Process Safety Lessons from the Investigation of a Chemical Plant Explosion

On June 13, 2013, there was a catastrophic equipment failure, explosion and fire at the Williams Olefins chemical plant in Geismar, Louisiana. The incident occurred during non-routine operational activities that introduced heat to a type of heat exchanger called a 'reboiler,' which was offline, creating an overpressure event while the vessel was isolated from its pressure relief device.

As a result, a worker died at the scene. The operations supervisor succumbed to severe burn injuries the next day. The explosion and fire also injured Williams employees and contractors, who were working on a facility expansion project. In all, 167 people reported injuries.

The fire lasted about 3.5 hours. Williams reported releasing over 30,000 pounds of flammable hydrocarbons during the incident. The plant remained closed for 18 months.

The US Chemical Safety Board investigated the incident and recently released its investigation report. The investigation concluded that process safety management program weaknesses at the plant during the 12 years before the incident caused the reboiler to be unprotected from overpressure. In addition, the company didn't perform a hazard analysis or develop a procedure for the operational activities conducted on the day of the incident.

Some key lessons from this incident include:

- It's important to ensure that the final implementation of PHA action items addresses the original safety concerns identified by the PHA team. Companies should ensure that action items have been effectively implemented and field verified before closing them out.
- Robust Management of Change (MOC) practices are needed to ensure the review analyzes hazards in the entire process affected by the change. Similar to Process Hazard Assessments (PHAs), conducting MOC reviews as a multidisciplinary group composed of individuals with different experiences and different areas of expertise can assist in identifying hazards introduced by a process change. Companies must conduct MOCs *before* implementing a change in the field and shouldn't treat them as a check-the-

box exercise.
- Pre-Start-up Safety Reviews (PSSRs) are key opportunities to verify effective implementation of design intent, accuracy of process safety information, and proper installation and configuration of field equipment. Companies should conduct thorough and effective PSSRs *before* placing equipment in service.
- Operating procedures need sufficient detail to ensure effective performance of critical steps, including performing steps in the correct order. Affected employees such as operators must receive training on the procedures. Management must establish expectations to maintain and follow accurate procedures.
- PHA and MOC teams should effectively use the hierarchy of controls to the greatest extent feasible when evaluating safeguards. For example, pressure relief devices (active safeguards) are higher on the hierarchy of controls than car seals (administrative controls).
- It’s essential to maintain a high level of vigilance when implementing process safety management programs. Only partially or ineffectively conducting elements of PSM programs such as MOCs, PSSRs, PHAs, safeguard evaluations, and procedure development programs can cause significant hazards to be overlooked, which can lead to catastrophic incidents, sometimes years later.

As to safety culture specifically, lessons from this incident have broad application to other organizations. Both a strong written OHS program and effective implementation of that program are required to have good process safety performance. Lessons to consider include:

- Ensure company standards always meet or exceed OHS laws, industry codes and standards, and best practices;
- Verify the facility complies with company standards and procedures through activities such as performing audits and tracking indicators; and
- Assess and strengthen the organizational safety culture including the organization’s commitment to process safety.