

Safety & security in the chemical- and hazardous materials transport sectors

Safety and security under optimal control

RESEARCH REVIEW



There has been a great call for optimal safety and security in many business sectors, particularly since 9/11. The Safety and Security Science Research Group of the faculty Technology, Policy and Management of the TU Delft focuses its research on a number of disciplines including safety & security in the chemical industry and all associated socio-economic optimisations. It is obvious that safety is pivotal in the chemical industry; without safety no 'license to operate'!

“Everyone is aware of the importance of safety and security, but usually only pays full attention after an accident happened.”

It goes without saying that safety is a top priority in the chemical sector: after all, corporate social responsibility is impossible without safety! “Safety is linked to a range of issues including technology, management and procedures, human behaviour, training and all related domains, and this is also the case in chemical

companies,” explains Prof. Genserik Reniers, Professor of Safety of Hazardous Materials at the faculty TPM: “Just consider legal aspects, risk management, risk modelling, risk assessment, risk communication, business continuity planning, safety performance management, economic aspects of safety, reliability engineering, learning from accidents, etc. In other words, safety indeed is a very important and interesting domain within a chemical company!”

Security of chemical companies against intentional criminal acts (such as theft and terrorism) is also a crucial research theme. “A cautious conclusion from previous research is that security and the security culture can often be improved upon,” says Reniers. “This is based on the fatalistic idea that a terrorist attack simply cannot be prevented. However, the opposite is true: the better a company’s security against deliberate acts to harm the company, the smaller the likelihood of an attack.”

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SAFETY ECONOMICS

This area of research concerns the revenues and expenses connected to accidents that have been prevented by taking safety precautions. How do organisations decide to take certain preventive measures? Refined mathematical methods are needed to properly weigh the costs and benefits. Which accident scenarios will you include/exclude? And what consequences will you be avoiding? Companies really do not want to suffer a major accident, significant costs are justified. However, economic activities must continue, so the costs cannot be infinitely high.

BITTEN BY THE SAFETY BUG GENSERIK RENIERS

Prof. Genserik Reniers (1974) is a Professor of Safety of Hazardous Materials at TU Delft. The Civil Engineer and Doctor of Applied Economic Sciences also teaches at the Brussels' campus of the University of Leuven and a is guest professor at the University of Antwerp. He acquired his passion for safety during his PhD research on developing a cluster safety culture in the chemical industry.

"During debates with colleagues and people from the industry, I realised how multidisciplinary and widespread the subject of safety is. That's when I was bitten by the safety bug. And, since 9/11, this has been joined by a healthy interest in security. After all, the essence is the same: dealing with uncertainty. My area of research is extremely broad. There is always something new to learn, and that makes it fascinating. There are also many overlaps with other disciplines, such as chemistry, engineering, psychology and economics, which are also passions of mine."



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>> Domino danger hubs

One interesting possibility for improving security is the prevention of domino effects in chemical industrial areas. This refers to systemic risks, where one accident triggers the next one. Reniers: "Chemical industrial parks can have domino danger hubs: installations that play a major role in the initialisation or continuation of domino effects. By protecting

"Refined mathematical methods are needed to properly weigh the costs and benefits of safety and security. But which types of mathematical methods are most suitable in which situations?"

these hubs against intentional acts, the hazard network can be broken down into various 'domino islands'. This can make a chemical production area far better equipped to withstand terrorist attacks. We are developing mathematical models for this purpose."

Fascinating literature

Domino Effects in the Process Industries: Modelling, Prevention and Managing geredigeerd door Genserik Reniers, Valerio Cozzani

Total Respect management, Peter Blokland, Genserik Reniers

Using Game Theory to Improve Safety within Chemical Industrial Parks, Genserik Reniers, Yulia Pavlova

Engineering Risk Management, Thierry Meyer, Genserik Reniers

Security Aspects of Uni- and Multimodal Hazmat Transportation Systems, geredigeerd door Genserik Reniers, Luca Zamparini

Multi-Plant Safety and Security Management in the Chemical and Process Industries, Genserik Reniers

TPM AS A HOME BASE

The TPM faculty is an excellent home base for safety and security research. That is because the research is an essential part of all academic disciplines, including typical TPM subjects such as technology, economy, management and philosophy.

Reniers: "The importance of safety considerations in economics and management sciences can hardly be overestimated. Many different safety aspects should also be considered when designing technological solutions.

After all, safety is one of the most important factors supporting, connecting and coordinating ethics within decisions."



Hazardous goods transport

According to Reniers, the international transport of hazardous goods (by rail, road, pipeline and inland shipping) is also an interesting area of research. After all, such hazardous loads can be used as a weapon or cause a disaster themselves. Therefore, safety and security are crucial. "Legislation for the various modes of transport already exists at the European level, but each country

has its own approach to questions such as 'how will we analyse risks, how high are the risks, and which measures will we take?' Ideally, risk assessment concerning the transport of hazardous goods should be harmonised at the European level. This makes it possible to map out optimal routes through Europe from A to B, taking into account safety and security aspects, as well as environmental and economic factors and legislation. Our work in this area includes the design of multi-criteria models. We also apply game theory as a mathematical technique."

Clustered safety and domino effects

The chemical sector has numerous chemical industrial clusters, with the companies in the different clusters forming a potential danger to one another. After all, accidents are not always confined to company boundaries. In terms of safety, however, companies often only work together at the operational level, and mainly on a reactive basis. For example, information about accidents is sometimes shared. TU Delft would like to see more cooperation: "We want to show companies in the industry that cooperating strategically, sharing information and managing prevention funds together can give them a competitive advantage. They can invest together in prevention, with an independent, coordinating advisory body optimally distributing the investment over the cluster on the basis of a mathematical model."

Want to know more?

- www.vk.tbm.tudelft.nl
- www.ua.ac.be/main.aspx?c=genserik.reniers
- www.tbm.tudelft.nl/en/about-faculty/departments/values-technology-and-innovation/risk-safety-and-security/staff/genserik-reniers

Would you like to find out what the Safety and Security Science Research Group can do for your organisation? Send an e-mail to G.L.L.M.E.Reniers@tudelft.nl

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