Collapse + Ammonia = 54 Hours of Duty

by
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SIZE-UP

Address: 66 Furman Street, Brooklyn.
Occupancy: National Cold Storage Frozen Food Warehouse. (This warehouse consists of what, many years ago, was three separate buildings which were subsequently interconnected on various floors.)

Exposures

Exposure #1. Furman Street.
Exposures #2, #3, and #4. Parking lots.
Exposure #0. A six-story, 185′ x 145′, heavy timber construction building. This building contained foods that required cooling temperatures above the freezing level. The refrigerant that was used was ammonia. Fortunately, this was an indirect type system, i.e., the heat transfer fluid, called "brine, is cooled by the refrigerant and then circulated to the space to be cooled. (The brine in this case was water, calcium chloride, and rust inhibitor.) This is much safer than a direct system, which would circulate the refrigerant itself (ammonia) through the piping on each floor.
Exposure #0-4. An eight-story, 100′ x 100′, fireproof building. This building consisted of offices, except for the first floor which was used as the mechanical equipment area for the entire plant.
Exposure #0-4A. A six-story, 224′x100′, heavy timber construction building. This building was used as a storage warehouse for frozen foods. The temperature inside this building is normally maintained at below 0°F.

All of the buildings faced onto Furman Street. The rest of the perimeter was composed of large parking lots. Due to the open surrounding area, the wind was not considered to be a factor in the tactics that were adopted.

The auxiliary fire protection consisted of a dry standpipe system and an ammonia mixer siamese connection.

THE COLLAPSE

On October 20, 1985, at 1230 hours, Brooklyn Box 489 was transmitted for an emergency at the National Cold Storage Frozen Food Warehouse. This initial Fire Department response was for a reported partial interior collapse of the 5th and 6th floor of Exposure #0 (see diagram). The failure involved a portion of the 6th floor (approximately 25′ x 25′) which had collapsed onto the 5th floor, and caused a similar part of that floor to give way. The 4th floor, although piled rather high with stock, was able to sustain the weight. Various coolant pipes had been broken, and brine had spilled out of them. On the exterior of the building, a large corner crack had developed, running from the 3rd to the 6th floors, with the spread at one point almost a foot wide. In addition, there were two noticeable bulges in the brickwork at the 5th floor level.

Responding units conducted a search of the entire complex and established that all building personnel were accounted for. They roped off the endangered area and requested the response of personnel from the Police Department and the Building Department.

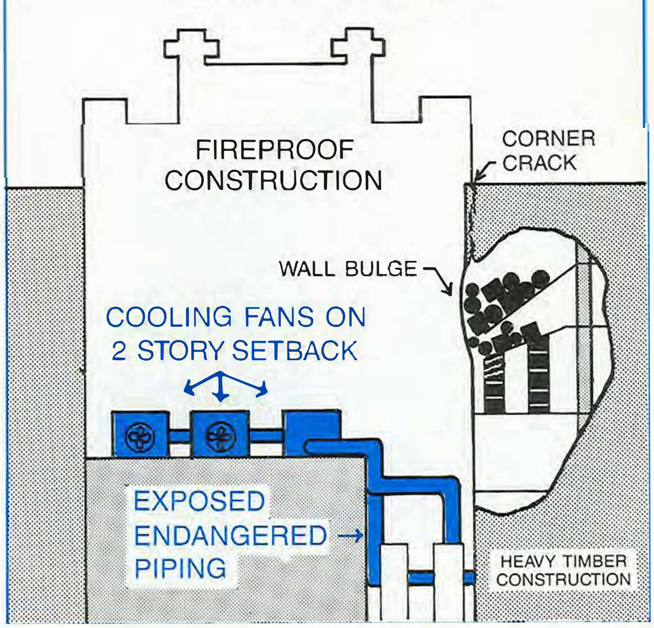
At this time, plant employees indicated that the mechanical equipment in the endangered area had been inactive for years. Leaving Police Department personnel in charge of the security of the area, and the Building Inspector to issue the necessary corrective orders, Fire Department units were returned to their quarters.

AMMONIA LEAK THREAT

After Fire Department units left the scene, the building engineering staff realized that, in fact, two live ammonia lines ran through the exterior of the endangered area (see illustration). When they were certain of their findings, they notified the dispatcher, which caused the second response at 1501 hours. The ammonia pipes in question were a 2 inch liquid line and a 4 inch vapor line.

As per the Mayor's Directive 82-2, *Hazardous Materials Response Plan*, additional agencies were directed to respond to the scene. These additional agencies included the New York City Department of Environmental Pro-

VIEW FROM REAR



tection, the Health Department, the Emergency Medical Service, and the U.S. Coast Guard. (The U.S. Coast Guard becomes involved due to the proximity of the emergency site to the East River.) Under the Plan, a representative of the Police Department would act as the On Scene Coordinator, and a Fire Department representative, in this case the chief of the 10th Division, would be the Incident Commander.

