



Review

Introduction of the concept of risk within safety science in The Netherlands focussing on the years 1970–1990



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ABSTRACT

Serious incidents in the 1970s and continuous growth of factories producing and/or using hazardous substances formed the basis of a quantitative approach to risk. While discussions of risk were conducted in all industrialised countries they were particularly important in The Netherlands due to space limitations and short distances between industrial plants and residential areas. This article is part of a series covering the history of the safety science discipline (Swuste et al., 2015; Van Gulijk et al., 2009; Swuste et al., 2010).

The concept *risk* entered the Dutch safety domain before the 1970s in relatively isolated case studies and in managing flood defences in The Netherlands. Since the 1970s these case studies paved the way for the development of mathematical models for quantitative risk analysis that were based on experience from nuclear power plants, the process industries and reliability engineering from operations research. ‘External safety’ was a focal point for these early developments in the process industries: adverse effects of dangerous goods outside the factory’s property boundaries. The models were documented in standardised textbooks for risk analysis in The Netherlands, the so-called ‘coloured books’. These works contributed to the development of the Seveso Directive. For internal safety (taking place within property boundaries) semi-quantitative approaches were developed simultaneously.

The models for quantitative risk analysis were deemed reliable, but the acceptability of a quantified risk was another matter. Making decisions on risk relates to complex societal issues, such as ethics, stakeholder perception of risks, stakeholder involvement, and politics, all of which made the decision making process far from straightforward. With the introduction of the abstract concept of risk in the Dutch safety science domain, the question of risk perception became important in Dutch safety research.

The concept *risk* and methods for quantitative risk analysis first entered into Dutch law in environmental risk regulations. It took a while for risk to be accepted by occupational safety experts, but just before the turn of the century ‘occupational risk inventory and evaluations’ or RI&E methods were introduced into Dutch occupational safety legislation. This finalised the paradigm shift to risk-based safety-decision making in the Dutch safety science domain. While methods for quantifying risk are now widely applied and accepted, the proper use of risk perception and risk in the political decision process are still being debated.

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1. Introduction

The public debate on whether to allow LNG super tankers into Rotterdam harbour in 1975 shed light on the context in which risk enters the safety domain in The Netherlands. The proposals for LNG landing led to spectacular visions of vapour cloud explosions with the power of a atomic bomb. These exorbitant projections drove the need to 'put some numbers' and thus to get a better grip on the problem, thereby facilitating sensible safety decision making. The heated debate about LNG abated after the discovery of a huge natural gas field in the North of The Netherlands, but the debate about the introduction of the risk paradigm and the acceptability of risks had started. The LNG discussion took place in the background of the introduction of new industrial activities in The Netherlands that would involve huge amounts of hazardous materials. In this context, the discussion about adverse consequences for local residents provided the motive for risk research in the seventies. The limited land space in The Netherlands and incidents in process industry (Parker, 1975; Ministry of Social Affairs and Public Health, 1968) forced consideration of safe separation distances between the (process) industry and residential areas. This development emphasizes the central role of the Dutch risk-based approach in the discussion about safe distances between urban centres and high hazard industries. As risk-based research progressed, the definition of risk as a combination of the probability and the effects of incidents became increasingly accepted. This definition had a structuring effect on the public debate on risks, and reduced the debate to realistic proportions (Pasma, 1999). From the seventies onward risk was frequently placed on the political agenda. The scientific debate on risk as a basis for safety decision making was not restricted to the field of safety science and is still on-going (Vlek and Stallen, 1979; Health Council of The Netherlands, 1996, 2008; WRR, 2008; Ministry of the Interior and Kingdom Relations, 2012). Despite that, the full implementation of the risk paradigm for safety decision making can said to be completed in the late 1990s.

This article is part of a series on historical research into the professional field of safety science. The first article in this series described the first steps in this field in the early twentieth century. The theory of accident-prone workers was developed in this period and was supported by the first statistics data on occupational accidents (Swuste et al., 2010). A second article deals with the development of safety engineering in the interwar period, with emphasis on the contribution of the American Heinrich (Van Gulijk et al., 2009). The third article covers the period after the Second World War until the early seventies. Then the focus remains strongly on occupational safety and broadens the analysis of accidents in the direction of task analysis and epidemiological approach (Swuste et al., 2014a). Two recent articles describe the period of emergence of safety management systems until the nuclear incident at Three Mile Island in 1979 (Swuste et al., 2014b), and from Three Mile Island till Piper Alpha (Swuste et al., 2015), both dealing with the development of occupational and process safety.

This article covers the period 1970–1990, during which the concept and definition of risk was introduced into the safety science domain. From 1970 onwards there are articles in Dutch journals discussing the assessment of risks. Gradually the attention shifts from damage and effect to damage related to probability: from damage control to risk control. Together with the concept of risk and risk perception, such terms as damage, effect and hazard were explored and defined.

In the period after 1990, the public debate about the concept of risk broadened. Therefore, 1970–1990 is an appropriate time period for this article, notwithstanding that occasionally the text reports developments that have taken place outside this period.

This article addresses the following research questions:

1. What developments were decisive for introducing the concept of risk in safety science in The Netherlands?
2. Which theories, models, and metaphors were developed in the considered period (1970–1990)?

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