



Step into our TestSafe Time Machine and revisit some of the amazing things that we have done over the years.

MAJOR EXPLOSION ROCKS SYDNEY

At about 9:56 pm on the evening of April Fools Day 1990, a 100 Tonne LPG storage tank ruptured and released about 47 Tonnes of LPG. Technically this was a BLEVE (Boiling Liquid Expanding Vapour Explosion) the biggest to ever occur in the Southern Hemisphere. The fireball ascended several hundred meters into the air, and the explosion was heard throughout Sydney. As a result of the explosion, many thousands of people were evacuated from the surrounding suburbs of St Peters, Erskineville and Marrickville, and Sydney Airport was temporarily shut down. The emergency responders who attended the scene were exposed to a terrifying and life-threatening situation. Their bravery, training and good judgement undoubtedly saved lives.



Arial view of the BORAL Gas site after the fire.

Note: LPG terminal (centre), fire damage to warehouses (centre left), Tank No:1 in Shea's Creek (right), and the destroyed Bottle Filling Shed (bottom right).



View of the LPG terminal before the explosion. Note: Red drencher pipes above and below each tank, and the LPG Road tanker in a similar position to that of the night of the explosion

The Site

The LPG Terminal was built in 1969 and contained a number of 100 Tonne elevated LPG tanks. In the weeks prior to the explosion, BORAL Gas was in the process of installing new safety systems that would enable isolation of the tanks from the distribution manifolds and associated pipes. This was only two weeks from completion when the explosion happened. Had these tanks been isolated then the explosion would have been avoided.



View of the LPG terminal after the explosion. Note: damaged manifold and pipes (centre left), Tank No 1 missing (centre right), remains of the destroyed LPG Road Tanker (far right) and discharge pipes from the PRVs on the top of each tank

Sequence of events

On the 1st of April, there was 346 Tonnes of LPG at the depot. Some time that Sunday evening, after all staff had left the BORAL Gas St Peters site, a small leak of propane started somewhere on a manifold below Tank No: 1. The escaping vapour formed a cloud at ground level, which eventually came into contact with an ignition source some time around 7:00pm.

Between 7:00pm and 8:50 pm, the LPG manifold fire grew to over half a Gigawatt in size. The fire spread enhanced via failures of the hydrostatic relief valves located on the Liquid Manifold, and consequent melting of metal pipes. Because the isolation valves were open back to the LPG tank, these pipes were able to feed the growing fire without interruption.

By about 8:50 the radiant heat and direct flame contact from the manifold fire had heated the 100 Tonne tanks sufficiently to raise their internal pressures to dangerous levels. The Pressure Relief Valve (PRV) on Tank 1 had started to cycle on and off so as to relieve this pressure. The propane vapour that was released ignited and formed jet flames 40 m high.

At 8:55 pm the Fire Brigade received an emergency call. The Fire Brigade arrived at 9:12 pm and observed Tank No: 1 had an intense fire involving its pressure relief valve and the large fire at the manifold.

At approximately 9:19 pm the PRV on Tank No: 2 operated. One minute later members of the Fire Brigade heard a high-pitched sound and withdrew some distance from the fire.

At 9:39 pm Tank 3 ruptured at the top of its hemispherical end forming a 300mm x 75mm slit. The ignited vapour produced a fan shaped flame 80m high. The Tank emptied over a period of about 6 mins.

Between 9:39 and 9:56, the PRV on Tank No: 1 remained continuously open. Tank No: 2 also ruptured in a similar way to Tank 3. The thermal radiation was so intense that tyres caught fire on many LPG Road Tankers parked nearby, and the PRVs on their tanks started to operate.

At 9:56 pm Tank No: 1 ruptured. A Boiling Liquid Expanding Vapour Explosion (BLEVE) occurred, as the heated end of the tank tore away. The resulting fireball was some 200 m in diameter, ascended 1 kilometre into the air and lasted for 14 seconds.



Tank No 1 resting in Shea's Creek, about 150m from the depot

The main part of the Tank rocketed 150m into nearby Shea's Creek. The Tank impacted and destroyed a LPG Road Tanker parked beside the Tank and a 500kVA electrical sub station. The fireball, and discharged propane, ignited fires in warehouses adjacent to the depot.

At about 10:05 pm, a major fire also developed in an LPG Bottle Filling Shed with numerous domestic sized cylinders of LPG bursting and shooting spectacularly into the sky.

The fire continued until 1 am the following morning when the Fire Brigades considered the fire under control.

Contributing Factors

The following factors contributed to this fire and explosion: -

1. The site was vacant on the Sunday afternoon, so there was no staff on site who could have intervened or raised alarm at an early stage of the fire.
2. The pipes and manifolds were open to the LPG Tanks so that any leak could potentially drain hundreds of tonnes of LPG.
3. The fire and leak alarms that were installed were not connected to the Fire Brigades.
4. The signs for the controls of the drencher system were not able to be read, so that the Fire Brigades could not switch on water sprays which could have cooled the tanks.
5. The orientation of the hydrostatic relief valves on the liquid propane manifold projected vapour in the direction of pipes also containing propane, and so caused progressive failures to pipes and escalation of the fire.

Industrial Relations Commission Judgement

Chief Inspector Richard Clarke on behalf of a large investigation team brought two matters before the Court under sections 15 and 16 of the Occupational Health and Safety Act 1983.

Justice Bauer found BORAL Gas guilty of the two offences. It was fined a total of \$35,000 and order to pay costs (which were considerable).

Conclusion

The investigation of this event was a major effort by many WorkCover and TestSafe (then LOSC) staff. The capacity to undertake such highly demanding, lengthy and arduous investigations is a great strength of the organization and needs to be maintained.

TestSafe stands ready to assist WorkCover to investigate these kinds of adverse events at Major Hazard Facilities and other depots where dangerous goods are stored and continues to provide a range of other specialist accident investigation services for WorkCover.

The BORAL Gas BLEVE had many outcomes including the establishment of the 1991 Chemical Inquiry and the completion of an audit of all major LPG Depots in NSW. This was undertaken by the current State Co-ordinator, Dangerous Goods, Doug Gibbins. The explosion was also the catalyst for the establishment of the Stored Chemical Information Database (SCID).

It is most fortunate that no one was injured or killed as a result of this fire and explosion. However, history shows that these kinds of events will occur from time to time when safety systems either fail or are non-existent.