

What If That “Wrong” Instrument Reading Is Correct?

An explosion at a large U.S. chemical manufacturing site occurred during startup of a distillation column. Investigators believe that early in the startup process, trays in the column were damaged, which may have created poor separation of a nitrobenzene/water azeotrope and a solution of nitric acid, sulfuric acid, and water in the column. An abnormally high, unstable concentration of nitrobenzene accumulated in the bottom of the column. The nitrobenzene ultimately triggered an explosion that killed 16 people and caused more than 300 injuries. In addition, the facility was damaged and experienced costly process downtime.

Hours before the explosion, the column was set to a total reflux state because of the startup difficulties. Technicians noticed a thermocouple on a tray at the bottom of the column read 121°C instead of the expected 102°C. At the time, the technicians assumed that the thermocouple had failed.

After the incident, investigators modeled the column using a computer-based simulation and incorporated the hypothesized tray damage that occurred early in the startup process into the model. The simulation predicted an increased concentration of high-temperature nitrobenzene at the bottom of the column. This explains the 121°C thermocouple reading that the technicians observed shortly before the explosion. In hindsight, the thermocouple was probably providing a correct reading.



What Can You Do?

We often dismiss abnormal readings as erroneous. While this may be the case, first assume that the instrument reading is correct. Then, try to understand why the reading is not as expected. Before assuming a measurement is incorrect:

- Use other process instruments and related information to perform a more comprehensive assessment of the process.
- Use alternative methods to understand whether the instrument has indeed failed. For example, can you take a process sample for analysis to help clarify the situation? Can you look at local temperature or pressure gages in the field? Can you look through a sight glass on top of a tank to see the level of the material?

- Get help from your coworkers, supervisors, and engineering support.
- Consider the possible consequences if this reading is correct. Asking questions may provoke a review that could uncover unseen hazards.

If the potentially erroneous reading could be a sign of a significant threat, work with your supervisors and technical support engineers to understand what actions should be taken to prevent a possible incident if the instrument reading is correct.

A good process safety culture assumes that instrument readings are correct until a thorough assessment proves otherwise.

Don't ignore abnormal instrument readings!

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