



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

Report:	CAI/Arnel Chemical Plant Explosion
Recommendation Number:	2007-03-I-MA-R9 2007-03-I-MA-R10
Date Issued:	May 13, 2008
Recipient:	National Fire Protection Association
New Status:	R9: Closed-Acceptable Action R10: Closed-Acceptable Action
Date of Status Change:	April 10, 2013

Recommendations Text:

Recommendation No. 2007-03-I-MA-R9:

Revise Flammable and Combustible Liquids Code (NFPA 30):

- *Prohibit heating flammable and combustible liquids above their flashpoints in tanks inside buildings, unless the tanks are sealed and vented to the building exterior.*
- *Require heated tanks and vessels containing flammable and combustible liquids to have equipment to prevent overheating, such as:*
 - o *Devices to stop the heating process if the temperature exceeds the safe operating limits;*
 - o *Devices to stop the heating process if the flammable vapor control equipment malfunctions (e.g., building ventilation system or heated tank vent); and*
 - o *A heating medium that is unable to heat the tank above safe operating temperatures.*

Recommendation No. 2007-03-I-MA-R10:

Revise The Standard for the Manufacture of Organic Coatings (NFPA 35):

- *Define equipment specifically discussed in the standard, such as kettles and thin-down tanks.*
- *Define the terms "open", "closed", and "sealed" and "vented."*
- *Prohibit heating flammable and combustible liquids above their flashpoints in tanks inside buildings unless the tanks are sealed and vented to the building exterior.*
- *Require heated tanks and vessels containing flammable and combustible liquids to have equipment to prevent overheating, such as:*
 - o *Devices to stop the heating process if the temperature exceeds the safe operating limits;*
 - o *Devices to stop the heating process if the flammable vapor control equipment malfunctions (e.g., building ventilation system or heated tank vent); and*
 - o *A heating medium that is unable to heat the tank above safe operating temperatures.*

Board Status Change Decision:

A. Rationale for Recommendation

On November 22, 2006, a powerful explosion and fire occurred in the middle of the night at the CAI/Arnel ink and paint products manufacturing facility in Danvers, Massachusetts. CAI Inc. (CAI) manufactured solvent-based inks, and stored alcohols, heptane, other solvents, pigments, resin, and nitrocellulose in its Danvers facility. The CSB investigation concluded that an unattended mixing tank overheated inside an unventilated building, causing the release of flammable vapors which subsequently ignited and exploded. The resulting fire, fueled by other flammables stored inside, destroyed the facility and the explosion heavily damaged numerous homes and businesses nearby, some beyond repair. Minor injuries were reported from the community.

Massachusetts regulations require new or modified buildings and structures that use flammable liquids to apply National Fire Protection Association (NFPA) standards, such as the *Flammable and Combustible Liquids Code* (NFPA 30) and the *Standard for the Manufacture of Organic Coatings* (NFPA 35). The CSB investigation found that at the time of the incident, both standards permitted unattended, indoor heating of flammable liquids in unsealed containers as long as adequate exhaust ventilation was provided to prevent flammable vapor accumulation within the building. However, neither standard required automatic shutdown, isolation, or emergency cooling measures, in the event the process overheated or the ventilation system failed to prevent flammable vapor accumulation.

B. Response to the Recommendation:

The National Fire Protection Association revised both NFPA 30 and NFPA 35 to include new requirements to prevent the accumulation of flammable vapors that could ignite and lead to an explosion inside a facility. NFPA 30 now requires that indoor heating of flammables at or above their flashpoints be allowed only if their vapors are vented outside the building. Temperature controls are now required on the process vessels and heat transfer medium (if used) and must be interlocked with the ventilation system in case the ventilation system is turned off or fails. NFPA 35 has also added new requirements that require mixing tanks containing flammables to have temperature controls that automatically shut off when safe operating limits are exceeded. It also requires that exhaust ventilation discharge the vapors to a safe location outside the building to prevent the accumulation of flammable vapors inside the building.

C. Board Analysis and Decision:

The Board reviewed NFPA's response and found their actions consistent with the intent of the CSB's recommendations. Therefore, the Board voted to change the status of Recommendation Nos. 2007-03-I-MA-R9 and 2007-03-I-MA-R10 to "Closed- Acceptable Action."