



## **SAFETY AND SECURITY OF SEVESO SITES: STEPPING TOWARDS RESEARCH SYNERGIES AND AN INTEGRATED FRAMEWORK**

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Received 15 May 2017

Accepted 7 June 2017

Increasing technological complexity, the rising frequency of severe natural events and increasing societal vulnerability are factors that result in a combination of new threats. Seveso sites are industrial sites storing or processing relevant quantities of hazardous substances. To date, in Europe the main issue with such industrial installations has been the protection of citizens from industrial activities based on safety promotion, as required by the Seveso Directives.

However, the European framework drastically changed since late 2015, calling attention on intentional acts of interference as credible initiating events for major accidents. Seveso sites potentially constitute an attractive target by a variety of criminal categories for a wide range of reasons (Argenti et al., 2015): the impact of society of an intentional release of such substances, or even the possibility to steal them and use them for the preparation of improvised explosive devices or other types of weapons used in CBRNE (Chemical Biological Nuclear Explosive) attack scenarios (Reniers et al., 2015; Reniers and Audenaert, 2014).

In perspective, competent authorities for Seveso Directive may require safety reports issued under Seveso-III Directive to include scenarios triggered by intentional events. Thus, the conventional approach to safety and security of Seveso sites should undergo a paradigm shift, and be looked upon pro-actively and strategically from the level of industrial clusters, on top of the traditional approach limited to single plants. On the one hand, the safety perspective based on internal assessment of conventional accidents required by the Seveso Directive (2012/18/EU) should be integrated with a holistic assessment of threats. On the other hand, consequence and impact assessment should be extended to consider cascading events that, through strong multi-sectorial dependencies and indirect impacts, may affect the population, industry, critical infrastructures (2008/114/EC) and society.

Major accident hazards are related to the release, mostly unintentional, of chemicals stored or processed in industrial sites. CBRNE scenarios are caused by the intentional release of a Chemical, Biological, Radiological, Nuclear, with malicious intents.

The prevention and mitigation of CBRNE and Major Accident Hazards go hand-in-hand and dedicated solutions for either one of the scenario categories may be less robust and less cost-effective nowadays (Aven, 2007; Bajpai and Gupta, 2007). A growing interrelation is present

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among these types of scenarios, and common models and tools and all kinds of other countermeasures may be used to prevent, assess and control their impact. The enhancement of the capacity of response and resilience of industrial system to malicious attacks must integrate preventive aspects, typical of cyber-security, industrial aspects, which mainly relate to the physical dimension of the plants, and aspects related to the protection and security of critical infrastructure and population (Landucci et al., 2015). The application of new methodologies, skills and technologies is a key element of the strategy for responding to such new and emerging threats (Argenti et al., 2017).

The development of new methodologies, skills and technologies is a key element of the strategy for responding to new and emerging threats. An increasing consciousness of the above is growing at European level, where the European Commission, within the H2020 program addressing Secure Societies is now widening the community of users (CoU) to safety practitioners involved in the safety and security of Seveso sites, with the aim of creating new synergies among safety and security.

In this framework, a number of topics may be identified for future research in safety and security. Among others, the following may arise as key issues to improve synergies among safety and security achieving more robust solutions for the holistic protection of Seveso sites.

Improved threat assessment and procedures for accident scenario identification should be developed, considering the entire supply chain integrating Seveso sites, thus also transport systems as pipelines and road, rail and marine/fluvial transportation of hazardous materials. Multi-sectorial dependencies should be identified, introducing a system dynamics perspective to scenario identification, linking the issue to the relevant research effort currently devoted to dynamic risk assessment (Khan et al., 2016; Villa et al., 2016).

The development of tools for the assessment of impacts, specifically focusing on cascading events that may propagate the effects to interconnected sectors and on the vulnerability of different areas, population categories, industries and infrastructures is also a critical issue, that may in perspective provide a more robust decision making context for the effective protection of the population. This may be linked to the development of tools for integrated protection strategies and decision-making in the short term, addressing critical vulnerabilities and measures, and in the long term, addressing system robustness and resilience also by an improved system-of-system-of-systems approach.

The above may be related as well to the development of improved and validated models for consequence and impact assessment, including cascading events all the way up to societal impact, joined to the application and exploitation of such models to major accident and CBRNE scenarios training and exercise

These are only few examples of a list of urgent research actions that should be considered to promote synergies among safety and security, aiming at the creation of an overall framework sharing competences and solutions with the ultimate goal of obtaining a safe and secure society.

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