Explosion in New Jersey: How a Small Amount of Water Proved Deadly

An Online Continuing Education Course for Engineers

Course Number: H-3006

Credit: 3 Hours / 3 PDH / 3 CPD

Explosion in New Jersey: How a Small Amount of Water Proved Deadly

Introduction

On April 21, 1995, at approximately 7:45 a.m., a violent explosion and fire occurred at the Napp Technologies, Inc. (Napp) specialty chemical plant in Lodi, New Jersey. Five employees of Napp ultimately died (four employees were fatally injured at the site, the fifth employee died several days later due to injuries related to the event). A majority of the facility was destroyed as a result of the fire, and other businesses near the facility were destroyed or significantly damaged. Approximately 300 residents in the area were evacuated from their homes and a nearby school. Additionally, firefighting efforts generated chemically contaminated water that ran off into the streets and nearby Saddle River.

At the time of the explosion and fire, Napp was conducting a blending operation involving water-reactive chemicals. The chemical mixing portion of the operation, which should have been completed in less than an hour, continued for nearly 24 hours. Operators noticed an unexpected reaction taking place in the blender, producing increasing heat and release of foul-smelling gas over time.

The joint chemical accident investigation team (JCAIT) formed by OSHA and EPA determined that the most likely cause of the accident was the inadvertent introduction of water/heat into water-reactive materials (aluminum powder and sodium hydrosulfite) during the mixing operation. The water caused sodium hydrosulfite in the blender to decompose, generating heat, sulfur dioxide, and additional water. The decomposition process, once started, was self-sustaining. The reaction generated sufficient heat to cause the aluminum powder to rapidly react with the other ingredients and generate more heat. During an emergency operation to off-load the blender of its reacting contents, the material ignited and a deflagration occurred which resulted in the deaths of the Napp employees and destruction of the facility.

The JCAIT identified the following root causes and contributing factors of the event:

- An inadequate process hazards analysis was conducted and appropriate preventive actions were not taken. Napp's process hazard analysis identified the water reactivity of the substances involved, but was inadequate to identify and address other factors, including sources of water/heat, mitigation measures, recognition of deviations,

consequences of failures of controls, and steps necessary to stop a reaction inside the blender. Consequently, appropriate prevention actions were not taken.

- Standard operating procedures and training were less than adequate. Napp's standard operating procedures (SOPs) and related training did not adequately address emergency shutdown including conditions requiring shutdown and assignment of shutdown responsibility, and operating limits, including the consequences of deviations, abnormal situations, and corrective steps required.

- The decision to re-enter the facility and off-load the blender was based on inadequate information. Although Napp was aware of, and concerned for, the strong possibility of a fire, there was a lack of knowledge or understanding whether off-loading the blender would have made the situation worse or created the potential for violent deflagration.

- The equipment selected for the GPA blending process was inappropriate. The blender used by Napp for the process was inappropriate for the materials blended.

- Communications between Napp and Technic were inadequate. Napp was carrying out a blending operation for another company. Inadequate communication of hazard information between the companies led to an inadequate process hazard review.

- The training of fire brigade members and emergency responders was inadequate. Napp fire brigade members were not trained to respond to the type of emergency that occurred.

The JCAIT developed recommendations that address the root causes and contributing factors to prevent a reoccurrence or similar event at other facilities:

- Facilities need to fully understand chemical and process hazards, failure modes and safeguards, deviations from normal and their consequences, and ensure that all relevant personnel know the proper actions to take to operate the process safely, recognize and address deviations, return to normal operations, or safely shutdown. This is best achieved though process hazards analyses, standard operating procedures, and training;

- Guidance is needed to address the unique circumstances surrounding tolling arrangements and the responsibilities for hazards assessments and communication of process safety information;

- Facilities should ensure that equipment manufacturers' recommendations for proper use of equipment are followed;

- OSHA and EPA should review the lists of substances subject to the Process Safety Management standard and Risk Management Program regulations to determine whether reactive substances should be added;

- OSHA needs to review the role of MSDSs in conjunction with HazCom, HazWoper, and PSM Standards to clarify that MSDSs should not be used beyond their intended design. Industry should consider additional consensus standards or guidelines to address MSDS consistency and use; and

- OSHA and EPA should consider whether additional guidance or outreach is needed for users to understand the limitations of MSDSs and industry awareness that more than the MSDS is needed to conduct full process hazards analyses.

1.1 Background

1.2 Facility Information

The Napp Technologies, Inc. (Napp) facility in Lodi, New Jersey, was located on Main Street in a mixed industrial/residential section of Lodi. Napp shared a block with other businesses and was directly across the street from homes and retail businesses.

Operations

Napp's primary business is pharmaceutical manufacturing. However, in limited cases, it also performs toll blending operations. In a tolling arrangement a company contracts with another company to perform a specific operation. Typically, the company letting the toll contract lacks the equipment or capacity to manufacture the chemical product. The raw material is delivered to the toll manufacturer, who processes it according to customer specifications, and delivers it to the original company for a fee or toll.

At the time of the explosion, Napp was performing a blending operation to produce ACR 9031, a gold precipitating agent (GPA) under a toll blending arrangement with Technic Inc. (Technic) of Cranston, RI. Lacking the necessary equipment to blend the ingredients, Technic entered into a contract with Napp whereby Technic purchased the components of GPA and had them delivered to Napp to be blended.

