

## INHERENTLY SAFER TECHNOLOGY FOR CHEMICAL AND RELATED INDUSTRIAL OPERATIONS

Inherently safer industrial technologies for the production, transport, and use of industrial and agricultural chemicals, pharmaceuticals, and both commodity and advanced materials is a vital concept that is currently the focus of significant activity in a wide range of forums in the industrial, academic, and governmental arenas. While many industrial processes and sectors use various definitions of this term, collectively, they capture a group of processes and technologies that improve safety by greatly reducing or eliminating hazards through a permanent and inseparable element of the process. Thus, safety is built into the process, not added on, and hazards are reduced or eliminated, not simply controlled.

Where feasible, inherently safer process technology can greatly reduce potential threats to public and worker safety, health, the environment, and plant and public infrastructure from a variety of scenarios that might result in the release – fugitive or otherwise – of hazardous and toxic materials.

Many organizations involved in the chemical, pharmaceutical, and related process industries have strongly advocated and advanced inherent safety, supporting the work of professional societies and academic institutions, utilizing the concept in training chemists and engineers, and incorporating it into internal process safety management programs.<sup>1,2</sup> Inherent safety is a well-recognized engineering process concept that is based on the belief that a hazard can be moderated or eliminated, thereby reducing risk and possibly removing the risk altogether. Certainly an inherently safer system or technology can make hazardous events less likely and less intense if there is an accident.

Change in “technology” is one aspect of inherent safety. The term inherently safer technology (IST) has received considerable attention in recent years, but it is only one of many approaches that may be employed to achieve risk reduction. A successful approach to changing technology in this area will come about through a holistic application of safety analysis that extends from the top to the bottom of the organization, designing safer systems that include safer practices and an organizational prejudice toward safety. IST, when properly applied, goes beyond shifting risks from one technology to another and leads to an overall safer process.

It should also be noted that the safest, most environmentally benign process choice may not be unequivocally identified. As observed in a recent National Academies study, evaluation of different process options “will not always result in a clear, well-defined, and feasible path forward” and may involve consideration of a series of tradeoffs and can change over time. And, while there are tools available to measure the safety of different process alternatives, there is not a clear consensus on the most reliable metrics.<sup>3</sup> ACS has consistently supported research and development initiatives that promote advancements in inherent safety and risk reduction. For example, ACS has long been a strong supporter of efforts by Congress to promote green chemistry and engineering.

The federal government has made homeland security, including the protection of the public and critical infrastructure, a priority, and Congress has addressed some issues surrounding inherently safer technology through legislation on the Department of Homeland Security Chemical Facility Anti-Terrorism Standards<sup>4</sup>. To protect the public, the environment, and critical infrastructure, it is necessary to make research, development, and technology investments that would help secure the nation’s chemical infrastructure and safeguard against the consequences of a terrorist attack.

The chemical enterprise has considerable experience in developing and implementing inherently safer systems and should welcome creative approaches for encouraging additional IST research and development. Several recent industry association security codes require member companies to conduct vulnerability assessments of their facilities. These codes recommend consideration of inherently safer and more secure technologies, especially during facility design or redesign.

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The American Chemical Society (ACS) Board of Directors Committee on Public Affairs and Public Relations adopted this statement on behalf of the Society at the recommendation of the Committees on Environmental Improvement and Corporation Associates. ACS is a non-profit scientific and educational organization, chartered by Congress, with more than 158,000 chemical scientists and engineers as members. The world’s largest scientific society, ACS advances the chemical enterprise, increases public awareness of chemistry, and brings its expertise to state and national matters.

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## Recommendations

1. *The American Chemical Society (ACS) supports increased attention on safer technologies and believes the focus should be on a broad portfolio of timely and effective methods of reducing risk and mitigating potential damage.*

The portfolio of risk reduction methods and tools should include IST and other inherent safety techniques. However, when risk analyses require replacing or significantly modifying current process technologies, considerable effort must be expended to develop, scale-up, test and install new, safer processes. Great care must be taken to ensure that the new processes do not result in inferior products or create unrecognized health, safety, or environmental impacts.

While scientists and engineers have made great strides in understanding the impacts of industrial processes and products over the past several decades, there is still no guaranteed formula for developing inherently safer production processes. In the future, chemical and related industries will benefit greatly from increased educational and professional development and training of scientists and engineers in the disciplines of green chemistry and engineering, risk analysis, and industrial ecology.

2. *ACS supports involvement of federal agencies in researching and facilitating the advancement of safer technologies.*

Several federal agencies, including but not limited to the Environmental Protection Agency (EPA), the Department of Homeland Security (DHS), and the Occupational Safety and Health Administration (OSHA), actively work with economic sectors such as manufacturing and agriculture to promote safer and more secure facilities. These agencies, through their collaborations and oversight of the manufacturing sector, have a keen understanding of private-sector efforts being developed and implemented to further the advancement of safer and more secure facilities. ACS believes that these agencies should support and encourage research and development – both in the public and private sector – to foster cost-effective, inherently safer chemistries, and chemical processes.

ACS also believes that these agencies, in collaboration with other appropriate agencies should evaluate, and where appropriate, make recommendations on potential incentives and disincentives that would best encourage the private sector to advance continued improvement in their safety and security performance. In addition, ACS supports development of inherently safer technology assessment frameworks that can be used by the chemical enterprise in making risk reduction decisions.

Similar actions have also been recommended by the National Research Council.<sup>3,4</sup>

3. *ACS supports examining the potential of public-private partnerships to encourage voluntary adoption of protective measures.*

In the long term, both the public and industry will benefit from the discovery of economically viable, inherently safer technologies. The benefits to the public of safer technology are obvious. For industry, moving towards a safer industrial model will lead to lower insurance and risk costs while ensuring the safety of customers and employees and protecting investors from excessive risk.

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1. American Chemistry Council Responsible Care® program
  2. American Institute of Chemical Engineers, *Final Report: Definition for Inherently Safer Technology in Production, Transportation, Storage, and Use*, July 2010.
  3. National Research Council, *The Use and Storage of Methyl Isocyanate (MIC) at Bayer CropScience*, Washington, DC: The National Academies Press, 2012.
  4. National Research Council, *Terrorism and the Chemical Infrastructure: Protecting People and Reducing Vulnerabilities*, Washington, DC: The National Academies Press, 2006.