

IM-94-16

U. S. DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
216 North Waco, Suite B

Wichita, Kansas 67202

DATE: September 5, 1980

REPLY TO
ATTN OF: Jeff C. Spahn, Area Director

SUBJECT: Recommendation for Issuance of a National Hazard Alert on Anhydrous Ammonia (NH₃) Operations

TO: Mr. Vernon A. Strahm
Regional Administrator

Based on information obtained during a recent fatality investigation at Garvey Elevators Inc., Seward, Kansas, involving the death of an employee due to an anhydrous ammonia exposure, I believe that a national hazard alert may be in order.

The accident involved a withdrawal hose separation on an anhydrous ammonia applicator tank mounted on a trailer. During the investigation it was discovered that there is a basic weakness in systems utilizing a combination liquid fill and withdrawal valve on applicator tanks. The hazard involves the lack of suitable devices to prevent the emptying of the ammonia supply containers in the event of severance of the applicator tank liquid withdrawal hose while applicator tank is being filled.

A CHEVRON Service Engineer advised the compliance officer during the investigation that there are still hundreds of applicator tanks in use today that are equipped with the same type combination liquid fill and withdrawal valves involved in the accident at Garvey.

Proposed hazard alert follows.

HAZARD ALERT

Subject: Inadequately protected anhydrous ammonia loading and unloading systems

The central purpose of this hazard alert on anhydrous ammonia NH₃ operations is to provide for equitable nationwide inspection programming adjustments regarding disclosure of violations of the Occupational Safety and Health Act of 1970. It will also provide employers, employees, and public officials with available information concerning a recognized hazard that has caused or is likely to cause death or serious physical harm to employees exposed to anhydrous ammonia gases due to inadequately protected loading and unloading systems. The Act requires employers to furnish each employee a place of employment free from recognized hazards likely to cause death or serious physical harm.

This hazard alert is based on information derived from an investigation of a recent anhydrous ammonia accident which occurred during the transfer of liquid ammonia from an 18,000 gallon bulk storage tank to an anhydrous ammonia applicator tank. During the transfer operation, a separation occurred in the applicator tank liquid withdrawal hose in the area of the coupling that connects the hose to the regulator unit mounted on the tongue framework of the applicator trailer. The separation allowed approximately 2700 gallons of liquid ammonia to escape to the atmosphere before the valves could be manually closed to stop the leak. The accident resulted in the death of one employee due to ammonia gas exposure, the injury of another employee, and the evacuation of all residents of a small town.

Investigation of the accident revealed that a weakness (from a safety standpoint) exists in this applicator system due to the use of a combination (sometimes called 3-way) liquid fill/withdrawal valve on the applicator tank. The problem exists during liquid transfer operations while the applicator tank is being filled.

The combination valve in question functions as follows:

The liquid feed hose from the supply container is connected to the

top opening of the valve.

The bottom opening of the valve extends into the applicator tank to allow the flow of liquid into the tank.

The applicator tank liquid withdrawal hose connects to an opening on the side of the valve which allows withdrawal of the liquid from the applicator tank when NH₃ is being applied in the field.

This combination valve has an excess flow valve at the tank entry point which is designed to prevent the applicator tank from emptying should a rupture occur in the applicator tank withdrawal system.

The valve is also equipped with a manual shut-off which is located between the side and tank entry openings on the valve. When the manual shut-off is open, the applicator withdrawal hose carries the same pressure as is in the tank. See the attached sketch and photographs of the valve for additional details.

In the event of severance of the liquid withdrawal hose on the applicator tank during filling operations (which was the case in this accident), the liquid ammonia is allowed to flow freely from the bulk storage tank through the combination liquid fill/withdrawal valve on the applicator tank directly into the applicator liquid withdrawal hose (and directly to the outside atmosphere in case of severance of the applicator withdrawal hose).

The OSHA General Industry Standard (1910.111.(b)(12)(vii) states that loading and unloading systems shall be protected by suitable devices to prevent emptying of the storage container or the container being loaded or unloaded in the event of severance of the hose. Backflow check valves or properly sized excess flow valves shall be installed where necessary to provide such protection. In the event that such valves are not practical, remotely operated shut-off valves may be installed.

The applicator tank combination fill/withdrawal valve is not designed with an internal excess flow valve to protect the system in case of rupture of the applicator withdrawal hose during fill operations, and devices were not employed to provide the required protection on the applicator tank involved in the accident. The fill/withdrawal valve does have an excess flow valve installed at the applicator tank entry point, but as described earlier, this excess flow valve does not protect the system when the applicator tank is being filled. In order to meet 1910.111(b)(12)(vii) requirements, systems using the combination fill/ withdrawal valves on the applicator tanks must be provided with devices to protect the system in case of severance of the applicator tank withdrawal hose. Employers should check with the manufacturers of their particular equipment to determine appropriate protection for the system. They should ascertain the possibility of installing a manual shut-off valve to the applicator withdrawal hose which could be closed during filling operations and thus prevent any flow of liquid into the withdrawal hose; or the possibility of installing an excess flow valve in the applicator withdrawal line; or the possibility of installing a completely separate withdrawal valve for the applicator withdrawal line; or any other means that will afford adequate protection of the system in case of severance of the applicator tank withdrawal hose as recommended by the manufacturer.

