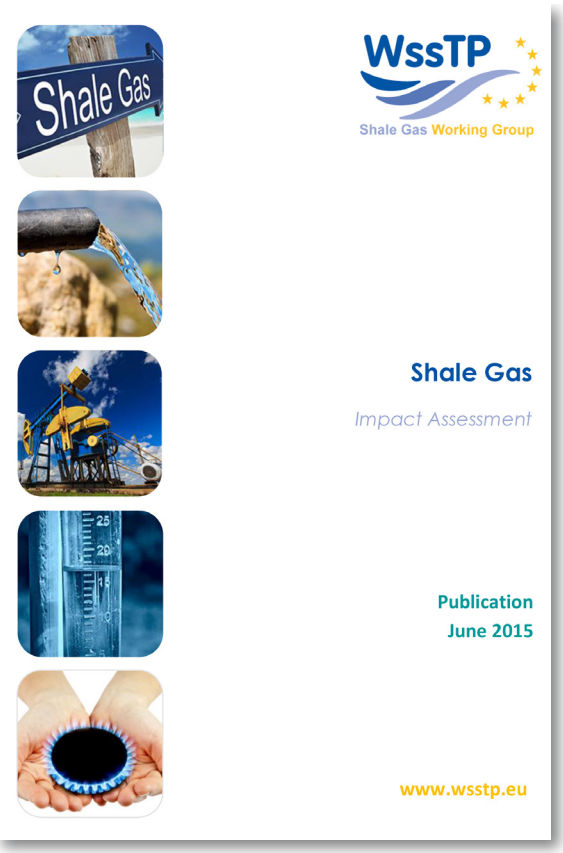
# Executive Summary
# SHALE GAS
# Impact assessment

The European Water Platform

**Writing Committee:**
Deltares (Hilde Passier, Stefan Jansen), Veolia (Natalia Quisel), KWR (Niels Hartog), KWB (Hella Schwarzmueller), IWW (Frank-Andreas Weber, Axel Bergmann, David Schwesig)

## THE BACKGROUND OF THE SHALE GAS - IMPACT ASSESSMENT REPORT

*This report was published in June 2015 and was elaborated the WssTP Shale Gas Working Group*




The main WssTP goals were:

1. To review European and international regulations, initiatives and demonstration projects targeting best practices related to water contamination during unconventional gas production.
2. To evaluate the risks related to these activities.
3. To identify further research and demonstration needs.

The WG objectives were to:

- Define the state of knowledge on best practices in setting up site-specific water quality monitoring strategies before, during and after the exploration or exploitation of shale gas. (key factors: geosystem, technology, substances, disposal).
- Define the state of knowledge according the research needs on properties, transport behavior, and transformation products of the fracking additives as well as formation water constituents under high temperature and pressure along flow path.
- Contribute to evaluation of current fracking fluids and designing of “green” fluids.

## KNOWLEDGE GAPS AND RESEARCH NEEDS

### Major gaps and missing technologies:

- Integrated spatial planning
  - » Interaction with other activities in the subsurface.
  - » Demands of large amounts of water of specific quality for several purposes may sum up for a region.
  - » Use of alternative sources of water (seawater, brine).
- Accumulation of impacts
  - » Shale gas development is a large scale operation with many different aspects and impacts.
  - » Pre-existing technical structures need to be considered (water wells, oil wells, other industrial activities).
- Risk management
  - » Harmonized approach including the (mandatory) development of mitigation and prevention plans and matrices. Integration of legislation, data, monitoring, models, solutions, stakeholders, information.

- Groundwater contamination by substances migrating from the fracking horizon
  - » Lack of site-specific conceptual or numerical hydrogeological models quantifying the relevance of potential impact pathways, especially with regard to long-term impact.
  - » Lack of knowledge on the behaviour, transformation, toxicological and ecotoxicological properties of fracking fluid and formation brine constituents.
- Participatory approaches and stakeholder involvement
  - » Development of regulatory instruments, i.e. baseline monitoring protocols; setback rules; data dissemination rules; long-term assignment of responsibilities.
  - » Transparency, e.g. public databases.

### Major research needs

- Conducting extensive baseline surveys
  - » Identification of case studies covering a wide range of geological systems and typical environments.
  - » Application of knowledge based on novel monitoring approaches involving tracers, isotope ratios.
  - » Knowledge on groundwater composition with respect to fracking additives, methane, and formation water constituents.
- Well integrity
  - » Impact of number and depth of wells on the regional water system.
  - » Long-term stability of the technical barriers; according monitoring instruments and financial and regulatory responsibilities.
  - » Develop monitoring and possibly sealing solutions to minimize impact.
- Predictive modelling of fault behaviour
  - » Methods and techniques able to forecast widths and lengths of fractures generated by hydraulic fracturing.
  - » Impact of number and depth of wells versus depth of geological barriers and pre-existing faults.
  - » Long-term stability of the geological barriers; according monitoring instruments and financial and regulatory responsibilities.
- Relevance of impact pathways
  - » System-oriented methods and techniques for developing conceptual and/or numerical hydrogeological models allowing for site-specific risk assessment of each potential impact pathway.
  - » Properties of the deep subsurface in necessary detail, e.g. detecting intersecting faults that affect only parts of the overburden.
  - » Knowledge from tracers in near-surface groundwater to indicate relevant impact pathways between the fracking horizon and near-surface groundwater.
- Substance migration
  - » The behaviour and fate of fracking fluid and formation brine constituents and transformation of products in the fracking horizon and along migration pathways under high pressure and temperature.
  - » The toxicological and ecotoxicological impact of relevant migrating substances (fracking additives, methane, and formation water constituents).
  - » Risk mitigation and prevention management. Monitoring, indicator, and evaluation of risks. To be able to provide options for stopping, limiting, or reversing any undesired impacts.
  - » The development of environmental safe fracking fluids. Substitution of toxic substances, reduction or substitution of biocides, reduction of the numbers of additives used, lowering of concentrations used.