin with large amounts of water.
3. Seek medical attention immediately.

### Respiratory

1. Remove the victim from the site of the release.
2. Begin rescue breathing if breathing has stopped, and CPR if heart activity has stopped.

3. Transfer the victim promptly to a medical facility. Observation after high exposure is recommended for up to three days, as fluid in the lungs (pulmonary edema) may be delayed.

## Disposal Methods:

1. Dilute with water.
2. Neutralize with dilute acid.
3. Discharge to the sewer.
4. In manufacturing of paper, textiles, fertilizer, and chemical process wastes, recovery is an option for disposal.

## Fire Extinguishing:

*Small fires:* Use dry chemical or carbon dioxide.

*Large fires:* Use water spray, fog, or foam. Apply water gently to the surface. Do not get water inside container. Move container from fire area, if you can do so without risk. Stay away from ends of tanks. Cool containers that are exposed to flames with water from the side until well after the fire is out.

## Ammonia Handling and Storage:

- Avoid contact with acids, bromine, calcium, chlorine, gold, hypochlorite bleaches, iodine, mercury, silver, and strong oxidizers. Mixing ammonia with any of these chemicals will result in a violent chemical reaction and production of poisonous gases.
- Store ammonia in tightly closed containers in cool, well-ventilated areas away from direct heat and sunlight.
- Avoid sources of ignition such as smoking or open flames in areas where ammonia is used, handled or stored. Misuse could result in a potential fire or explosion hazard.

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**For more information on the TxHSEES program, call 512-458-7220.**

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This fact sheet does not replace the material safety data sheet (MSDS) required for a hazardous chemical under the Occupational Health and Safety Act of 1970 (29 U.S.C. 651 ET SEQ.) and regulations promulgated under this Act.

*Information for this fact sheet was obtained from the TxHSEES program, the Missouri HSEES Program; the Environmental Protection Agency (EPA); the Agency for Toxic Substances and Disease Registry (ATSDR); the Handbook of Toxic and Hazardous Chemicals and Carcinogens, Third Edition; ACGIH\*, Threshold Limit Values and Biological Exposure Indices, 2003; Federal OSHA† Regulations: 29 CFR 1910.1000, 29 CFR 1910.111; and National Institute of Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards, 2003.*

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## Texas Hazardous Substances Emergency Events Surveillance (TxHSEES) Evaluation Form for Texas Ammonia Fact Sheets

Date \_\_\_\_\_

(1)	(2)	(3)	(4)	(5)
<u>Low</u>	_____	<u>Medium</u>	_____	<u>High</u>

1. Did the fact sheet hold your attention? \_\_\_\_\_

2. Did you find the information relevant? \_\_\_\_\_

3. I will share the fact sheet with a friend or co-worker. Yes \_\_\_\_\_ No \_\_\_\_\_

4. What statistics are most relevant to your job/your company?

5. How would you improve the fact sheet?

6. Please suggest other people/groups who might find TxHSEES data useful.

Name:

Name:

Organization:

Organization:

Phone:

Phone:

E-Mail address:

E-Mail address:

7. Other suggestions/observations:

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