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[Analysis of Terrorism Risk for Energy Installations]

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CO	Confidential, only for members of the consortium (including the Commission Services)	

Analysis of Terrorism Risk for Energy Installations

Executive Summary (Public)

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Note: The full report of this Deliverable is confidential.

Executive Summary

Work package 5.7 of the SECURE project analyzes severe accidents and terrorism risk in the production and use of energy. This report presents an analysis of the terrorism risk of large energy infrastructure facilities with the potential for catastrophic consequences following a terrorist attack. The targets include oil refineries, liquefied natural gas (LNG) terminals, hydropower dams and different types of nuclear power plants that rely on current as well as future technologies. For each type of energy installation a specific location in China, Europe and the US was defined, where possible representing a real facility.

Certainly the attacks on the World Trade Center (WTC) in 2001 have put scenarios with low probability but high consequences into the focus of policy makers, authorities, reinsurers as well as the general public. At the same time this event has highlighted the need to integrate information that might be in principle available but dispersed to form a complete picture of vulnerabilities and possible attack scenarios.

Terrorism is a highly complex phenomenon with aspects spanning over many disciplines. For SECURE, a framework was developed that allows to integrate diverse expertise ranging from political sciences and intelligence on the motivation of terrorists to military knowledge on scenario planning to physical assessment of consequences. The framework also addresses the challenge of the large differences in the reliability of information in the different areas: While consequences can be modeled with relatively high confidence, the motivations of terrorist naturally can be judged only within large error limits. The resulting large variation of uncertainty in the quantification of those aspects is addressed through a consistent treatment of uncertainty through all steps in the model.

The risk is calculated based on three factors:

- the probability that an attack is planned based on historical evidence of attractiveness of a target and evidence of terrorist activity in the considered country
- the probability that a certain scenario can be implemented based on the necessary resources, time, know how and countermeasures in place
- the consequences in fatalities, injured and land contamination.

The reasoning behind this approach is that a terrorist will, more or less formally, follow the same evaluation: Consequences of an attack should be maximized, but this aim has to be weighted against the success probability, the planning effort and the financial and personnel means available.

Several different concepts were integrated into the framework: The scenario quantification is based on fault/event tree logic. The “initiator frequency” of terrorist attacks, i.e. the probability that a given target is chosen per year is treated with Bayesian frequency updating. Uncertainties in the quantification process are addressed by using fuzzy logic, i.e. uncertainty functions that are evaluated by Monte Carlo analysis. This allows the systematic and formalized integration of expert judgment with a physical analysis of the consequences and attack scenarios to

generate a complete picture of the probability that an attack can be successfully executed and the likely resulting consequences.

The results indicate that the risk to oil refineries and LNG terminals may be substantial though maximum consequences are more limited than for hydro and nuclear. Countermeasures on site may reduce the impact of a terrorist attack but will not ensure the elimination of threats. Risks from attacks to dams are potentially very large because of the population and land that may be affected. However, the chance that a catastrophic accident can be induced by a terrorist attack is much smaller than for oil and LNG installations.

Finally, the chance that a terrorist attack causes very large consequences at a nuclear installation is extremely small, and comparable to that resulting from the normal operations of the plants. Again, however, the possibility of disastrous consequences cannot be excluded, no matter what countermeasures are in effect, and no matter how impervious the plants are to disturbances (redundancy of safety systems, barriers against radioactive releases).

In spite of large uncertainties the analysis indicates that the frequency of a successful terrorist attack with very large consequences is of the same order of magnitude as can be expected for a disastrous accident in the respective energy chain. This is primarily due to the fact that centralized large energy installations are hard targets and relatively easy to protect, requiring sophisticated attack scenarios to cause significant damage and lasting impacts. Historic preference of terrorists for fatalities implies lower risk compared to soft targets, which are much more vulnerable and do not necessitate mobilization of very large resources by the terrorists.

The main merit of the current exploratory study is that it provides a structured methodology for quantitative assessment of terrorist threats against energy infrastructure. Such a framework has not been available until now. The framework was implemented and applied to selected facilities in specific locations. The numerical results should be seen as indications and depend on the judgment made by risk analysts engaged in the project. Full scale implementation would call for engagement of a variety of intelligence and technology specialists to provide more robust judgments and address the credibility of the postulated scenarios.