The On Scene Coordinator, Chief of Patrol Colangelo, set up the Interagency Command Post about 800 feet north of the building. The Incident Commander, Deputy Chief Richard A. Travers, established the Haz-Mat Operations Post some 300 feet west of the building, in the rear parking lot. Due to the probability of a prolonged operation, and the active involvement of other agencies, a Log Book was established.

With the threat of an ammonia leak, in the event of additional structural failure, "fire lines" were expanded, and Furman Street was closed to traffic. The ammonia lines in the exposed area were isolated by valve closures, which would limit the amount of discharge if the pipes were to fracture. A pumper was connected to the ammonia mixer in case it became necessary to flush the refrigerant into the sewer. It was felt that "flushing"would be preferable to letting the toxic vapors escape into the air.

After these preliminary steps, an interagency conference was held to discuss the best method of alleviating the potential hazard of a large scale ammonia leak, and how to effect emergency structural repairs to prevent the potential loss of over $20 million worth of the now unrefrigerated food stored in the complex.

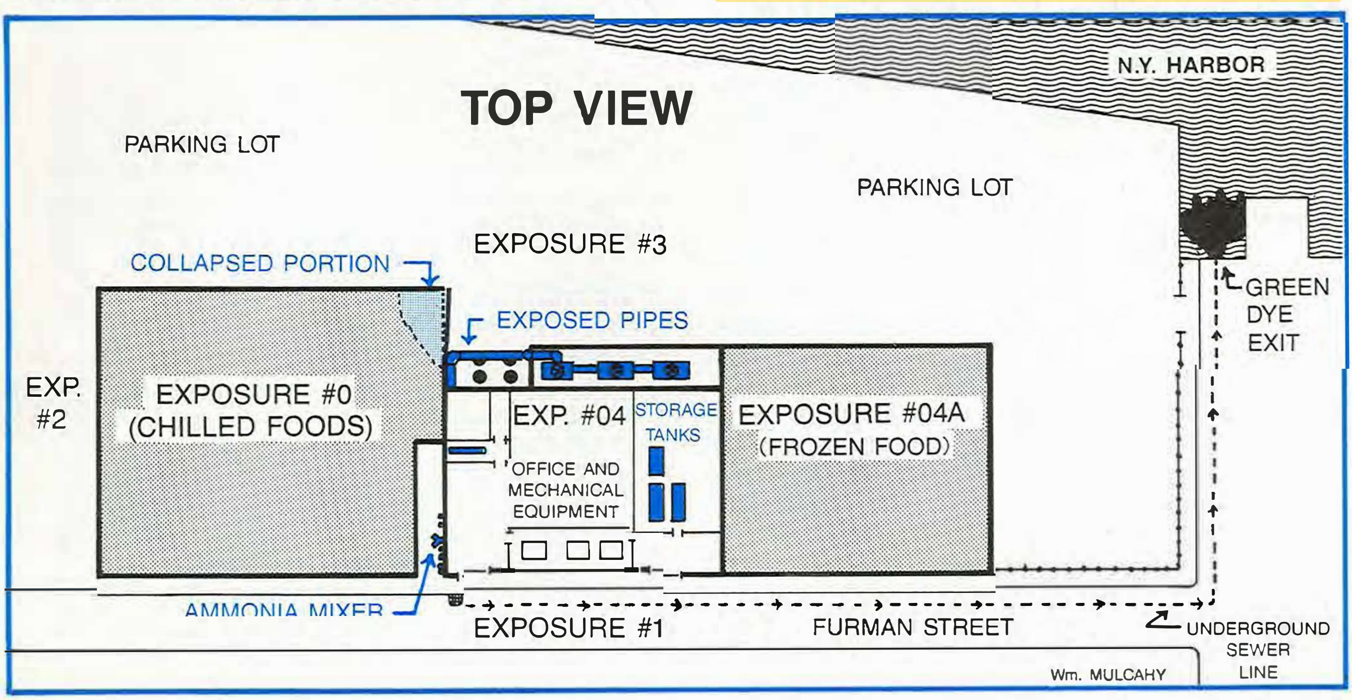
During the meeting, the Fire Department opted for flushing the refrigerant into the sewers, which would then allow construction workers to proceed, unthreatened, with repairs. The U.S. Coast Guard objected to the discharge of a foreign substance into a waterway via the sewer, and the Department of Environmental Protection expressed concern that dangerous fumes might seep into other buildings that were on the run of the sewer line. Both agencies wanted the ammonia off-loaded into tanker trucks. The Fire Department agreed to an off-loading attempt, with the stipulation that if any substantial danger was perceived, flushing would be instituted on Fire Department authority without any further consultation.

Two tankers were brought to the scene, and attempts to drain the system began. The first truck developed mechanical problems and was removed. The second truck's portable discharge hose started leaking badly in the building, and the Haz-Mat unit shut down the transfer. Dangerous levels of ammonia fumes had accumulated in two rooms, and an explosion-proof smoke ejector was used to ventilate these rooms. Due to the high concentrations of ammonia in these confined areas, and because certain rooms were equipped with open flame gas heaters, the natural gas supply was shut down at the curb. This task was accomplished promptly, since the Brooklyn Union Gas Co. was already on the scene. They had been called to the scene earlier to locate the correct curb valve in the event such a situation should arise. Gas company personnel had cleaned out the valve box, and one of our units had attached their gas key to the valve. Thus, when it was required to close the valve, no time was lost—only the order to shut down was needed.

