

ANALYSIS OF TECHNOLOGICAL ACCIDENTS TRIGGERED BY NATURAL DISASTERS (NATECH EVENTS)

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External hazard factors as natural events and intentional acts of interference are perceived as important threats affecting the safety of chemical and process plants. The increasing frequency of some natural events having a particularly high severity also raised a growing concern for the integrity of industrial assets and for the consequences of major accident scenarios that may be triggered by intense natural events and that may lead to the release of huge quantities of hazardous substances.

The specific features of technological accidents triggered by natural events were recently recognized, and these scenarios are now indicated as NaTech (Natural-Technological) accidents. The analysis of past accident databases points out that NaTech accidents frequently impacted industrial facilities. However, these scenarios are seldom considered in major accident hazard assessment, as well as in safety assessment of industrial facilities. Methodologies and tools for the specific assessment of the potential consequences of NaTech accidents were only recently developed, and are still missing for a number of specific NaTech scenarios.

The present activity aims at the development of a framework for the analysis of NaTech accidents and to the advancement of tools aimed at the assessment of NaTech events.

A first aim of the activity is the development of screening criteria to apply on a regional scale, to identify hot-spots and critical sites for NaTech scenarios. A second issue is the development of models for the probability of failure of equipment items when involved in natural events. A third activity is the development of a specific methodology supported by a software tool aimed at the calculation of the individual and societal risk due to NaTech scenarios.

Results obtained for case-studies evidenced that technological accidents triggered by natural events may strongly affect the overall risk due to an industrial activity.



Fig.1 Effects of an earthquake on a process plant.

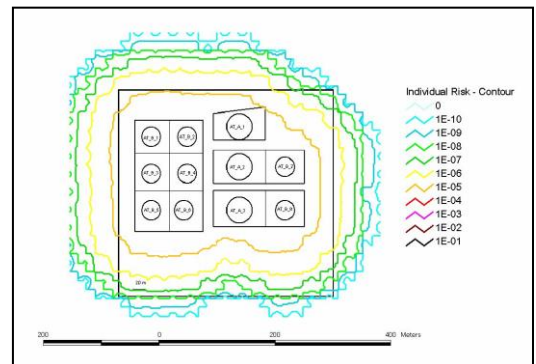


Fig.2 Individual risk calculated including NaTech accident scenarios caused by seismic events.

MAIN PUBLICATIONS

Antonioni, G., Spadoni G., Cozzani, V. (2007). A methodology for the quantitative risk assessment of major accidents triggered by seismic events. *J. Hazardous materials* 147, 48.

Antonioni, G., Bonvicini, S., Spadoni, G., Cozzani, V. (2009). Development of a general framework for the risk assessment of NaTech accidents. *Reliability engineering system safety* 94, 1442

Campedel, M., Cozzani, V., Garcia-Agreda, A., Salzano, E. (2008). Extending the quantitative assessment of industrial risks to earthquake effects. *Risk analysis*, 28,1231.

Cozzani, V., Salzano, E., Campedel, M., Sabatini, M., Spadoni, G. (2007). The assessment of major accidents caused by external events. *Proc. 12th int. Symp. On loss prevention and safety promotion, Icheme, Rugby (UK)*, pp.331-336.

Cozzani, V., Campedel, M., Renni, E., Krausmann, E. (2010). Industrial accidents triggered by flood events: analysis of past accidents. *J. Hazardous Materials* 175, 501.

Krausmann, E., Cozzani, V., Salzano, E., Renni, E. (2011). Industrial accidents triggered by natural hazards: an emerging risk issue. *Natural hazards and earth system sciences* 11, 921.

Krausmann, E., Renni, E., Campedel, M., Cozzani, V. (2011). Industrial accidents triggered by earthquakes, floods and lightning: lessons learned from a database analysis. *Natural hazards* 59, 285.

Landucci, G., Antonioni, G., Tugnoli, A., Cozzani, V. (2012). Release of hazardous substances in flood events: damage model for atmospheric storage tanks. *Reliability engineering and system safety*,

Necci, A., Antonioni, G., Renni, E., Cozzani, V., Borghetti, A., Nucci, C.A., Krausmann, E. (2012). Equipment failure probability due to the impact of lightning. *Chem.eng.trans.* 26, 129

Renni, E., Cozzani, V., Antonioni, G.,

Krausmann, E., Cruz A.M. (2009). Assessment of major accidents triggered by lightning. *Proc. Eur. Safety and reliability conf.*, Taylor & Francis: London; pp. 959-965.

Renni, E., Krausmann, E., Cozzani, V. (2010). Industrial accidents triggered by lightning. *J. Hazardous Materials* 184, 42.

Sabatini, M., Ganapini, S., Bonvicini, S., Cozzani, V., Zanelli, S., Spadoni, Gigliola (2008). Ranking the attractiveness of industrial plants to external acts of interference. *Proc. Eur. Safety and reliability conf.*, Taylor & Francis: London; p.1199-205.

Salzano, E., Basco, A., Busini, V., Renni, E., Rota, R., Cozzani, V. (2010). Acceptability parameters for industrial risk with respect to natural-technological interactions. *Proc. 13th international symposium on loss prevention and safety promotion, Ti-Kviv, Antwerpen (B)*; pp.81-88.

RESEARCH PROJECTS

iNTeg-Risk - Early Recognition, Monitoring, and Integrated Management of Emerging, New Technology related, Risks. European Commission, 7th Framework Programme - Nanoscience, Nanotechnologies, Materials and New Production Technologies. Large scale integrating project, 2008-2013

Framework agreement DICMA - EC JRC IPSC 2011-2014

Convenzione quinquennale DICMA - Agenzia Regionale di Protezione Civile Emilia-Romagna (2010-2015)

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