Ambiente
Environment

DII research group
Analisi del Rischio
nell'Industria di Processo

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analisi-del-rischio-nell'ndustria-di-processo

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Main research topics:
- Development and Application of Risk Analysis Procedures in the Process Industries.
- Reliability and Safety Engineering.
- Analysis and Mitigation of Emerging Risks Concerning Energy Supply Critical Infrastructures.
- Risk Analysis in Transport of Dangerous Goods
- Development of Early Warning Detection Systems in Runaway Reactive Systems.
- Innovative Hazard Identification and Evaluation Techniques in the Green Chemistry and Biorefineries.
- Interaction between Seismic and Natural Risks and Consequences on Facilities subjected to Risk of a Major Accident.

Risk Assessment of CO_2 Pipeline Network for CCS – A UK Case Study

The Carbon Capture and Storage (CCS) in geological reservoirs is considered to be on the most promising solutions to control greenhouse gas emissions during the 2020s. The CCS chain involves three stages: the capture of the CO2 from large stationary sources, its transmission to the storage site and finally the injection into the geological reservoir. CO2 can be transported using one or a combination of transport media: truck, train, ship or pipeline. Transport by pipeline is considered the preferred option for large quantities of CO2 over long distances, and is the subject of this paper. In general, it is therefore necessary to identify a suitable CCS infrastructure routing that must be safe, environmental acceptable, economical and practical. From a safety perspective, the route must provide a safe and secure environment for the pipeline during construction and over its operational life and ideally be routed away from populated areas.
This study focuses on a CO2 pipeline network located in the UK starting from the previous work, based on technical and economic drivers. The aim of work is mainly consisting on the application of a quantitative risk assessment (QRA) method to the case study with the analysis of actions and workable alternative design options aimed at mitigating risks connected to accidental CO2 releases. Figure 1 describe the QRA approach. Accidental events in a CO2 pipeline can produce a spray release followed by a dense gas dispersion, and the high concentration of CO2 can cause fatalities. To determine possible health effects it is important to quantify not only the CO2 concentration but also the duration of the exposure, as the gas cloud evolves. For the calculation of risk, the consequences are associated to the Probit function, which calculates the percentage of the death of the individual.
The result of mitigation risk and the analysis of the costs arising from alternative pipeline pathways are shown by means of a specific example, Figure 2.

Figure 1 QRA methodology

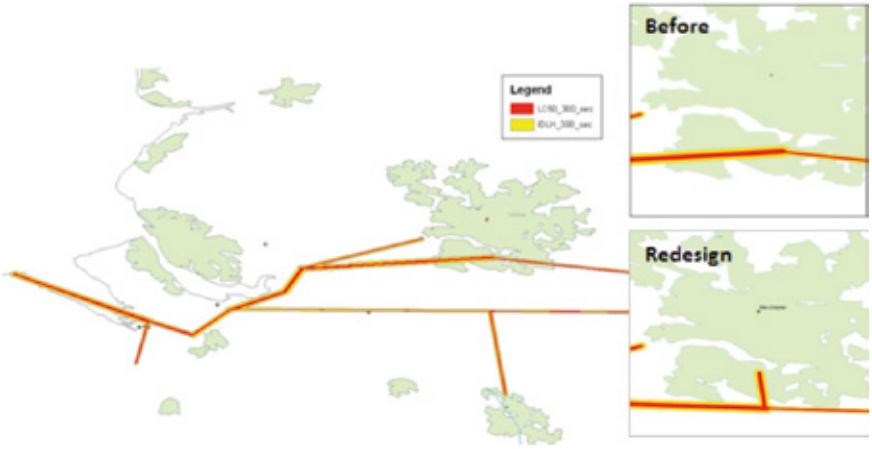

Figure 2 Pipeline network near Manchester city: CO2 consequences due to full bore rupture and redesign network to improvement the safety near center of city.