

The Agitator Stopped! Now What?

November 2023



▲ An explosion and fire devastated a resin facility in Columbus, OH. Read U.S. Chemical Safety and Hazard Investigation (CSB) report No. 2021-04-I-OH for more information.

A flammable vapor release, explosion, and fire incident occurred at a resin facility when a reaction in a kettle was nearly complete. While the operator was not near the kettle, the agitator shut down. The operator began cooling the kettle's contents a few minutes later. The agitator should have been running but it remained stopped.

The operator added solvent into the top of the kettle. The batch temperature was about 430°F (221°C), and the solvent was at approximately 70°F (21°C). Since the temperature was not dropping, the operator looked through the sight glass on the manway and noticed the agitator had stopped. Knowing that the agitator was supposed to run while cooling, he turned it back on.

The agitation mixed the stagnant layers of hot resin and liquid solvent. The solvent vaporized, which quickly increased the pressure inside the kettle, triggering the kettle's high-pressure alarm. Within a few seconds, liquid resin and flammable solvent vapor ejected from the manway and quickly filled the enclosed room with white vapor. The operator tried to turn off the agitator, but failed because he could not see through the vapor cloud and had been sprayed with hot resin. He then evacuated. About two minutes after the release began, the vapor cloud ignited and exploded. One employee was killed, and eight others required medical attention. The resin building was destroyed.

Did You Know?

- Agitators can stop due to mechanical, power, or control failures. Agitator failure may be detected by the control system or through visual inspection.
- When some mechanical failures occur, the agitator motor may be running, but no mixing is occurring.
- Certain process steps, such as sampling, may require the agitator to be temporarily stopped. Operating procedures must explain when to stop and restart agitation.
- Adding a volatile material or solvent to a process above the solvent's boiling point can produce rapid boiling and increase pressure.
- Agitation moves material to the cooling surfaces. When agitation is stopped, cooling is also reduced.
- When the agitator is restarted, volatile materials may vaporize and increase the reactor pressure.
- The decision to restart the agitator depends on many factors, such as the length of shutoff time, the materials in the process, and others. See the August 2018 Beacon on agitator failure for more information.
- Process hazard analyses (PHAs) should include agitator failure and restart as a topic of review and discussion.

What Can You Do?

- Operating a chemical process requires careful monitoring of the process variables, including temperature, pressure, and agitator status.
- When the procedure directs you to stop the agitator and take an action, read the entire step to determine whether to restart it or not after the action is completed.
- If the agitator stops or you find that it did not restart, contact your supervisor to determine the correct action.
- Carefully review agitator failure during PHAs. Many variables must be considered when determining the hazards and proper corrective actions.

When the agitator stops, ask for help!