

Process Interruptions: A Threat to Safety

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▲ Mononitrotoluene (MNT) exploded in this vacuum distillation tower while it was shut down. Image courtesy of the U.S. Chemical Safety and Hazard Investigation Board (CSB).

On Oct. 13, 2002, an explosion in a vacuum distillation tower propelled large fragments of debris, injuring three people. The column contained about 1,200 gal (4.5 m³) of crude mononitrotoluene (MNT) — an energetic and reactive material that can decompose violently when heated. The debris from the explosion caused a storage tank fire and multiple smaller fires both on-site and off-site.

Prior to the explosion, plant startup was delayed because of low product demand, but the MNT column was kept in total reflux until the shutdown was complete. A fire elsewhere in the plant caused operators to isolate heat sources to all columns (including the MNT column) by closing the manual steam block valves and control valves. However, the manual block valves on the MNT column were leaking and the temperature of the material in the column continued to rise. The temperature exceeded 450°F (232°C) in about eight days, causing the runaway reaction and explosion. There was no alarm system or evidence that operations personnel actively monitored the column temperature control system. (Read U.S. Chemical Safety Board Report No. 2003-01-I-MS for more information on this incident.)

Did You Know?

- Some chemicals can decompose, especially when heated, creating additional heat and possibly causing explosions.
- Chemical reactions may continue at a slow rate at temperatures below the usual reaction temperature, but the material can reach decomposition conditions over time.
- Chemical reactions can occur in locations where they are not expected, such as distillation columns and storage tanks.
- Procedures may lack detail for non-standard operations, such as temporarily idling or shutting down equipment when materials are still present in the process.

What Can You Do?

- Follow procedures and equipment isolation plans when equipment is shut down.
- Continue to monitor process parameters and alarms during shutdowns or temporary operations.
- Monitor any chemicals that are left in idling equipment and keep conditions within safe limits. If the safe limits are exceeded, take appropriate action and notify the supervisor.
- If you notice block valves leaking, repair or replace them. Do not expect flow control valves to serve as block valves.

Pay attention to all equipment that contain chemicals — even if it is shut down.