



## U. S. Chemical Safety and Hazard Investigation Board RECOMMENDATION STATUS CHANGE SUMMARY

<b>Report:</b>	Airgas Facility Fatal Explosion
<b>Recommendation Number(s):</b>	2016-4-I-FL-R3
<b>Date Issued:</b>	March 17, 2017
<b>Recipient:</b>	Compressed Gas Association
<b>New Status:</b>	Closed – Acceptable Alternative Action
<b>Date of Status Change:</b>	April 1, 2021

### Recommendation Text:

#### *Ensure Effective Flame Arrestor Design*

*Modify Compressed Gas Association (CGA) standard CGA G-8.3, Safe Practices for Storage and Handling of Nitrous Oxide to require testing of safety devices, such as strainers used as flame arrestors, for applications where a safety device is used to quench a nitrous oxide decomposition reaction. To ensure that these safety devices meet the intended purpose, the user should test the safety device by simulating conditions of use. In addition, require users to document the required performance standard or test protocol followed.*

### Board Status Change Decision:

#### A. Rationale for Recommendation

On Sunday, August 28, 2016, at approximately 12:10 p.m., a nitrous oxide trailer truck exploded at the Airgas manufacturing facility in Cantonment, Florida. The explosion fatally injured the only Airgas employee present and heavily damaged the facility, halting nitrous oxide manufacturing at Cantonment indefinitely. The U.S. Chemical Safety and Hazard Investigation Board (CSB) determined that the most probable cause of the incident was that a pump heated nitrous oxide above its safe operating limits during the initial loading of a trailer truck. This most likely started a nitrous oxide decomposition reaction that propagated from the pump into the trailer truck, causing the explosion.

As a part of its investigation, the CSB reviewed relevant industry standards by the Compressed Gas Association (CGA). The CSB determined that CGA G-8.3, Safe Practices for Storage and Handling of Nitrous Oxide require testing of safety devices where a safety device is used to quench a nitrous oxide decomposition reaction. The CSB issued three recommendations to CGA. This evaluation is specific to CSB Recommendation No. 2016-4-I-FL-R3.

#### B. Response to the Recommendation

CGA informed the CSB that they published the third edition of *CGA G-8.3, Safe Practices for Storage and Handling of Nitrous Oxide* (CGA G8.3) in November of 2019. The newest edition advises that equipment used shall be designed, constructed, and tested in accordance with the

regulatory requirements and prohibits the modification of filters or strainers with steel wool or similar packing to make flame arrestors. Additionally, G-8.3 focuses on preventing decomposition reactions and subsequent propagation from loss of prime and excessive temperatures and provides guidance on safety devices for those purposes. Lastly, it applies to existing facilities and equipment. As such, to comply with this guidance, if your equipment has been modified, you are required to correct it.

### C. Board Analysis and Decision

Instead of requiring testing of safety devices, such as strainers used as flame arrestors, for applications where a safety device is used to quench a nitrous oxide decomposition reaction, G-8.3 directs that nitrous oxide equipment be used for its intended purpose and prohibits modification of safety devices to quench decomposition reactions. It focuses on preventing decomposition reactions and its subsequent propagation. Though not the specific action prescribed in the recommendation, the action taken is directed at preventing the hazard in lieu of mitigating the consequences of a decomposition reaction and its propagation. Therefore, it is an acceptable alternative as it provides an equivalent level of safety and meets the safety objectives envisioned by the Board. Based upon the information above, the Board voted to designate the status of **CSB Recommendation No. 2016-4-I -FL-R3** as **“Closed - Acceptable Alternative Action.”**