



National Transportation Safety Board

Washington, D.C. 20594

Hazardous Materials Accident Brief

Accident No.: DCA-96-MZ-001
Transportation Mode: Rail
Type of Accident: Tank car failure and release of poisonous and corrosive vapors
Location: Gaylord Chemical Corporation, Bogalusa, Louisiana
Date and Time: October 23, 1995, about 4:45 p.m.
Shipper: Vicksburg Chemical Company
Tank Car Specification: DOT 105A500W
Tank Car Manufacturer: Union Tank Car Company
Injured: 4,710 people were treated at area hospitals,
of whom 81 were admitted
Evacuated: Approximately 3,000 people
Material Released: Nitrogen tetroxide, a poisonous material (oxidizer)
Type of Failure: Corrosion

Accident Narrative

At 3:55 p.m. on October 23, 1995, at the Gaylord Chemical Corporation plant in Bogalusa, Louisiana, yellow-brown vapors began leaking from the dome of the DOT class 105A railroad tank car UTLX 82329 that contained a mixture of nitrogen tetroxide, which is a liquefied poisonous gas and oxidizer, and water. The vapors initially formed a plume between 10 and 15 feet in diameter. Plant personnel notified emergency response agencies and used two plant fire hoses to spray water into the plume to suppress the vapors. About 4:30 p.m. Bogalusa fire personnel arrived at the plant and set up fire hoses to help-suppress the vapors.

The head on the B-end of the tank car failed about 4:45 p.m., resulting in one end of the tank car jacket being torn away and thrown about 350 feet. The tank car was then propelled 35 feet down the track and derailed at a track bumping block. A large reddish-brown vapor cloud was released from the tank car. Vapors continued to be released from the opening in the tank car for another 36 hours until the chemical reaction that had occurred within the tank was brought under control through neutralization and dilution.

Some 3,000 people were evacuated from the area as a result of the vapor cloud. Of 4,710 people who were treated at local hospitals, 81 people were admitted.

Events Preceding the Accident

On September 14, 1995, nitrogen tetroxide vapors had leaked at a valve on the tank car while it was at the Gaylord plant. A mechanic sprayed water to suppress the vapors and then directed the water stream onto the valve stem as the tank car was unloaded. When the water

was turned off could not be determined. Another mechanic stated that the water was no longer being applied over the valve on September 22, when employees of the Union Tank Car Company (manufacturer and owner of the tank car) arrived at the plant to replace the valve; they replaced four valves. Postaccident examination of those valves removed from the tank car disclosed that one valve stem had significant wear.

The tank car was moved to the Vicksburg Chemical Company in Vicksburg, Mississippi, on September 26, for another load of nitrogen tetroxide. On October 5, the chemical company recorded that the tare weight of this tank car was 9,500 pounds over the marked weight for the tank car. A Vicksburg employee noticed the new valves on the tank car and assumed that the car had been rebuilt and that the tank car's trucks had been replaced, thus changing the weight. He did not, however, verify these assumptions. The tank car was then filled with approximately 10,000 gallons (110,000 pounds) of nitrogen tetroxide. A quality check had been conducted on the nitrogen tetroxide before it was transferred to the tank car, and it was found to meet the specifications of the Gaylord Chemical Corporation. No quality check was performed on the material after it was loaded into the tank car. The loaded tank car was returned to Gaylord.

On October 12, Gaylord mechanics began transferring nitrogen tetroxide from the tank car to a storage tank. While this transfer was taking place, the material in the storage tank was simultaneously being transferred into the plant. At 9 a.m., the process safety interlocks shut down the chemical reactor. Gaylord's investigation into the cause of the chemical reactor shutdown revealed that the nitrogen tetroxide had been contaminated with water. To prevent corrosion damage from nitric acid, which results when water reacts with nitrogen tetroxide, Gaylord decided to transfer the contaminated material from the tank car and storage tank into stainless steel highway cargo tank trailers. A meter was used to measure the amount of product transferred from the tanks. A pressure gauge with a maximum calibrated pressure of 100 psig was used to monitor the internal pressure of the tank car.

Overnight, between October 12 and 13, the meter indicated that 10,100 gallons of product were transferred from the tank car into two cargo tanks. No other check was made on the tank car or the cargo tanks before the accident to determine how much material had been transferred. When the transfer operation was stopped, a material sample was taken from the transfer system; the sample contained a small amount of green liquid with foam. At 4 a.m. on October 13, Gaylord employees believed the tank car was empty, except for a small amount of residual material that could not be pushed up through one of the eduction pipes, and water was added to the tank car to dilute this residual material. Postaccident weighing of the material loaded into the two cargo tanks revealed that only 491 gallons (6,080 pounds) had been transferred. Postaccident examination of the tank car showed that the carbon steel eduction pipes had corroded and that only a small section of each, near the top of the tank, remained.