It is emphasized that the system is not adequately protected without devices designed specifically to protect the system in case of rupture of the applicator tank liquid withdrawal hose. It is strongly stressed that excess-flow valves or other protective devices installed in bulk storage tank feed hose outlet lines are not designed to protect the system in case of an applicator tank withdrawal hose rupture. These devices are required to protect the lines that they serve and are designed specifically for this purpose only. For example, a manufacturer of anhydrous ammonia equipment advised that an excess flow valve installed in a bulk storage tank hose outlet (designed to accommodate a one-inch fill hose that is 15 feet in length) will be spring-loaded to trip should the hose be severed at any point along the 15 foot length of the hose; however, it is doubtful that adequate protection would be provided beyond the 15 foot point. Thus in the case of the applicator tank equipped with the combination valve, the hose outlet excess flow valve provides protection of the system from the bulk tank

to the applicator fill/withdrawal valve with doubtful effectiveness in protecting the system beyond this point. It should be noted that the applicator tank involved in the accident was provided with a 3/4 inch liquid withdrawal hose. A reduction in the diameter of the hose line on the applicator tank further reduces the possibility of the bulk tank hose outlet excess flow valve tripping in case of severance of the applicator tank withdrawal hose -- especially in view of the fact that excess flow valves function on the basis of gallons per minute (GPM) flow rates and pressure differentials, i.e., a sudden drop of pressure in the line.

The preceding discussion has been limited to liquid lines and the filling of an applicator tank from a bulk storage tank. However, the same principles apply when filling the applicator tank from a nurse tank. In addition, it is equally important that protective devices be installed in the vapor lines to protect the system in case of vapor line rupture.

It should also be noted that the bulk tank that was used to fill the applicator tank involved in the accident was not provided with an excess flow valve on the one inch hose outlet on the bulk tank.

Jeff C.Spahn
Area Director

Enclosures

FOUR POINT RECOMMENDATION

1. As an interim measure, establish and/or encourage local inspection of excess flow valves/devices to ascertain that all bulk, nurse and applicator tanks are protected in accordance with manufacturers specifications.
2. The Wichita Area Office (OSHA) will conduct a series of seminars throughout the State, similar to seminars conducted during 1978, which successfully trained representatives of over 100 volunteer and paid fire departments in inspection techniques related to grain elevator dust explosions.
3. Request that the State Fire Marshall, State Department of Agriculture, educational institutions and other interested groups promote and assist participation in planned inspector training seminars.
4. Raise public awareness of the hazards related to Anhydrous Ammonia while emphasizing that while hazards exist, properly applied known engineering controls also exist to safely handle and consume this invaluable agricultural chemical.

U. S. DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
216 North Waco. Suits 8

Tele. No. (316) 267-6311, Ext. 644
Kansas Toll Free No...-1-800-362-2896
September 8, 1980

Wichita. Kansas 67202

NEWS RELEASE

Six alleged Serious type Safety Citations were issued on September 4, 1980, to Garvey Elevators, Inc., in Hutchinson, Kansas, that are related to an industrial accident which occurred on August 1, 1980. (Copies of Citations are attached).

The industrial accident resulted in the death of one employee, and the temporary evacuation of the City of Seward, Kansas, due to an Anhydrous Ammonia leak.

The purpose of this news conference is to urge all suppliers, handlers and consumers of Anhydrous Ammonia to examine their bulk storage applicator and nurse tanks to ascertain that adequate and correct excess flow valves or other protective devices are in place, are operable and are designed for the protection of the system as specified by the manufacturers.

The Wichita Area Office of the Occupational Safety and Health Administration has developed a National Hazard Alert related to the same subject. The National Hazard Alert has been submitted to the Regional Administrator of OSHA, Mr. Vernon A. Strahm, in Kansas City, for study and forwarding to the OSHA, National Office for possible nationwide distribution to all OSHA field offices.

In excess of 800 bulk storage tanks containing Anhydrous Ammonia are located with the State of Kansas. Several thousand nurse and applicator tanks are in use. Anhydrous Ammonia is the most widely used commercial fertilizer in the United States. The hazardous properties of Anhydrous Ammonia are well known, being highly toxic, flammable and highly explosive under certain conditions. Improperly stored and/or handled, the hazards far transcend employee safety. Most bulk storage tanks are located in population centers thus exposing significant sectors of the, general public.

Alleged "serious" violation number 2, points out a principle hazard associated with safe handling of Anhydrous Ammonia. In this situation adequate excess flow valves were not installed in a manner wherein the entire system was protected by automatic self-closing devices or remote shut offs, to prevent significant release of Ammonia during filling/transfer operations. In each portion of the system, bulk tank, appurtenances, rubber hoses, whether on the bulk tank, applicator tank or nurse tanks should have such devices installed and clearly marked to react to break or rupture in the system.

Engineering controls, properly applied, are available to allow safe handling, storage and transfer, and ultimately consumer use of this valuable agriculture chemical. If any member of the general public has questions pertaining to the subject, a toll free number (Kansas only), will be available for use after 12:00 p.m., on Thursday, September 11th, 1980, to provide additional information. The toll free number will be 1-800-362-2896.