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Good morning. I am Scott Berger, Executive Director of the Center for Chemical Process Safety (CCPS), a Technological Community of the American Institute of Chemical Engineers (AIChE). CCPS has published over 100 books and other reference documents which guide the implementation of process safety technology and management systems. However, my comments today are specifically directed towards the topic of Inherently Safer Technologies (IST).

By way of background, the topic of Inherently Safer Design (ISD), which we believe is a more technically accurate term, has been discussed in CCPS and AIChE conferences and other forums since the 1970s. CCPS has published two editions of a book dedicated to ISD (1996, 2009) and included ISD in two books on Engineering Design (1993, 2012). In 2010, our unique expertise in ISD led the Department of Homeland Security (DHS) to request CCPS to lead a team of IST/ISD technical experts to formally define IST and ISD. Since the language of the EO refers to IST, we will use this term for consistency.

IST is, and long has been, one important tool in the broader toolbox used by chemical engineers to design safe processes. It is so ingrained in the design process that chemical engineers often do not even realize they are doing it. This was certainly my personal experience. I never heard the term IST (or ISD) before the early 1990s, yet once I heard it, I recognized that I had learned these principles as an undergraduate in the 1970s and had been using them since my first industrial assignments.

The formal definition of IST that CCPS developed for DHS is key to understanding the role it should play in future efforts to improve process safety. A copy of the final DHS report may be found at the CCPS website at http://www.aiche.org/ccps/publications/books/inherently-safer-chemical-processes-life-cycle-approach-2nd-edition. I would like to highlight and comment on the key elements of the definition:

- "Inherently Safer Technology (IST), also known as Inherently Safer Design (ISD), permanently eliminates or reduces hazards to avoid or reduce the consequences of incidents."

  Specifically, IST is one way to mitigate hazards that can cause process safety incidents, i.e. fires, explosions, and toxic releases.

- "IST is a philosophy applied to the design and operation life cycle, including manufacture, transport, storage, use, and disposal."

  IST is not a specific technology or group of technologies that can be substituted. Each case is unique, and adopting the IST philosophy typically leads to different results from case to case.

- "There is no clear boundary between IST and other strategies."

As we can readily see from the NJ TCPA program, IST can go well beyond the simple replacement of one substance with a safer one or one reaction with another. Elements of IST can be applied at the process control level, the procedural level, and even the emergency response level. The bottom line is that IST is an integral part of developing a safe design and not separate from the desired goal of safe design

- "ISTs are relative: A technology can only be described as inherently safer when compared to a different technology, including a description of the hazard or set of hazards being considered, their location, and the potentially affected population."

  One technology may be inherently safer than another with respect to some hazards but inherently less safe with respect to others. Also, even if the technology is safer, it may not be safe enough to meet society's expectations.

- "Because an option may be inherently safer with regard to some hazards and inherently less safe with regard to others, we must make decisions about the optimum strategy for managing risks from all hazards."

  The choice of technology is rarely cut and dry. It depends on the relative importance of the range of hazards, where in the lifecycle different hazards occur, and the potential for shifting risk from one potentially affected population to another. Technical and economic feasibility also play a significant role

Based on this definition of IST, it is clear that several existing regulatory provisions already address IST:

- 29CFR§1910.119 (a): The setting of thresholds for coverage under this regulation is an incentive to reduce hazardous inventory, a key principle of IST
- 29CFR§1910.119 (e): The activity of process hazard analysis prompts the broad-based hazard analysis team to determine safeguards and process modifications, including IST, to address the hazards identified, implement them, and review the analysis every 5 years
- 29CFR§1910.119 (m): When incidents occur, the company must identify the causes and implement safeguards and process modifications, including IST, to address eliminate these causes
- 40CFR§68.10: The setting of thresholds for coverage under this regulation is an incentive to reduce hazardous materials inventory, a key principle of IST
- 40CFR§68.12 and related: The performance of worst case analysis drives engineers to seek IST alternatives to reduce potential consequences
- 40CFR§68.50 and related: The activity of process hazard analysis prompts the broad-based hazard analysis team to determine safeguards and process modifications, including IST, to address the hazards identified, implement them, and review the analysis every 5 years
- 40CFR§68.60 and related: When incidents occur, the company must identify the causes and implement safeguards and process modifications, including IST, to address these causes
- 40CFR§68.155: Every 5 years, the facility is required to submit plans to improve safety

Considering that the application of inherently safer design methodology is so tightly integrated into the overall work of process development, any regulatory action related to IST which goes beyond these existing provisions would likely require that regulatory authorities conduct a detailed expert review of the complete set of design documents, essentially validating the design decisions made. Without significantly greater regulatory resources, such a detailed review is clearly impractical.

As I hope I've made clear, AIChE and CCPS support the use of IST as part of the overall engineering process. We strongly support increasing the education of chemical engineers and other scientists and engineers involved in process design and technology selection in the philosophy and art of IST.

To this end, AIChE was pleased to receive a recommendation from the US Chemical Safety and Hazard Investigation Board asking us to work to modify the undergraduate chemical engineering curriculum to improve the knowledge of process safety among BS graduates. In 2012, the CSB voted to declare this recommendation "closed, exceeding recommended action."

AIChE and CCPS are also pleased to support the continuing process safety education of experienced chemical engineers through a variety of courses, including one on IST.