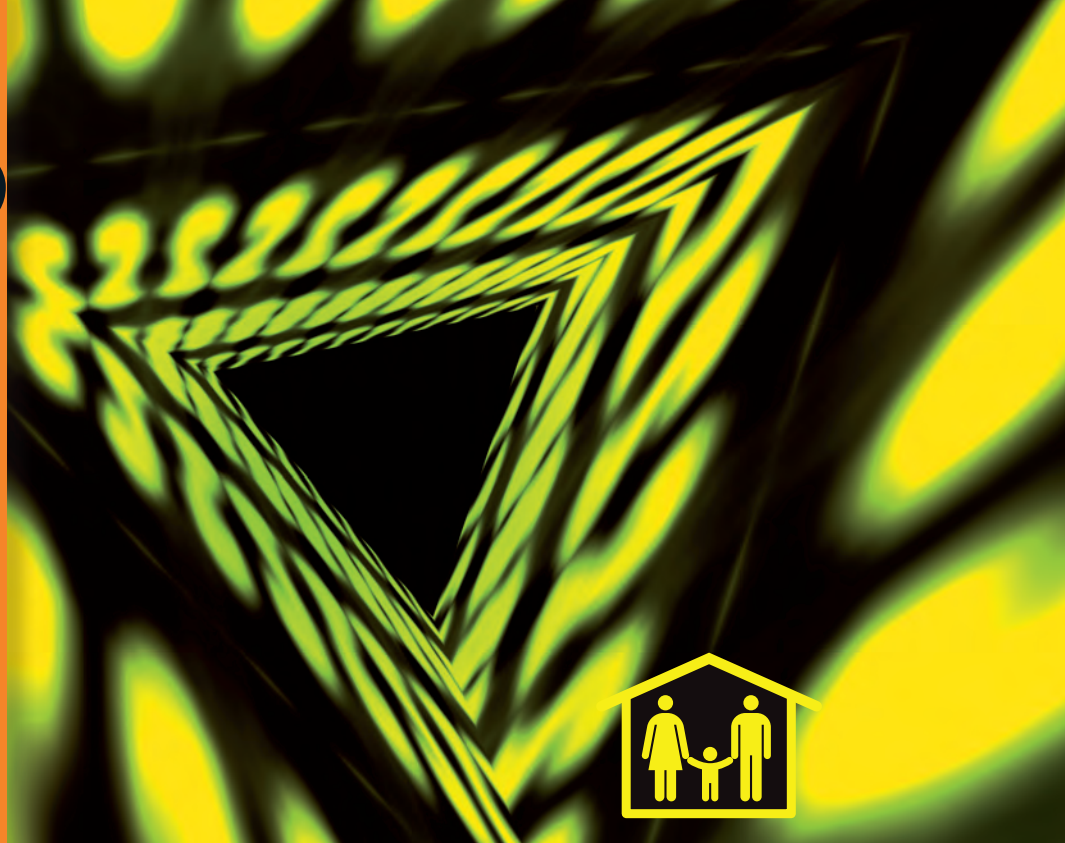


Risk analysis of extreme undesirable events How safe is safe enough?

RESEARCH
REVIEW

How can we provide the Netherlands with the best possible protection from disasters, such as floods? And: how safe is safe enough? **The Safety and Security Science Research Group of the faculty Technology, Policy and Management of TU Delft is calling for a uniform risk analysis of extreme events, which enables the benchmarking of risks between the different domains.**

The demand for safety decision models is greater than ever. And there are also more risks to manage than ever before - for example, in the water sector, the chemicals industry, the world of internet, logistics and transport, electricity networks & infrastructures, the construction sector and the healthcare sector. This involves important safety issues, ranging from extreme water levels and temperatures to the risk of explosions, the risk of cyber attacks, medical mistakes and building collapses. There is a need for risk analyses of natural events (earthquakes, forest fires, etc.) on the one hand, and of man-made hazards (traffic accidents, chemical disasters, etc.) and intentional hazards (theft, vandalism, terrorism) on the other.

Uniform approach

In a risk analysis risks are quantified by determining the probability of a threat and the consequences thereof, so that the correct measures can then be determined. The faculty of Technology, Policy and Management is currently working on a harmonised approach to risk analysis. Chances of undesirable events in the different safety domains are modelled in the same way and the consequences of undesirable events (fatalities, injuries, direct and indirect economic damage and non-material damage) are also modelled consistently. Safety measures then also need to be studied within the same framework in order to determine the extent to which the risks and consequences can be reduced. The advantage is that this is a very generic approach that enables the comparison of risks between the different domains.

