Detonation of NOx Gums in a Cold Box

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ABSTRACT

On the morning of March 13, 2008, the rupture panels on the top of the Port Arthur cold box opened, releasing a mixture of nitrogen, hydrogen and methane to the atmosphere. A root cause investigation team comprised of cross-functional, cross-company experts concluded that the most probable source of the incident was a decomposition-triggered detonation of ‘NOx Gums’ in a 1-inch drain line in the coldest portion of the cold box.

The NOx Gums formed when a conjugated di-olefin, most likely butadiene, carried over from the first two drums in the chilling train to the fifth drum and reacted with NOx gases that had condensed and accumulated. The heat of reaction was sufficient to initiate a decomposition, which proceeded to a detonation. A 4-foot section of 6-inch piping and a 2-foot length of 1-inch piping were destroyed. Another section of piping and some control cabling adjacent to the detonation source was damaged. Much of the energy of the detonation was absorbed by the Perlite insulation that fills the cold box.

The primary purpose of this paper is to communicate the key lessons learned from this incident to other members of industry and their application to all processes, not just those operating a cold box.

The topics to be covered will include:

- Background information
- Cold box process overview
- History of previous NOx gum incidents
- What happened?
- How did the incident occur?
- Why did the incident occur?
- Application for Industry