At this time, it was decided that the off-loading procedure was not a viable solution, and another meeting was called. The Building Department put forth an alternative plan. They suggested that a protective roof be erected over the exposed piping to protect it in the event of further collapse. It was agreed to attempt this plan. However, the work crew would not be available until morning, some eight hours away.

After the meeting, Fire Department personnel, assisted by Sewer Department personnel, conducted some tests to make certain that the ammonia could be flushed in a manner that would minimize the risks. Sewer maps were studied, and it was determined that the flow from the ammonia mixer would run about 1½ blocks north and discharge directly into the river. That route was confirmed, when a bright green dye was dumped into the sewer and shortly thereafter appeared at the expected spot in the river.

A water-only test-flush was conducted through the



mixer, and a leak was discovered in a 4 inch pipeline. Haz-Mat personnel quickly repaired the pipe, stopping the leak. Taking the age of the system into consideration, it was decided not to put a second line into the siamese, and to limit the pressure in the first line to about 50 psi of water pressure. This pressure would be sufficient to move the ammonia into the sewer; however, it would not provide sufficient volume to ensure complete dilution. It was decided to augment the volume by placing two hoselines into two adjacent manholes on the sewer run if dumping became necessary.

As it was now the very early hours of October 21 (repairs would not start until daylight) some Fire Department units were released, and a watchline situation was established.

The following morning, preparations were made to erect the protective roof. Since workmen would be exposed to toxic fumes if a leak were to develop, tactics were carefully planned. A tower ladder was employed to allow a close-up examination of the building crack by Building Commissioiner Smith and a civil engineer prior to commencing the work. While the work was being done, a tower ladder would, if necessary, provide an escape route. In addition, an engine company was stationed nearby with a charged fog line.

While the construction was underway, a consultant refrigeration engineer was brought in to examine the system to determine if it could be safely returned to operation. This safeguard was required when the Fire Department issued a violation order to management to "... provide a written affidavit from a qualified engineer that the system is safe for use before start-up is permitted..."

By the afternoon, the protective roof was finished, and the refrigeration expert had supplied the required document.

PLANT START-UP

The refrigeration system in Exposure #0 could not be started up until extensive pipe repairs were made on the 6th floor. National Cold Storage management made arrangements to remove the food products from the unendangered portion of this exposure.

The return of refrigeration to Exposure #0-4A was considered vital, as this area housed frozen foods that, once thawed, could not be refrozen. Only a few hours were left to restore this area and prevent a large loss of food products.

Before start-up of the system was attempted, Haz-Mat personnel donned their exposure gear and masks. They manned the ammonia mixer valves and monitored their air sampling devices. Other FDNY units were assigned to man fog lines to "cover" Haz-Mat personnel, and to use their fog lines to dissipate any ammonia cloud that might develop.

The building engineering staff was ordered to bring the system up to 50 psi, which is about half the normal working pressure in this plant. It was held at this pressure while the system was monitored and declared safe. The ammonia pressure was then raised to 100 psi. After an hour of holding the system at this pressure, and with continued monitoring, the area was declared free of ammonia fumes. This allowed the release of Fire Department units. Building Department personnel remained on the scene to supervise further structural repairs, and

Photo shows severe crack that developed in Exposure #0 after the collapse. At one point, the crack was almost one foot wide. In addition, there were noticeable bulges in the brickwork at the fifth floor level.

Police Department personnel remained for traffic control. The Fire Department's commitment at this operation was completed.

CONCLUSION

In general, the Hazardous Materials Response Plan functioned well. The conferences with other agencies were helpful in exploring alternatives. However, it must be remembered that according to the Response Plan, the Fire Department has the responsibility of mitigating, by containment and/or control, any hazardous substance that is accidently released into the environment. The Fire Department Incident Commander should be tactful, but assertive, when stating our requirements, priorities, tactics, and strategies. ▲

Ammonia

Chemical Symbol: NH_3

Density: 0.6 (air = 1). When air is dry, ammonia vapor will rise. When air is heavy and damp, the ammonia vapor combines with the moisture in the air and forms a white cloud that may hug the ground, especially if there is no wind or ventilation.

Boiling Point: − 28° F.

Autoignition Temperature: 1204° F.

Flammable Limits: 16% to 25%

One gram of NH_3 absorbs 327 calories of heat. When vaporized, one part by volume of liquid becomes 855 parts by volume of gas.

While ammonia does have a flammable range, ignition other than in very confined areas is not common, as the vapors tend to dissipate rapidly in the open. In fact, when shipped, the Department of Transportation allows a green placard placement, which classifies the shipment as a non-flammable gas.

As ammonia is very soluble, its vapor clouds can be readily controlled by water spray. The maximum allowable industrial exposure for an 8 hour period is 50 ppm. At leak operations, impermeable clothing should be worn.