

# Environmental Impact Assessment of Shale Gas Production – Polish experiences

Małgorzata Woźnicka Ph.D.  
Polish Geological Institute –  
National Research Institute



## Shale gas in Poland

110 licences  
for prospecting and  
exploration of  
shale gas

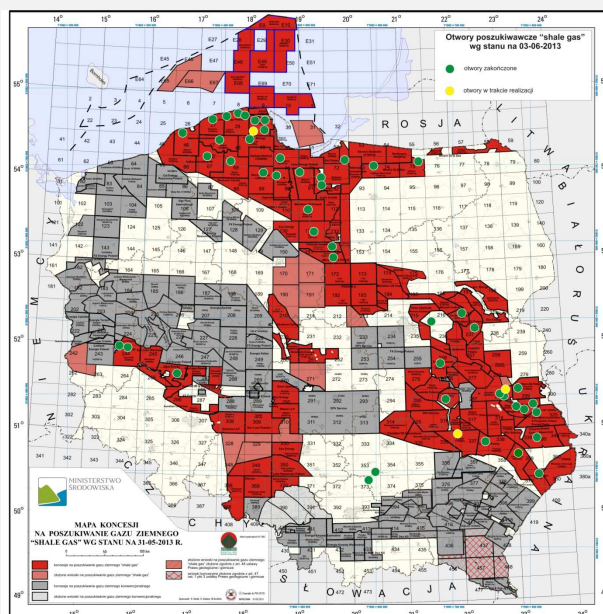
44 wells, including  
10 horizontal wells

2003



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# Licenses for prospecting and exploration of shale gas

- Objective** – prospecting and exploration of deposit
- Time** – definite (usually 3-5 years)
- Scope of activity**– specified and confirmed
- Control** – Ministry of the Environment, Mining Authority
- Effect** – geological documentation



**Possibility to obtain the licenses for shale gas exploitation**



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# The activities under control

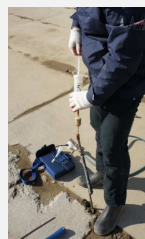


Knowledge of  
proces

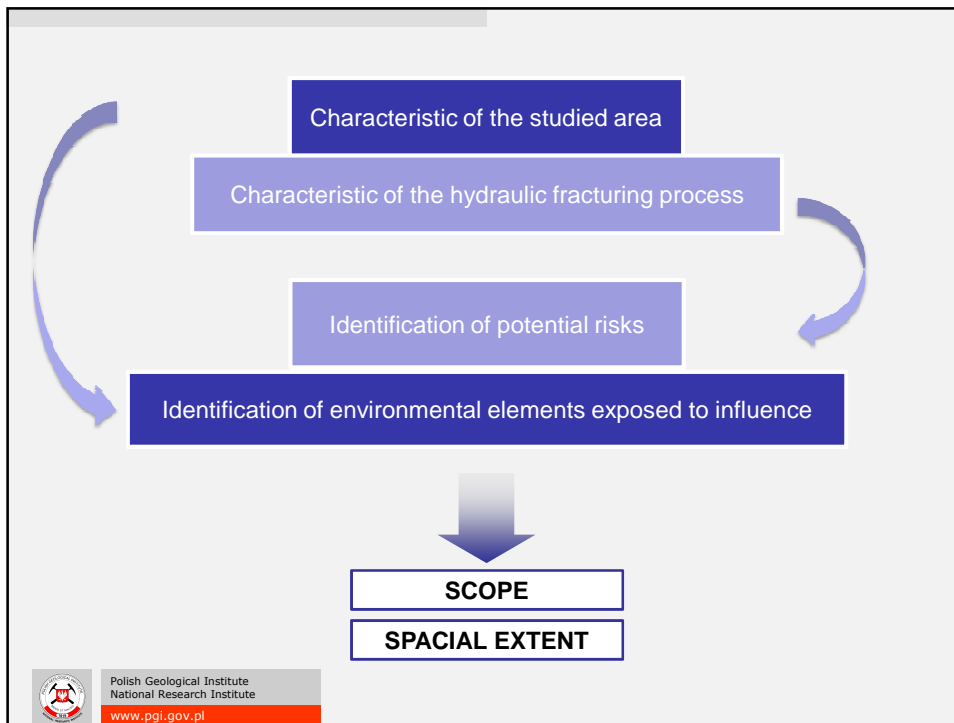
Geological and  
hydrogeological  
conditions