No work was performed on the tank car for several days while Gaylord employees were cleaning, testing, and inspecting the plant storage tank. On October 16, Gaylord determined that the vapors coming from the tank car were excessive, indicating that the material in the tank car was not dilute enough to permit discharge of the residual material into the plant sewer system. Plans were made to transfer the residual material into another cargo tank, but these plans were changed when vapors started leaking from the manway of another cargo tank

that had been filled with material from the storage tank. Gaylord determined that several cargo tanks had gaskets and valves that were not appropriate for nitrogen tetroxide and fuming nitric acid and between October 17 and 20 replaced these gaskets and valves.

On October 19, material samples obtained from the tank car and the three cargo tanks were taken to the Vicksburg Chemical Company for chemical analysis. Gaylord employees began the transfer of the material remaining in the tank car on October 20, and by 6 p.m. that day, the meter indicated that 6,700 gallons of material had been transferred from the tank car to a cargo tank. At the conclusion of the transfer, a material sample taken from the transfer system was observed to contain foam and a very small amount of green liquid. Postaccident weighing of the material loaded into this cargo tank revealed that only about 850 gallons (10,520 pounds) of material had been transferred.

Water was added to the tank car using a fire hose to purge and clean it; the addition of water was discontinued when the internal pressure of the tank car rose to between 60 and 65 psig. Gaylord employees vented the vapors from the tank car through the plant scrubber to lower the pressure in the tank car. Later on the evening of October 20, Gaylord employees began emptying the material from the tank car into the plant sewer system; after 2 or 3 minutes, a large vapor cloud was released, and the unloading was stopped. On October 21, a Gaylord employee twice added water to dilute the material in the tank car and vented the vapors through the scrubber. The internal pressure of the tank car increased each time the water was added.

On October 23, the gauge on the tank car indicated that the internal pressure was 18 psig. Plans were made to complete the emptying and the cleaning of the tank car. At 12:54 p.m., Gaylord received the results of the chemical analysis of the material sample obtained from the tank car on October 19. The results indicated that the material was wet nitrogen tetroxide. These results were unexpected because Gaylord believed that on October 13 the nitrogen tetroxide had been unloaded from the tank car and that the residue had been diluted with water. After discussing the apparent discrepancy with the Vicksburg laboratory specialist who had tested the sample, Gaylord personnel decided the sample may not have been representative of the material in the tank car.

Between 1:30 and 1:45 p.m. on October 23, Gaylord employees put more water into the tank car, and the internal pressure rose from 18 to 80 psig in 4 to 5 minutes, at which point the water was turned off. About 2 p.m., the pressure reached 92 psig and then slowly began to decline. The plant scrubber was still being used to vent the vapors from the tank car, and an additional hose was run from one of the tank car valves to a water-filled drum for additional venting. The internal tank car pressure was 55 psig by 2:30 p.m. When Gaylord employees reopened the fire hose, the pressure rose to 100 psig, which is the maximum calibrated pressure on the gauge. The water was turned off, and the vapors were again vented. At 3 p.m., the pressure appeared to be falling, but at 3:30 p.m., it was still above the measurement limit of the gauge and appeared to be rising. At 3:55 p.m., a yellow-brown vapor was observed leaking from the dome of the tank car. The head on the B-end of the tank car failed about 4:45 p.m. releasing a huge reddish-brown vapor cloud.

Postaccident examination of the safety relief mechanism mounted in the dome revealed that it had recently activated. (Activation pressure is about 375 psig.) The examination also revealed an 8-inch-high by 66-inch-wide corroded opening in the B-end head of the tank car near the top. In addition, at least three distinctive horizontal bands of corrosion were found near the top of the interior tank wall; one band was at the same level as the opening in the tank head.

Postaccident Actions

Gaylord Chemical Corporation has discontinued the use of tank cars to transport nitrogen tetroxide and now uses smaller tanks that hold only 3 percent of the volume capacity of the tank car involved in the accident. Cargo purity assurance procedures, including the testing of cargo before and after loading, have been implemented to prevent the transport of contaminated cargo. The plant has additionally installed equipment to warn residents of any accidental release and, in coordination with the city of Bogalusa, has developed emergency procedures and conducted training.

The tank car destroyed in this accident was the last carbon steel tank car in use that had been approved by the US Department of Transportation for transporting nitrogen tetroxide.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the lack of adequate procedures on the part of the Gaylord Chemical Corporation and the Vicksburg Chemical Company to prevent or detect the contamination of nitrogen tetroxide with water, resulting in the formation of an extremely corrosive product and the subsequent failure of the tank car. Contributing to the severity of the accident were the Gaylord Chemical Corporation's inadequate procedures for emergency transfer of contaminated cargo from the tank car.

Recommendations – None

Adopted 1/27/98