



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

log P-281

Date: April 17, 1986

In reply refer to: P-86-3 through -8

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About 10:50 a.m., on August 22, 1985, liquid methane was being drained from the cold box 1/ into a vertical aluminum tank 3 feet in diameter and 7 feet tall (vessel 17.23A) at the Alabama Gas Corporation's (Alagasco) natural gas liquefaction plant in Pinson, Alabama. There was no pressure gauge on the tank. Shortly after the liquid methane began entering vessel 17.23A, the weld attaching an 8 1/4-inch by 12-inch aluminum plate that was being used to cover a hole that had been cut in the side at the bottom of vessel 17.23A failed. The pressure within the tank propelled the plate 24 feet away into a building which housed a control room, a boiler room, and offices. Some of the windows in the control room were blown inward, and methane escaping from the opening in vessel 17.23A entered the building, where it was ignited by one of several available ignition sources. Six persons were injured, and damage to the plant was estimated to be more than \$1 million. 2/

On the morning of the accident, temperature gauges in the control room of the liquefaction plant indicated that the third stage of the methane heat exchanger in the cold box was becoming restricted by frozen compressor oil. The accumulation of frozen compressor oil in the third stage of the methane heat exchanger is a routine occurrence because of the design of the compressor piston ring forced-feed lubrication system. When the excess oil that is moving with the methane encounters the cold temperatures of the third-stage heat exchanger, it congeals and adheres to the heat exchanger. Upon instruction by the plant manager to defrost the third stage of the methane heat exchanger, the plant operator, with the help of two trainees, began to shut down the plant for defrosting. The steam boiler had been lit; the pressure in the liquid ethylene system had been reduced; the compressor had been blocked in by closing the discharge and suction valves; the plant feed gas valve had been closed; ethylene had been moved from the second and third stages to the first-stage heat exchanger and was being drained into storage; the ethylene, propane, and methane discharge valves had been closed; and the ethylene, propane, and methane suction valves had been closed. The plant operator and the two trainees were opening manually operated valves to drain liquid methane from the cold box into vessel 17.23A when they heard a noise that sounded like a relief valve opening and felt the platform on which they were standing shake. One of the trainees saw the plate that had been welded to vessel 17.23A being propelled through the air and strike the control room building.

1/ A cold box consists of heat exchangers, separators, vessels, and associated piping, all of which are enclosed in an insulated shell.

2/ For more detailed information, read Pipeline Accident/Incident Summary Report-- "Alabama Gas Company, Pinson, Alabama, August 22, 1985" (NTSB/PAR-86/01/SUM).

Liquid methane has a temperature of approximately minus 260 degrees F, and when converted to a gaseous state each cubic foot of liquid provides 618 cubic feet of gas. In this accident when the liquid methane initially entered vessel 17.23A, the vessel was at ambient temperature. When the cold liquid came in contact with the relatively warm vessel, it immediately began to vaporize, thereby increasing the pressure in vessel 17.23A. The investigation revealed that the noise heard by the employees and likened to that of a relief valve opening was caused by the separation of a 1-inch-diameter plastic hose that was being used as a substitute for a metal pipe connection to couple two pieces of 1-inch-diameter copper pipe. When the aluminum plate failed on vessel 17.23A, vessel 17.23A was propelled back about 3 inches into the platform on which the operator and the two trainees were standing, causing the platform to shake.

An operator of the plant stated that on June 25, 1985, he observed a leak of material from vessel 17.23A around the plate and entered his observation in the plant logbook. The assistant plant manager acknowledged this entry in the logbook. The assistant plant manager stated that because of the logbook entry a contractor had been contacted and had visited the plant to provide the company with an estimate for repairing or replacing the vessel with a stainless steel tank. The contractor provided to the Safety Board a copy of his estimate dated August 21, 1985. Title 49 CFR 193.2603(a) and (b) require that each component in service, including its support system, be maintained in a condition that is compatible with its operational or safety purpose by repair, replacement, or other means, and that an operator not place, return, or continue in service any component that is not maintained in accordance with this subpart. Therefore, the plant operator in this instance should not have continued this vessel in service.

During the investigation, three current plant operators, two trainees, and a previous plant manager were interviewed to learn of the procedures they would use in performing a similar defrost operation. All but one person had to refer to the engineering flowsheet for locating the valves to be operated; the other visually traced each external pipe to locate the control valve. None used the operating manual which identifies for each operation the valve to be operated and the sequence of operation. No two persons operated the valves in the same sequence. The one operator who did not use the engineering flowsheet often referred to it when asked specific questions. The former plant manager stated that failure to operate the plant in the prescribed manner could damage the equipment and create unsafe conditions. The engineering flowsheet had not been kept current. A 4-inch-diameter pipe connecting the exhaust of several relief valves to vessel 17.23A was not shown on the flowsheet, and the piping from which the plastic hose separated during this accident was not shown on the flowsheet as entering the header between the cold box and vessel 17.23A.

