EVALUATING BEST PRACTISE FOR SHALE GAS DEVELOPMENT

FracRisk focused generic modelling scenarios used as a basis for uncertainty analysis and risk approximation

http://www.fracrisk.eu/
Impact Objectives

- Develop a knowledge base for understanding, preventing and mitigating the potential impact of the exploration and exploitation through hydraulic fracturing (fracking) of significant shale gas reserves found throughout Europe.

- Develop a decision support tool for risk quantification of the environmental impacts of the technology

Evaluating best practise for shale gas development

FracRisk team members Katrina Edlmann, Chris McDermott, Professor Martin Sauter and Simon Parry discuss how this global collaborative effort aims to determine and communicate the risks of shale gas exploration in Europe in an effort to inform policy makers and the public at large.

Why is shale gas such a valuable resource? What makes shale gas reservoires in Europe unique?

KE: Shale gas is important for two reasons, local energy security and reducing climate impact as gas increasingly replaces coal for electricity generation thus decreasing greenhouse gas emissions. Methane from shale gas is a much cleaner form of energy than coal, so whilst the technology for a zero carbon future is being developed, the use of shale gas will reduce the overall carbon footprint, whilst keeping the lights on, industry moving and homes warm. Conventional gas production in Europe is also in decline and if shale gas could be produced within Europe then gas prices would go down and the security of the gas supply would increase, as Europe became less dependent on imported gas. The European Commission estimates that there is around 16 trillion cubic meters of technically recoverable shale gas in Europe. The majority of the suitable shale gas geological formations are located in Denmark, France, Germany, Netherlands, Poland, Romania, the UK and Ukraine.

What are some of the key challenges with shale gas extraction? How will the FracRisk project help to address these?

SP: A major risk factor which has arisen in the US regarding shale gas development was not related to the actual process of fracking, rather it was related to a lack of knowledge and the practice of partial cementation of the boreholes in the early days of the development industry. This left un-cemented casing sections spanning from above the target horizon to below the fresh water aquifers. These open sections created pathways between strata and allowed deeper fluids and gases to migrate upwards, however this practise will not be allowed to occur in the UK to begin with.

What lessons can be learned from US shale gas development?

CM: We collect data from seven key shale gas basins in Europe which characterise the subsurface conditions and provide a good understanding of the main features of the different environments. Data include available information on the geometry of the subsurface, the types and locations of different rock strata, the rock pressures or stresses, the fluid pressures and existing legacy constructions such as previous boreholes. This data is used to inform six different focused generic modelling scenarios. These scenarios are ‘basis’ models of the processes occurring during and after fracking which could lead to an impact on a receptor. A receptor is either an environmental feature, groundwater or some other feature which should be protected. For example, the release of a contaminant is simulated in a representative geometry, with representative physical parameters and the movement of the contaminant towards a receptor is predicted. This helps us determine the risks that the hazard and pathway to the receptor pose. Using this interpretive foundation, further computer modelling based on our six focused scenarios is carried out with the purpose of predicting the effect of the migration of chemicals and gases, movement of the assets and seismics, which then support risk and uncertainty assessment.

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Can you talk a little about how you are building synergies between academia, government and industry?

ME: The research team not only includes academics but also researchers who come with industry experience. Moreover, the project was designed to yield impartial, objective and pragmatic results. In order to achieve this goal an oversight group named the Science, Industry and Regulatory Advisory Board was created. This board included representatives from industry, national regulatory bodies and academia and is commissioned to independently evaluate and comment on the research as it progresses, specifically with a mandate to help guide the project towards producing technically excellent science that is deliberately focused on the real and practical needs of regulators, industry and citizen. Various dissemination events have been held to share the findings with members of staff from the European Commission, Members of European Parliament from both the Energy and the Environment Committees and staff from national regulators and national geological institutes.

How will FracRisk influence local decision making and what are your concerns that the technology is not yet implemented as a local tool?

