CACHE News
Winter 2019

Safety First

University of Michigan's H. Scott Fogler launches safety initiative that integrates into existing chemical engineering curricula, builds a "safety mindset"

On a scorching day in June 2005, grainy camera footage from Praxair's former industrial gas facility in St. Louis, Mo. revealed clusters of upright compressed gas cylinders, each filled with highly flammable product (http://umich.edu/~safeche/courses/thermodynamics.html). Seconds after a camera captures a subtle white gas escaping from one cylinder, a bright orange flame shoots skyward. Within minutes, thick black smoke begins obscuring the camera's watchful eye.

More than a decade later, students enrolled in a University of Michigan Chemical Engineering Department thermodynamics course reviewed the chemical safety video of the Praxair incident and ran incident-specific calculations.

Their goal: Through careful review and calculations, to determine what combination of conditions and decisions sparked the incident and—if facing a similar scenario—how they could delay or prevent an explosion similar to the one that left Praxair's facility engulfed in flames and a local neighborhood littered with metal debris.

The students' task is a part of the *Process Safety Across the Chemical Engineering Curriculum* initiative developed by H. Scott Fogler, the Vennema Professor of Chemical Engineering and Arthur F. Thurnau Professor at the University of Michigan.

Fogler, a veteran of the University of Michigan Chemical Engineering Department and author of *Elements of Chemical Reaction Engineering,* the field's dominant textbook, wants to help students develop a "sense of safety" by completing a safety module in every chemical engineering course and the curriculum.

"Sometimes chemical process safety is taught in a separate safety course within the core chemical engineering curriculum, and sometimes it is taught only in the senior year as a part of the process design course. In both scenarios, only a portion of students receive safety training," Fogler says.

With wide variation in how—or if—chemical process safety is taught across the country, Fogler decided to develop a resource for professors and students that could be integrated within an existing curriculum. Increased consistency in teaching chemical process safety can help safety, Fogler hopes, become an integral part of chemical engineering culture.

"By integrating safety into every course through a safety module, professors can help our students develop a safety mindset, whether they enter an academic or industrial lab," Fogler says.

What are the components of a safety module?

- **Watch a video** created by the U.S. Chemical Safety Board, an independent federal agency that investigates the causes of chemical accidents, that simulates a real-world, course-specific incident and, if available, view the actual incident report.

- **Complete a "safety algorithm**," which asks students to identify elements that led to the incident and what preventative actions might have helped prevent it.
- **Carry out incident-related, course-specific calculations** that helps students quantify what went wrong leading up to the incident.
- **Fill in the National Fire Protection Association (NFPA) diamond** for the chemical of interest in the video.
- **Construct a BowTie diagram**, a risk assessment tool that visualizes the path a hazard may take, for the incident in the video.

University of Michigan undergraduate students who have completed a safety module as a part of a course have praised the efforts.

In an assessment, one student reflected that the module was "an interesting way to apply what we are learning in class to a real-world example."

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