Anhydrous Ammonia Leak in a refrigeration plant Caused by a partial building collapse at: 66 Furman Street October 20, 21, 22, 1985

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Hazardous Materials Co.1 was special called to Brooklyn box 473, The unit was met with the following conditions upon arrival: possible anhydrous ammonia leak in a cold storage warehouse #1 adjacent to another warehouse #2 which had just sustained a partial interior collapse with the rear corner wall pulled away from the building. The refrigeration system was located in warehouse #1 with exterior piping running to warehouse #2 directly under the threating wall. No evidence (visible) that interior collapse broke any lines in warehouse #2. Upon inspection found secondary cooling lines (Brime) had been broken by interior collapse. H a z - M a t 1 m ade the necessary notifications, organized, and coordinated all parties involved. Formulated operational plan, checked system for breaks marked valves and piping, determined problem with ammonia mixer-broken line to sewer and sewer clogged-repaired both. Attempted to use pressurized trailers to remove product from compressor-collector receiver. Major leak in receiver room and in defueling line-repaired both. Haz-Mat officer determined that this operation was too dangerous. The decision was made to keep the product withi n the system. Contractor constructed protective shed for piping system. Recharged system after inspection and necessary repairs, Members operated in encapsulated suits while doing above plus taking readings and safety handlines. This operation took 54 hours with following factors foremost in

mind: History of explosions of this product; previous collapse and threating collapse; break in the system freeing product- 840 to 1 expansion ratio, NFPA health rating of 3 TLV 25ppm. Despite the complexity Haz-Mat Co.#1 succeeded in controlling the hazard. They exhibited exceptional teamwork and a high degree of knowledge and professionalism, bringing the operation to a successful conclusion.

About Anhydrous Ammonia it has the potential to be one of the most dangerous chemicals used in agriculture today. It is used and stored under high pressures, which requires specially designed and well-maintained equipment. Those who work with anhydrous ammonia must be trained to follow exact procedures in handling it. Anhydrous ammonia is classified as a hazardous substance. Most accidents with anhydrous ammonia are due to uncontrolled releases. Few problems occur when the ammonia is being handled and applied as intended. Most uncontrolled releases are due to improper procedures, careless or untrained workers, or faulty equipment. Protective equipment is required by law to be available where anhydrous ammonia is handled or applied. Wearing protective equipment greatly reduces the chance of injury from the ammonia release. Countless tons of anhydrous ammonia are applied every crop year without problems; safe procedures and good-quality equipment do work.

Anhydrous ammonia has the potential to be one of the most dangerous chemicals used in agriculture today. It is used and stored under high pressures, which requires specially designed and well-maintained equipment. Those who work with anhydrous ammonia must be trained to follow exact procedures in handling it.

CHARACTERISTICS OF ANHYDROUS AMMONIA (IT'S **Odor)** Anhydrous ammonia is a clear, colorless gas at standard temperature and pressure conditions and has a very characteristic odor. The odor is the strongest safety feature of the product. At a concentration of only 50 parts per million (ppm), one sniff tells what is in the air. Normally, the odor will drive a person away from the area. A concentration of more than 5,000 ppm will disable a person so that escape is impossible and suffocation results.

PRESSURE FOR STORAGE

Anhydrous ammonia is a liquid when compressed or cooled. It is stored under pressure to prevent vaporization so a large volume can be available for use. One cubic foot of anhydrous ammonia in a liquid state produces 855 cubic feet of ammonia gas. Retail storage tanks and nurse tanks for anhydrous ammonia are built to withstand internal pressures of at least 250 pounds per square inch (psi). Terminal storage tanks refrigerate ammonia to minus 28 degrees Fahrenheit. At this temperature, the storage pressure is less than 1 psi.

EXPOSURE LEVELS AND THE HUMAN BODY

Table 1. Exposure Levels and The Human Body.		
Exposure (ppm)	**Effect on the Body**	**Permissible Exposure**
50 ppm	Detectable by most people	No injury from prolonged or repeated exposure
134 ppm	Irritation of nose and throat	Eight hours maximum exposure
700 ppm	Coughing, severe eye irritation, may lead to loss of sight	One hour maximum exposure
1,700 ppm	Serious lung damage, death unless treated	No exposure permissible
2,000 ppm	Skin blisters and burns within seconds	No exposure permissible
5,000 ppm	Suffocation within minutes	No exposure permissible

TEMPERATURE/PRESSURE RELATIONSHIPS

When anhydrous ammonia is released from compression in a storage tank (200 psi) to the atmosphere (0 psi), the temperature drops from 100 F to minus 28 F. At this temperature, ammonia freeze-burns human skin on contact. Clothing actually is frozen to the skin. Because anhydrous ammonia is stored under high pressure, a sudden rupture can shoot ammonia 10 to 20 feet from the point of release.

FLAMMABILITY

Table 2. Temperature and Pressure Relationships.	
Degrees F	**Pressure (psi)**
-28 F	0 psi
0 F	16 psi
32 F	48 psi
60 F	93 psi
100 F	200 psi

Anhydrous ammonia is generally not considered to be a flammable hazardous product because its temperature of ignition is greater than 1,560 degrees F and the ammonia/air mixture must be 16% to 25% ammonia vapor for ignition. Despite the difficulty of igniting such a mixture, never weld on any container or piping that has not been completely decontaminated and cleaned of all ammonia and its salts. Remember, never weld on a closed container of any kind; all containers must be completely cleaned and vented. Apply heat only to open containers, including all piping.

Anhydrous ammonia contains no water. Anhydrous is the Greek word for “without water.” Anhydrous ammonia has a very strong affinity for water. It requires large quantities of water to neutralize its caustic effects on moist areas of the body. When anhydrous ammonia contacts water, it forms ammonium hydroxide. Living tissue is dehydrated quickly and the cells destroyed on contact. Anhydrous ammonia attacks any moist part of the body: eyes, ears, nose, throat, bronchia, lungs, any moist skin. Any tissue containing moisture is chemically burned.

When anhydrous ammonia encounters water, it forms an alkali that chemically burns animal tissue. The chemical burns into the body tissue unless it is diluted by large quantities of water. Anhydrous ammonia is extremely destructive to animal tissue. Skin is reduced to a sticky, gooey substance as the chemical burn progresses. Skin that is chemically burned by the ammonia is killed and is not capable of healing or replacing itself. Damaged tissue must be removed surgically so that healing can proceed. The results often are disfiguring.