

CSB SAFETY SPOTLIGHT: IMPLEMENTATION OF A SAFETY MANAGEMENT SYSTEM IS KEY TO A SAFER CHEMICAL INDUSTRY



U.S. Chemical Safety and
Hazard Investigation Board

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The U.S. Chemical Safety and Hazard Investigation Board (CSB) spotlights the actions of Airgas, Inc., an Air Liquide Company (Airgas), for its rapid and comprehensive response to CSB recommendations. Though the Occupational Safety and Health Administration's (OSHA's) Process Safety Management (PSM) standard does not apply to its business, Airgas is driving chemical safety change through its rapid and comprehensive actions in developing and implementing company-wide process safety management components for its nitrous oxide operations.

Summary of Incident and Key Findings

On August 28, 2016, a nitrous oxide trailer truck exploded at the Airgas manufacturing facility in Cantonment, Florida. The explosion fatally injured the only Airgas employee and heavily damaged the facility. The CSB determined that the most probable cause of the incident was that, during the initial loading of a trailer truck, a pump heated nitrous oxide above its safe operating limits. This likely started a nitrous oxide decomposition reaction that propagated from the pump into the trailer truck, causing the explosion.

The CSB investigation found that Airgas did not have an effective safety management system that identifies, evaluates, and controls process safety-related hazards like those that led to the explosion. Following the incident, the company quickly began a comprehensive initiative to review the safety programs for its nitrous oxide production facilities, trucking fleet, and cylinder-filling operations. The scope of this safety initiative, which includes 17 different areas for process safety improvements (e.g. inherently safer design, hazard analysis, and management of change (MOC), etc.), and Airgas's status of implementation at the time the recommendation was issued is provided [here](#).



Post-incident photo that shows damage from the 2016 fatal explosion in Cantonment, Florida.

As a result of the investigation and in recognition of the proactive work Airgas initiated prior to the completion of our investigation, the CSB issued a single recommendation to the company to complete its "in-progress" post-incident actions and to continue safety initiatives for its nitrous oxide operations.

Rapid and Comprehensive Implementation of PSM Components

Airgas embraced the challenge and aggressively pursued actions to close out the CSB recommendation. These actions resulted in an approach that now exceeds the quality of a number of similar company safety programs where such operations are covered by the OSHA PSM standard.

Airgas developed and implemented recommended PSM components for its nitrous oxide business by creating a new Industrial Risk Management Program, a process hazard analysis methodology, a management of change procedure, and a

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Photo showing explosion damage at the Airgas facility in Cantonment, Florida.

project design authority within the company, and by initiating a project risk identification process. These are all now included in written programs that have been added to the company's safety manual and incorporated into company operations.

Some of the company's most significant actions focused on initiatives typically associated with the most effective and preventive efforts found in

- the hierarchy of controls,
- inherently safer design,
- engineering solutions,
- hazard evaluation, and
- improved audit practices.

Airgas also strengthened its facility operations by implementing the following improvements:

- adding technical and hourly staffing,
- applying more appropriate transfer pumps for nitrous oxide service,
- upgrading maintenance requirements for flame arrestors (this followed a significant technical review of existing flame arrestor technology),
- updating procedures and training for drivers and operators during transfer operations, and
- issuing personal gas monitors to personnel to help eliminate or mitigate potential exposure to nitrous oxide.

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Hazard Investigation Board

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Post-incident photo of the administrative and operations building at the Airgas nitrous oxide manufacturing facility in Cantonment, Florida nitrous oxide manufacturing facility.

Closing out the Recommendation, Improving Airgas Safety and Helping Industry

The volume, depth, and pace of Airgas's actions in response to the CSB investigation and recommendation are laudable. Several components of the CSB's recommendation required literature reviews, third-party engineering assessments, policy development, senior level hiring, audits, training for operations personnel, and the application of new approaches. Despite the scope and breadth of these activities, Airgas met with the CSB investigation team and members of the CSB Office of Recommendations in March 2019 to discuss status of the recommendation and then provided a formal written presentation. In May 2019, Airgas responded formally to the CSB documenting the successful close-out of the actions taken in response to the CSB's recommendation.

In a little more than two and a half years, Airgas reengineered its entire approach to managing process safety in its nitrous oxide business. Airgas also increased its efforts aimed at sharing lessons learned and good safety practices, both inside the company and with the broader compressed gas industry. In addition, Airgas implemented new information-sharing practices internally, which connected to ongoing engineering assessments, audits, and training for operations personnel.

Conclusion

The CSB acknowledges Airgas's actions to advance chemical safety by identifying and implementing important safety changes even before the CSB investigation concluded. As a result, Airgas exceeded the CSB's recommended actions by developing and rapidly executing comprehensive process safety changes that have broadly applicable lessons for the entire compressed gas industry.