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Messages for Manufacturing Personnel
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"What Happens If?" An Important Question for Hazard Reviews

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▲ A hydrogen explosion occurred during a mixing procedure. Read U.S. Chemical Safety and Hazard Investigation Report No. 2019-03-I-IL for more information.

On May 3, 2019, operators at a plant in Waukegan, IL, were performing a batch operation, manually adding and mixing chemicals in a tank inside a building. An operator pumped an incorrect chemical into the tank. That chemical was incompatible with a chemical already in the tank. The chemicals reacted after they were mixed, and the tank contents foamed and overflowed from the tank top opening. The reaction produced highly flammable hydrogen gas that was released into the building. The hydrogen ignited, and the explosion destroyed the building, killing four employees.

The incompatible chemical was stored in a 55-gal blue plastic drum identical to drums containing the correct chemicals. The only differentiating markings were small labels on the drums and bung caps. The company did not have a written procedure requiring employees to segregate incompatible chemicals in the production building or remove containers after use. In March 2019, two months before this incident, the company had a near-miss involving two chemicals stored in similar 55-gal blue metal drums, in which the wrong material was added to a batch from similar drums. To avoid confusion from similar containers, the company developed a procedure for two people to verify material identity before addition.

This company assessed product manufacturing operations using a technical service request (TSR), which evaluated business and safety risks. However, the TSR did not assess hazards of process operations or establish safeguards, nor was it intended to.

During the incident, workers recognized that a process upset had occurred when the tank overflowed and a fog formed. However, the workers did not recognize the immediate hydrogen hazard created by the upset, which was noted on the safety data sheet (SDS) for the input material.

Did You Know?

- Batch processes can have many manual operations, which increase the possibility for human errors.
- Chemicals are often supplied and stored in similar containers. Proper labeling of those containers is the primary safeguard to prevent a mistake (see the January 2021 Beacon on material identification).
- Many hazard review methods require a review of past incidents with the process. Past events reveal weaknesses that may be present if safeguards are not working well.
- Companies need to conduct thorough process hazard reviews that evaluate potential human errors and error traps. Asking "What if?" or "What happens if?" is important for protecting the workers, environment, and company.
- Blending operations are usually simple mixing procedures with no intended chemical reaction. However, reactions can be caused by possible contamination, wrong material, or material added at the wrong time or step.
- Tanks and mixing vessels should be closed, sealed, and vented to a safe location when in operation to prevent spills and chemical exposures.

What Can You Do?

- When participating in hazard reviews, be honest about possible errors that could occur and errors that have occurred — even those that seem minor.
- Hazard reviews need to evaluate possible reactions even if the process is not designed to have reactions.
- The best way to evaluate possible reactivity issues is to conduct a reactivity review using the unit's reactivity/compatibility matrix. If you are not aware of this matrix, ask your supervisor if a copy is available (see the July 2016 Beacon on such matrices).
- The best way to stay alert and involved in a hazard review is to actively participate by asking questions and listening to the responses.
- When asked, double-check tasks or materials rigorously and in person.

Sometimes, we need to think the unthinkable.