Monitoring

Impact  
analysis



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## Specific of the shale gas production

- Dense grid of production wells; numerous wells (several thousand per basin)
- Well pad bigger than in conventional exploration (temporary use)
- Long horizontal intervals; up to 2.000-3.000 m
- Production stimulated by hydraulic fracturing, several fracturing stages per well
- Water use for fracturing
- Flowback waters utilization
- Track transport more intensive than in conventional drilling



## Potential environmental impacts

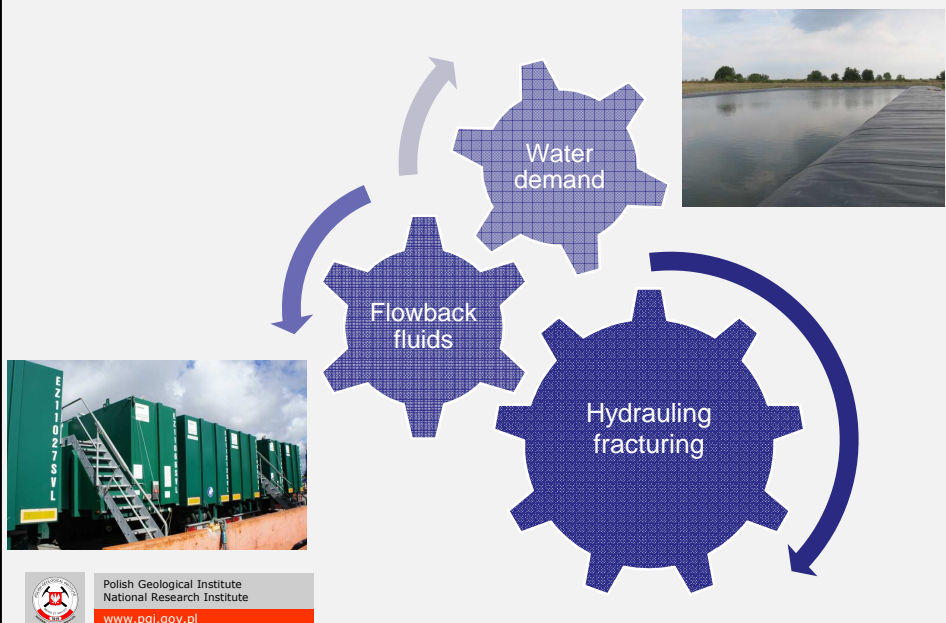
- Water use
- Hazard of fresh water contamination
- Surface pollution
- Land use
- Soil pollution
- Air pollution
- Noise pollution
- Seismic issues



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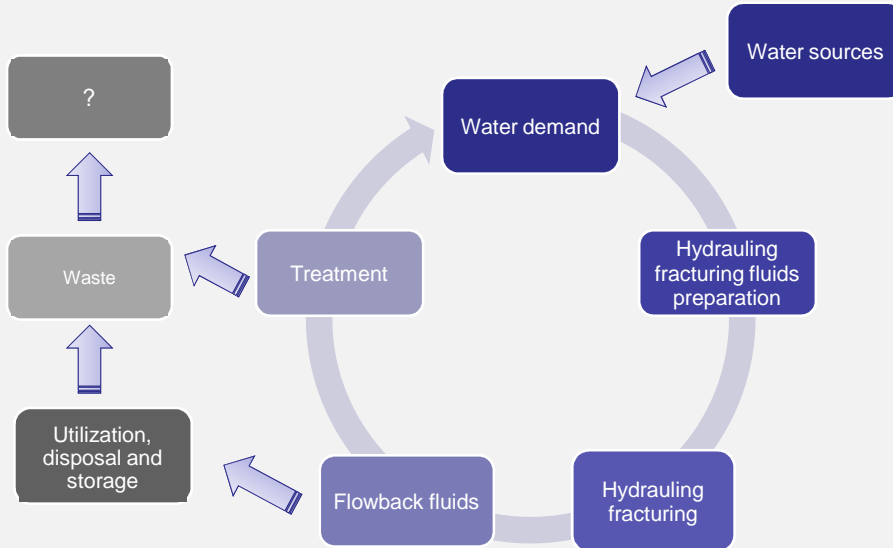
## What is the most important?