The Patterson-Kelley (PK) 125 blender used in the GPA blending operation was located in the PK-125 Blending Room, located in the Pulverizing and Blending Department on the south side of the facility, near the main warehouse area (see Figure 1).

Facility Chemical Review Procedures

Consistent with Napp's "New Product Review" standard operating procedure (SOP), new products that potentially will be used or manufactured at the Napp Lodi facility are subject to an evaluation of employee health and safety, permit requirements, regulatory compliance (FDA, EPA, NJDEP, etc.), equipment suitability, process limitations, and product characteristics. The New Process Review is an internal procedure in which management officials, the Regulatory Affairs Manager, Chemical Manufacturing and Engineering Manager, Operations Director, and Vice President of Regulatory and R&D participate.

The objective of the "New Product Review" procedure was "to establish a uniform policy for evaluating potential products before their use or manufacture on this site."

The Regulatory Affairs Manager initially reviews the job request which may be rejected due to regulatory concerns or company policies. If the request is accepted, the Regulatory Affairs Manager will complete the New Product Review form, assemble relevant documentation, and circulate the package to other Napp management for further review. As part of that management review, the Chemical Manufacturing and Engineering Manager, the Operations Director, and the Vice President of Regulatory Affairs individually review (i.e., no concurrent team review) the package for safety permitting, and process requirements. The last person to review the package returns it to the Regulatory Affairs Manager. Each participant in the review indicates his approval or rejection of the proposal on the New Product Review Form. All of the managers involved in the New Product Review approved of the processing of the GPA.

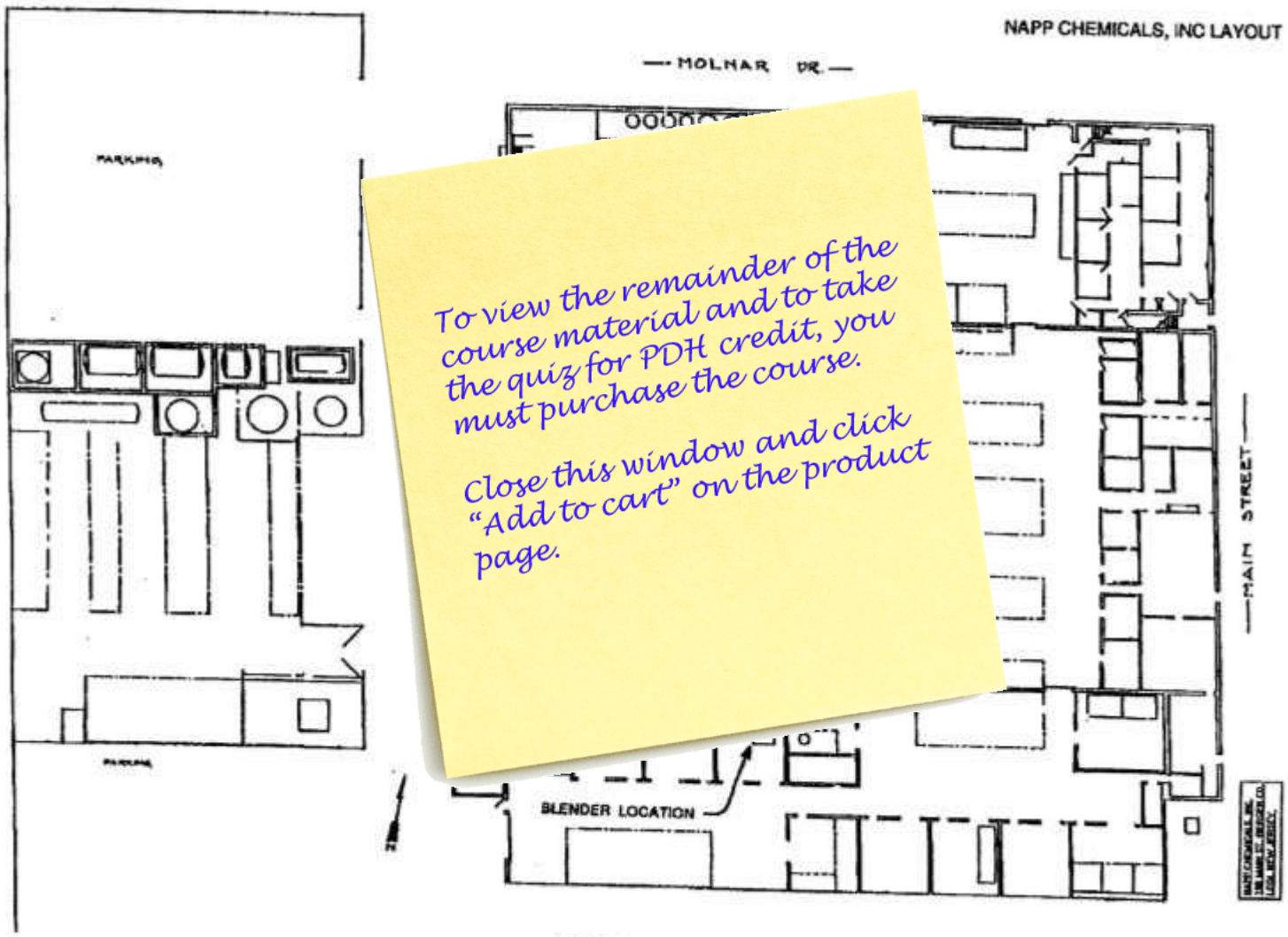

FIGURE 1

To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.

Close this window and click "Add to cart" on the product page.