A postaccident inspection of the plant revealed many deficient maintenance conditions. At one point in time a numbered tag had been attached to each valve; the tags conformed with numbers identifying valves shown on an engineering flowsheet used by plant operators. Some of these tags were incorrect or missing at the time of the accident, and many valve tags as well as gauges could not be read because paint obscured the numbers and gauge dials. Some of the gauges had glass missing or broken, some had the back cover missing, and some were deteriorated due to the glass not being in place. Liquid was found trapped between some of the glass coverplates and gauge dials, which made them difficult to read. Electrical junction boxes within the plant were open, exposing the wiring to the weather and to flammable gases. Some valve handles were missing, and their stems showed indications of having been operated by pipe wrenches.

Covers for some electrical control panels in the building housing the control room and in another building housing the auxiliary generator control room were not positioned properly to enclose the panels, and they appeared to have been open quite some time before this accident.

During a normal work week, the day shift at the Pinson plant consists of six persons. The evening, night, and weekend day shifts are staffed with only one person. When there is only one person at the facility, that person is required to make hourly reports by telephone to Alagasco's North Birmingham Station and to wear a radio transmitter which, when activated, generates a tone at Alagasco's North Birmingham Station. When this tone is received, the North Birmingham Station personnel notify by telephone the persons on a call list, and those notified are to report to the plant. Should the North Birmingham Station fail to receive hourly a call from the plant operator, station personnel will first call the plant. If there is no answer at the plant, persons on an emergency notification listing of company personnel and emergency response agencies are next called. The first person on the list to answer the call is required to go to the plant to determine the reason for the failure of the plant operator to answer the telephone and to take any necessary emergency action. The accident on August 22 damaged the telephone system at the plant, and the plant manager was forced to go to a nearby manufacturing plant to notify emergency responders.

At the time the Pinson plant was constructed, there were no standards for the construction of natural gas liquefaction plants. However, 49 CFR Part 193 states that the construction, operation, and maintenance of such plants, and the qualification and training of personnel employed at such plants, must comply with current standards and that facilities that are replaced or significantly altered must comply with Federal regulation 49 CFR 193.2005(b), which states, in part, that the design, installation, and construction of a facility "must meet the applicable requirements of the National Fire Prevention Association [NFPA] Standard 59A (1972 edition)." The current NFPA standard requires a distance of 50 feet between equipment containing volatile gases and control rooms, offices, shops, and other occupied structures.

At the Pinson plant the building housing the control room and the boiler room was within 24 feet of equipment that contained volatile gases and liquids. Because the regulations use the term "significantly altered," which is subject to interpretation, the Safety Board is concerned that if the building is rebuilt at the same location, it could be subject to damage in similar accidents. The building should be reconstructed in compliance with 49 CFR 193.2005(b). The Board is further concerned about the potential for accidents if the operators and trainees do not follow the plant operating manual and if the plant is not maintained as designed.

Therefore, the National Transportation Safety Board recommends that the Alabama Gas Corporation:

When reconstructing the control room and boiler room building at its Pinson, Alabama, natural gas liquefaction plant, provide a minimum separation of 50 feet between the building, which may contain numerous ignition sources and equipment containing flammable gases. (Class II, Priority Action) (P-86-3)

Develop and implement a program for monitoring compliance with its operating procedures by employees at its natural gas liquefaction plants, and correct deficient actions. (Class II, Priority Action) (P-86-4)

Develop and implement maintenance practices at its natural gas liquefaction plants in compliance with applicable standards (49 CFR Part 193 and the National Fire Prevention Association Code), and maintain the operating equipment in optimum condition. (Class II, Priority Action) (P-86-5)

Develop, in coordination with local emergency response agencies, a system independent of the telephone to notify without delay fire, police, or other local safety officials about emergency conditions at its natural gas liquefaction plants. (Class II, Priority Action) (P-86-6)

Revise its engineering flowsheet and operating manual for its natural gas liquefaction plants to reflect accurately current facilities, and keep the flowsheets and manuals current. (Class II, Priority Action) (P-86-7)

Determine through inspection of each valve and pipe system identified by number on the engineering flowsheet that all valves and pipe systems are identified correctly by an identification tag and that each tag is legible. (Class II, Priority Action) (P-86-8)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "...to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER, Member, concurred in these recommendations.

By: 
Chairman