A Guide to Hazard Identification Methods, 2nd Edition

By Frank Crawley
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Universities and companies welcome headlines about winning prestigious research grants and building processes that improve the quality of life and make millions of dollars. Unfortunately, there are also headlines that read, "Graduate student died in research lab" or "Chemical release causes significant environmental damage and an evacuation of surrounding communities." These events happen due to a lack of understanding of the hazards associated with research or industrial processes.

AIChE and ABET have emphasized the importance of process safety and hazards recognition for chemical engineering graduates through the Program Criteria within the ABET, Inc., EAC accreditation criteria. Frank Crawley's second edition of *A Guide to Hazard Identification Methods* provides examples of hazard identification methods to help faculty train their students to meet this criteria for accreditation and to help prevent future incidents.

If the reader is new to process safety, it will take some time to get familiar with the technical terms used in this book. The author does supply a list of acronyms and abbreviations. The CCPS Glossary App is a useful tool that defines many terms used in process safety. I find the app easier to use compared to looking through the book to find the definition.

The book describes 14 different hazard identification methods: HAZOP, HAZID, Task Analysis, LOPA, Relative Ranking, RAST, Checklists, What if, FMEA/FMEACA, Fault Tree Analysis, Event Tree Analysis, Safety Audits, Bow-Tie Diagrams, and PHR. For each of these methods, the author provides a definition, description, resource requirements, timing, advantages/disadvantages/uncertainties, application/methodology/example, and references with additional reading.

The first three chapters are a great reference for an ethics or professional issues course. The first chapter begins with the need for hazard identification methods, more specifically the regulations that have been developed over time due to significant incidents, such as Seveso (1976), that cost lives, ruined processes, and significantly impacted the environment. The chapter focuses on the regulations for the European Union, which is not relevant to all countries, but the reason for the regulations is described. This enables the reader to look at the regulating system within their own country and be able to understand why regulations are needed. The second and third chapters discuss what methods are optimal for different stages in the life of a process, from conception to demolition. Chapter 3 emphasizes that hazard identification is a team effort and suggests critical team members along with estimates of the length of time to conduct the analysis.

Faculty who teach laboratories, capstone/project-based courses or who run a research lab could utilize at least one of the 14 hazard identification methods in their teaching or research practice. However, one of the challenges with implementing these methods in an academic setting is that all the participants typically have the same level of knowledge and experience. The author notes that it is essential that the hazard identification team be comprised of individuals who are knowledgeable and experienced with the process. Some of the simpler methods that are easier to start with are the What-If Analysis and the Checklist. These could be implemented in a first-year engineering program or as part of a laboratory course or review. The author gives examples and resources for conducting these methods.

FMEA and Event Tree Analysis could be implemented in a capstone/project course. This is a good exercise for students who spend most of their time designing processes that succeed. These exercises will help them think about all the ways that a process could fail.

All the other methods are more beneficial for graduate level courses where there may be students with industry experience who have more process knowledge and intuition. These students could then practice these methods in a simulated multidisciplinary team. Another option would be to invite alumni with industrial experience to simulate the execution of one of these hazard identification methods.

There is an extensive chapter on Risk Assessment that considers not only the hazards but the consequences and the frequency/probability of an event occurring. This chapter would benefit a graduate process safety course. The elements of risk-consequence and frequency can be introduced at the undergraduate level utilizing a qualitative rather than a quantitative risk matrix.

Overall, *A Guide to Hazard Identification Methods* is a good resource for faculty looking to increase their knowledge about hazard identification methods. Faculty could use these methods in their own laboratories to enhance the safety of their research program. They can also share these methods with their undergraduate and graduate students to increase their awareness of the hazard identification methods used in industry – and help meet accreditation criteria as well. ❒