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## Water management



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## Water use in hydraulic fracturing

### Water demand

- 1.000 - 5.000 m<sup>3</sup> per one stage used once in well history
- up to 10.000 m<sup>3</sup> per well



### Water sources for fracturing

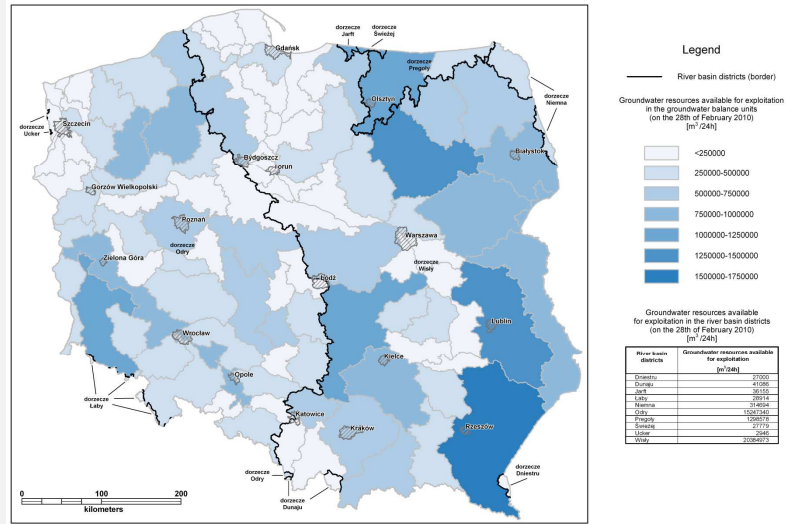
- Surface water
- Shallow groundwater (the first aquifer)
- Usable aquifers (generally available)
- Shallow formation brines (Cretaceous, Jurassic)
- Sea water
- Mine water
- Flowback fluids



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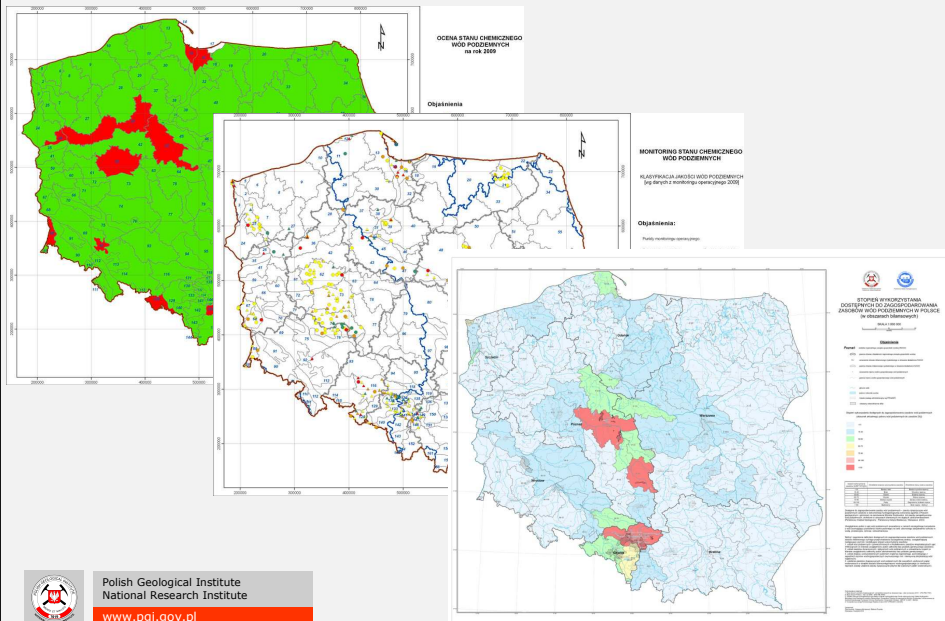
# Groundwater resources in Poland



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Source: Polish hydrogeological survey, 2011

# Groundwater status in Poland



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## How to maintain good groundwater status?