KE: The project has collected data sets of factual information that can and ought to be a standard frame of reference for use by all interested parties in the debate about the risk and level of uncertainty concerning shale gas development. It is a web-based platform with a user friendly graphic interface. It includes layers of geographic information, databases of pollutants and geological materials plus their properties. The DST provides decision-making structures with regard to authorisation, prevention and or mitigation based on the existence of pathways linking a source of pollution to a sensitive receptor such as human settlements, animals or freshwater sources. Currently, EU law does not require, but only recommends that subsurface risk and uncertainty be explicitly quantified when planning and licensing a shale gas project; the DST will possibly serve as a catalyst for political pressure ensuring these quantifications of uncertainty and risk is required.

CM: Managing operations in the subsurface means dealing with uncertainty and trying to quantify the probability of certain events happening. The EU is aware that national regulators are not currently experts who are knowledgeable about the nature and probability distributions of the different risks associated with shale gas development. Practically, for safe implementation of shale gas projects within the EU to be permitted regulators would benefit significantly from developing expertise in this area. In furtherance of this goal, the EU funded FracRisk under the Horizon 2020 program to provide technically objective, impartial practically useful research to serve as a resource from which national regulators can become acquainted in great technical detail with the issues of subsurface risks posed by shale gas. The desired outcome is a deeper understanding of risk and uncertainty by all parties in the debate and better decision making by politicians and regulators.
Shale gas extraction, commonly known as fracking, is a relatively new source of natural gas and petroleum that could greatly benefit European countries. Several large shale gas deposits have been identified within the continent and their development would go a long way to providing energy security by reducing the EU’s reliance on foreign gas supplies and decreasing greenhouse gas emissions by replacing coal power generation. Fracking though, like all resource extraction, is not without risks that will need to be carefully quantified before projects are approved. Furthermore, as has been demonstrated in the US, public and political opposition can develop if the risks are not properly assessed and communicated. FracRisk, a multi-partner EU H2020 project made up of mainly geoscience experts but also strong industry and government partners as well, is tackling the challenge of identifying these risks in Europe and educating both regulators and the public.

RISK IDENTIFICATION

The FracRisk consortium brings together institutions with experience in subsurface geo-engineering, including hydrocarbon exploitation, radioactive waste storage, carbon capture and storage, geothermal resources and water resources. All the partners have a particular expertise in the investigation of subsurface geo-reservoirs. Project Coordinator Christopher McDermott explains: ‘The key challenges with shale gas extraction that the FracRisk project will address are the understanding of subsurface groundwater contamination and potential induced seismicity.’ The fracking process involves drilling long horizontal boreholes at a depth of over 1 km, and injecting principally water with a small amount (~2 per cent) of additional chemicals to form multiple limited fractures in low permeability shale and enable the gas naturally captured within the shale to be collected in the boreholes. This process occurs 1 to 3 kilometres below the surface, and well below any natural fresh water aquifers.

However, as with all industrial processes there is always a limited chance that things might not work according to plan, and there is the limited potential for products used and produced by this process to leak into groundwater. Likewise there is the minimal possibility that small seismic activity will be generated as the pressurised fluids used for fracking are introduced into the rocks. ‘The quantification of the subsurface processes currently pose the most significant research challenges in shale gas extraction and the intensity of public concerns is such that these challenges must be properly addressed,’ observes McDermott. To address the risks involved the team has developed a detailed modelling approach to map and simulate contamination and seismic risks. Perhaps most importantly though, the team is making the results public by establishing a Features, Events and Processes risk database associated with shale gas extraction and making publicly available an interactive, web-based decision making tool. Both resources are meant to address the main mandate behind the project ‘providing scientific recommendations and a knowledge base for best practise for shale gas development,’ says McDermott.

CAPACITY BUILDING

In order for shale gas projects to be developed properly, regulators, politicians and the public in general need impartial information and access to understanding and expertise so they may make informed decisions on the resources their countries develop. Currently, there is a lack of broadly available knowledge in Europe which FracRisk is rapidly addressing. By communicating with those who have travelled this path before in the US they are adding to existing experience and passing on this knowledge to European stakeholders. By also providing training opportunities to the next generation of researchers FracRisk is ensuring that safe, transparent and sustainable shale gas operations become possible in Europe.

Project Insights

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