

Appendix P

LNG Facility and Carrier Safety Record

LNG Land-Based Facility Safety Record

A review of available information is limited to land-based LNG facilities and indicates there have been only seven documented incidents with one or more (worker and/or public) fatalities associated directly with operations at land-based LNG facilities; (1) Skikda, Algeria, January 2004; (2) Bontang, Indonesia, (3) Maryland, United States, 1979; (4) Arzew, Algeria, 1977; (5) New York, United States, 1973; (6) Raunheim, Germany, 1966; and (7) Ohio, United States, 1944. Two of the seven incidents were related to construction or maintenance activities at the LNG facilities and not directly to LNG operations (CH-IV International 2006). These incidents include:

- **Skikda, Algeria, January 2004.** Available reports suggest that a gas cloud of unknown origin found a source of ignition in a boiler resulting in a large fire. Twenty-seven individuals were killed in the incident. The preliminary investigation suggests more liberal use of gas detection instruments in LNG facilities as a preventative measure, especially in the vicinity of air intake devices (CEC 2004; Kornfield et al. 2004).
- **Bontang, Indonesia, 1983.** An overpressure explosion occurred due to a valve being inappropriately in the closed position during facility maintenance. Three individuals were killed. Industry analysts have classified this as a maintenance accident since no LNG was present in the system (CH-IV International 2006). Current standards and practices for management of valves in relief systems should prevent recurrence of such an incident.
- **Maryland, U.S., 1979.** An explosion occurred in an electrical substation at a LNG receiving terminal. One individual was killed. No gas detection system was installed in the substation because natural gas was never expected to enter. As a result of the incident, design code changes were made and applied industry-wide (CH-IV International 2006).
- **Arzew, Algeria, 1977.** Due to the rupture of a cast aluminum valve, LNG was released from an inground storage tank. One worker was killed. Industry standard practice now is to use stainless steel for fabrication of large valves (CH-IV International 2006).
- **Staten Island, New York, U.S., 1973.** A LNG tank was out-of-service for repairs. Mylar and foam liner materials ignited, leading to temperature rise and pressure surge. The pressure surge caused a roof collapse, killing 37 workers who were inside the tank. The investigation classified this as a construction accident, not a LNG accident (CH-IV International 2006). Compliance with OSHA requirements for confined space entry and hot work should prevent recurrence of such an incident.
- **Raunheim, Germany, 1966.** Accidental venting occurred while LNG was being passed through a vaporizer that used a liquid level controller to operate below its maximum capacity of 4000 kg. The resulting vapor cloud drifted towards a control room resulting in fire and explosion, killing one. It was determined that the liquid level failed and as a result around 500 kg of LNG was vented out of the vaporizer (ÅF Industry AB and SSPA Sweden AB 2011).
- **Cleveland, Ohio, U.S., 1944.** A LNG storage tank built with low-nickel content steel failed shortly after being placed into service, resulting in a leak and subsequent fire that killed 128 people. The investigation concluded that, had the tank been built to code, the accident would not have occurred (CH-IV International 2006).