

Article outline is loading...

JavaScript required for article outline



Safety Science

Volume 50, Issue 5, June 2012, Pages 1299– 1303



The safety chain: A delusive concept

R.B. Jongejan^{a, b}, S.N. Jonkman^{a, c, d}, J.K. Vrijling^a^a Delft University of Technology, Faculty of Civil Engineering and Geosciences, Section of Hydraulic Engineering, The Netherlands^b Jongejan Risk Management Consulting, Delft, The Netherlands^c University of California Berkeley, RESIN Project (Resilient and Sustainable Infrastructure Networks), United States^d Royal Haskoning, Coastal and Rivers Division, Rotterdam, The Netherlands<http://dx.doi.org/10.1016/j.ssci.2011.12.007>, [How to Cite or Link Using DOI](#)

View full text

Purchase \$39.95

Abstract

Various governments have defined a so-called safety chain to structure their efforts in the field of risk management for low-probability disasters. The safety chain typically consists of the following components: proaction, prevention, preparation, repression. While the terminology suggests that the safety chain should be interpreted a series system, the safety chain more closely resembles a parallel system. This has important implications: the safety chain is not as weak as its weakest link; unreliable links need not always be strengthened as it will often be more efficient to rely on a few layers of protection, or just one. To avoid misguided efforts caused by the confusing terminology 'safety chain', we propose the use of the term 'layers of protection', as is currently the case in the Dutch flood safety policy. Furthermore, we show that imperfect preparedness for low-probability disasters is often perfectly defensible or rational, given the differences between the cost-effectiveness of investments in prevention and disaster preparedness.

Highlights

- Terminology suggests that the safety chain should be interpreted a series system.
- The safety chain more closely resembles a parallel system than a series system, or chain.
- The safety chain is not as weak as its weakest link.
- It will often be efficient to rely on a few layers of protection, or just one.
- Inadequate preparedness for low-probability disasters is often defensible from an economic perspective.

Keywords

Safety chain; Risk management; Layers of protection; Disaster preparedness

Figures and tables from this article:

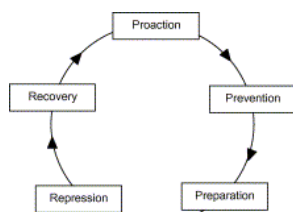


Fig. 1. Graphical representation of the safety chain.

Figure options

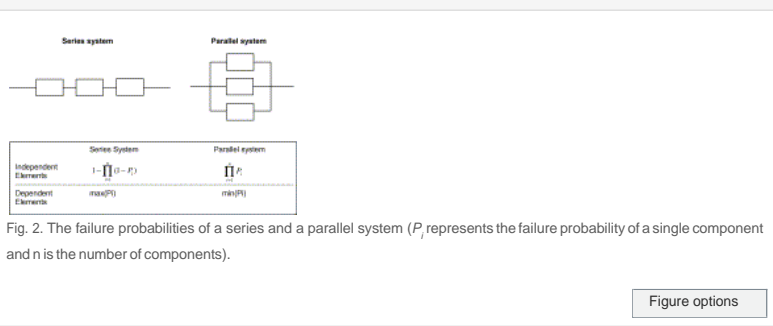


Fig. 2. The failure probabilities of a series and a parallel system (P_i represents the failure probability of a single component and n is the number of components).

Figure options

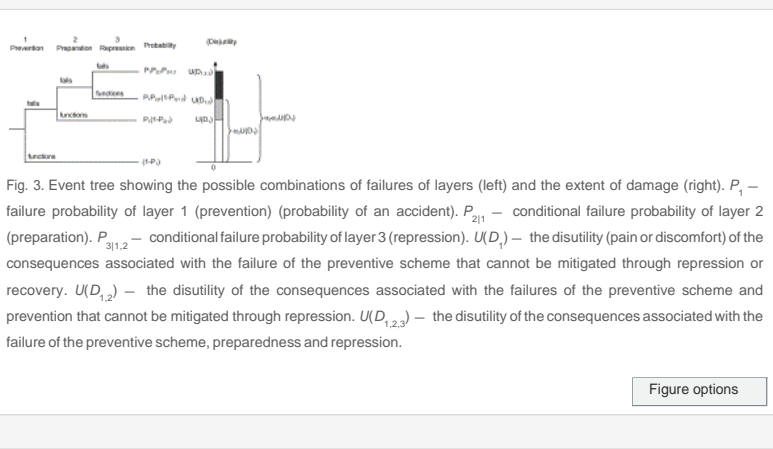


Fig. 3. Event tree showing the possible combinations of failures of layers (left) and the extent of damage (right). P_1 – failure probability of layer 1 (prevention) (probability of an accident). $P_{2|1}$ – conditional failure probability of layer 2 (preparation). $P_{3|1,2}$ – conditional failure probability of layer 3 (repression). $U(D_1)$ – the disutility (pain or discomfort) of the consequences associated with the failure of the preventive scheme that cannot be mitigated through repression or recovery. $U(D_{1,2})$ – the disutility of the consequences associated with the failures of the preventive scheme and prevention that cannot be mitigated through repression. $U(D_{1,2,3})$ – the disutility of the consequences associated with the failure of the preventive scheme, preparedness and repression.

Figure options



Corresponding author at: Jongejan Risk Management Consulting, Korvezeestraat 484, 2628 DX Delft, The Netherlands. Tel.: +31 614996316.

Copyright ©2011 Elsevier Ltd. All rights reserved.