

# Chapter 1

## Mapping of Areas Presenting Specific Risks to Firefighters Due to Buried Technical Networks

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### **ABSTRACT**

*Vehicles or freight cars on fire below a bridge or inside a tunnel are exceptional events and imply difficult intervention conditions for firefighters. A buried technical network like high voltage electricity line, gas or steam pipeline around such a fire causes additional specific risks. Vulnerability areas for firefighters are zones where both factors exist: a difficult incident area together with a specific risk like buried networks. They require intervention teams with specific emergency response capabilities. The paper proposes a method developed for the Paris Fire Brigade for vulnerability mapping. Results aim at improving the mobilization in allocating directly the specific responses capabilities intervention teams. Results are debated from an operational point of view. Cutting off several network lines during firefighters' interventions may strongly affect the society. In case of simultaneous incidents in vulnerable areas, firefighters could be an early warning system and inform authorities of the risk of services disruption.*

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## **INTRODUCTION**

DEMOCRITE is a project funded by the French National Research Agency under grant agreement ANR-13-SECU-0007-01 (Lapebie, 2015). It aims at developing a software platform for the French civil security on risks analysis and risk coverage. The Paris Fire Brigade (BSPP) is one of the first engaged institutions when a disaster happens in the Paris and suburbs areas. BSPP is a partner of this project, and helps to define two main lines of research for improving the quality of their emergency services. The first one concerns common incidents: based on the BSPP feedbacks database, DEMOCRITE aims at identifying correlations between incidents and local urbanism, population characteristics and period of the day. Perspectives of this axe concern for instance the “Grand Paris” project. Future fire stations and capacities should be placed in new built areas as a function of expected incidents frequency such as to optimize risk coverage. The second research main line concerns three exceptional risks. First, terrorist bombing: a simplified and fast code is under development for estimating the consequences area of a potential bombing in an urban area. Second, a quarter fire: a modeling of fire propagation speed through several buildings is proposed, not including firefighting for the moment. This could happen with the Seine centennial flooding that threatens Paris: potable water networks could be severely damaged and fire coverage would be difficult to assume. The third point concerns the results of this article: the mapping of territory vulnerabilities linked to technical networks. A perspective of this work concerns the modelling of cascading effects following firefighters dispatch that could require switching off one network. Three deliverables of the DEMOCRITE project have been produced and released to the Paris Fire Brigade in 2015. A first report explains the production of vulnerability maps and analyzes them network-by-network (DEMOCRITE, cartes, 2015). Secondly, an ArcGIS code for the DEMOCRITE toolbox has been developed in order to compute these maps. Another report on the methodology itself explains the structures of the different models inside the toolbox and the technical limits of this approach as well as its implementation with real data. (DEMOCRITE, méthode, 2015). This last report together with the statistics of the first report are presented here. Indeed, the method developed is easily transferable. Authors believe that it may help others firefighter services to apply it for a better knowledge of their specific risks.

Vulnerability zones for firefighters are defined as zones where both following factors exist: a complex incident area - like tunnels or bridges over roads/ railway lines - with a specific risk like buried networks. These areas require emergency teams with specific response capabilities.

By “vulnerabilities linked to technical networks” the authors mean areas where firefighters require the mobilization of external partners to secure the incident: gas, high voltage or steam operators (used in Paris area for building heating) send

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