



## **Environmental aspects of hydraulic fracturing - Main results and recommendations from two studies on behalf of the German Environment Agency**

Bernd Krischbaum (1), Andreas Bertram (1), Christian Böttcher (1), Züleyha Iyimen-Schwarz (1), Jörg Rechenberg (1), Uwe Dannwolf (2), and Georg Meiners (3)

(1) Umweltbundesamt - German Environment Agency (UBA), Dessau-Roßlau, Germany, (2) RiskCom GmbH, Pforzheim, Germany, (3) ahu AG, Aachen, Germany

The German Environment Agency (UBA) accompanies the debate on fracking for years. Two major reports on risks and environmental impacts regarding the exploration and exploitation of unconventional natural gas, in particular shale gas have been published. On the basis of these studies as well as on scientific evidence UBA considers ecological barriers as a sustainable means to minimize the risks to environment and human health.

- 1) Recent studies show that the contamination of shallow aquifers by rise of fluids through natural faults or artificially created fractures is extremely unlikely. However, activities on the surface and lack of wellbore integrity pose threats and substantial risks for the quality of shallow aquifers.
- 2) The need for thorough groundwater monitoring is fully accepted, yet its range and design is subject to discussion.
- 3) Formerly, analysis and mass balances of flowback and produced water have been insufficient, thus there is a lack of exact information on proportions of frac-fluids, flowback and formation water respectively, as well as data on possible reaction products.
- 4) Currently, neither on national nor on European level best reference techniques (BREF) for the treatment and disposal of flowback and produced water are available.
- 5) In addition, land consumption, emission of greenhouse gases, and induced seismicity are major issues.

UBA recommends amongst others the implementation of an environmental impact assessment (EIA) for fracking activities, the prohibition of fracking in water protection areas as well as their catchments, and the disclosure of all frac-fluid chemicals within a national chemical registry. To achieve these objectives the German Environment Agency suggests a step-by-step approach. The paper will present the main results from the studies and the recommendations of the German Environment Agency regarding hydraulic fracturing for unconventional gas exploitation.