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**MULTIDISCIPLINARY:
THE TU DELFT SAFETY AND
SECURITY INSTITUTE**

The TU Delft Safety and Security Institute was launched in the summer of 2013, under the leadership of the TU Delft Safety Science Research Group. In the institute six TU Delft faculties (TPM and five other faculties) work together on safety issues.

Broad research themes are currently being set up for public safety, public security and security in the private sector. The institute hopes its multidisciplinary approach will help attract research funding, for example from the European financing programme Horizon 2020.

**THE TESTING GROUND OF
PIETER VAN GELDER**

Mathematician Pieter van Gelder (1968) is a Professor of Safety Science at the faculty TPM. Formerly he worked at the CEG faculty on calculating the risk/probability of floods and high water levels. Within the Safety Science Research Group he develops mathematical models for risk management. He also holds a number of other positions, including Director of the TU Delft Safety and Security Institute, Chairman of the ESRA Technical Committee on Natural Hazards and Programme Director of several Delft Toptech programmes. He is also on the annual ESREL Scientific Committee. Van Gelder's PhD research, completed in 2000, studied the reliability analyses of flood defences and the statistical methods used in that context. Modelling is his great passion. "I work in a great testing ground where all kinds of mathematical techniques can be applied. It is fantastic to be able to take the observations in the field, in nature, and use them to make an abstract model which can be used to reach optimal decisions. This also makes the research work rewarding."



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“A harmonised approach to risk analysis has many advantages: it makes it possible to compare risks between the different domains.”



IN SAFE HANDS WITH TPM

The TU Delft safety group attracts worldwide attention. There is a good reason for the group being incorporated in the Faculty of Technology, Policy and Management (TPM). Although each faculty is involved in the safety of its own technical domains, safety is also a cross-faculty issue. The generic study of safety from a helicopter view fits perfectly with TPM, which is known for its multi-disciplinary socio-technical approach.

>> The research is progressing steadily, but still faces many challenges. There are still major steps to be taken, particularly in domains such as public safety, in which the human factor plays a crucial role - for example, the identification and quantification of malicious acts by humans. Furthermore, new technological developments make it a 'never-ending' process. The development of nanotechnology, for example, and innovations such as self-healing materials and extreme adhesives raise new safety issues.

At the same time, TPM is keeping a close eye on the big data developments. Drones, mobile phones and - in the near future - Google Glass gather immense amounts of data. The Safety Science Research Group is researching methods for using this data to further optimise safety.

Interesting literature

R.D.J.M. Steenbergen, P.H.A.J.M. van Gelder, S. Miraglia, A.C.W.M. Vrouwenvelder (2013). Safety, Reliability and Risk Analysis: Beyond the Horizon.

P.H.A.J.M. van Gelder, C.V. Mai, W. Wang, G. Shams, M. Rajabalinejad, M. Burgmeijer. Journal of Hydraulic Research (2008). Data management of extreme marine and coastal hydro-meteorological events (pag. 191-210).

S.N. Jonkman, P.H.A.J.M. van Gelder, J.K. Vrijling. Journal of Hazardous Materials (2003/4/4). An overview of quantitative risk measures for loss of life and economic damage.

P.H.A.J.M. van Gelder, 1999. Statistical Methods for the Risk-Based Design of Civil Structures, Communications on Hydraulic and Geotechnical Engineering.

P.H.A.J.M. van Gelder, F. Nadim & C. Guedes Soares. (2010). Risk assessment of natural hazards with applications to landslides and abnormal waves. In C. Guedes Soares (Ed.), Safety and reliability of industrial products, systems and structures (pag. 85-98). s.l.: Taylor and Francis Group.



Evidence-based decision making

TPM's uniform risk analysis facilitates an evidence-based or transparent decision-making process. This has great social importance. It enables taxpayers' money in the Netherlands to be spent on the various safety domains in the most responsible manner possible. However, large and small businesses can also benefit from such mathematical models for the safety of their products and processes. This gives them a better understanding of the safety measures on which to spend their money.

www.vk.tbm.tudelft.nl



Want to know more?

Would you like to find out what the Safety and Security Science Research Group can do for your organisation? Send an e-mail to p.h.a.j.m.vangelder@tudelft.nl