- 1
  - Good legal regulations (permit for water, environmental impact assessment, geological documentation, etc.)
- 2
  - Safe technologies
  - Best practices
- 3
  - Sustainable water management
  - Minimize water demand
- 4
  - Dedicated monitoring
- 5
  - Maximize recycle
  - Flowback treatment



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## Dedicated monitoring of environment



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## Monitoring of quantity

- Water use
- Waste and wastewater
- Emissions
- Noise
- Traffic



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## Monitoring of quality

- Possible migration of pollution
- Hydrodynamic modelling
- Tracer studies
- Environmental assessment at various stages of activities

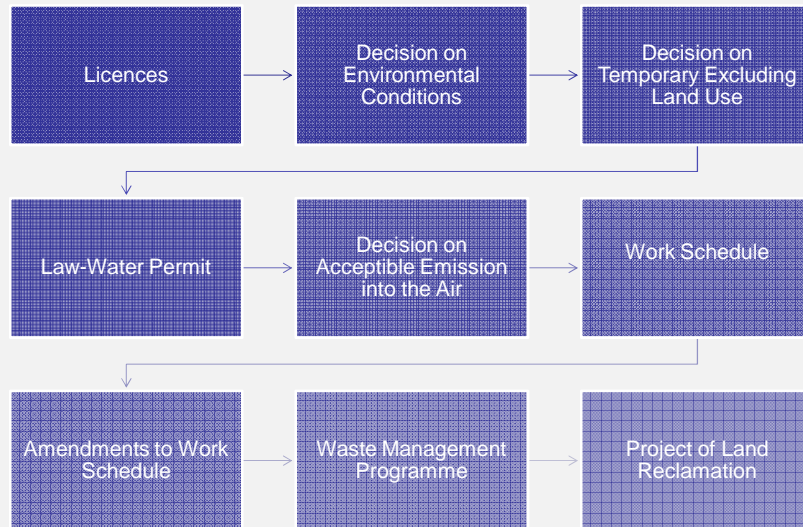


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## Monitoring of procedures



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## First hydrauling fracturing in horizontal well in Poland – Łebień (Lane Energy)

- State of the environment before the start of the hydraulic fracturing job - as a benchmark
- Observations and measurements during the hydraulic fracturing process and gas tests
- State of the environment after the hydraulic fracturing process and production tests

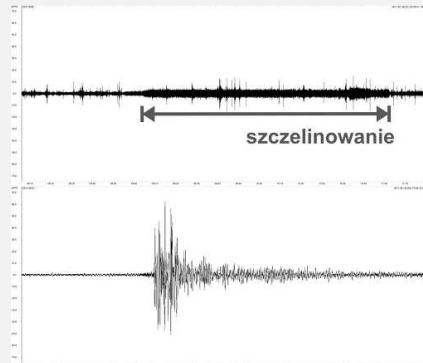


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## Scope of activity

- Seismic Monitoring
- Air and Noise Pollution
- Radioactivity – Radon level
- Potential emissions of shale gas
- Surface and Groundwater
- Technological fluids and waste



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## Conclusions

- More data and information
- Continuation of environmental research - Case studies
- Constant cooperation of science, industry and administration
- Procedures
- Low emission technologies

**Environmental pressure analysis  
and monitoring.**



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Thank you  
for your attention.

[malgorzata.woznicka@pgi.gov.pl](mailto:malgorzata.woznicka@pgi.gov.pl)



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