NETL test of Fracking Leakage


Leakage was tested by: (1) using a downhole seismic array to locate micro-earthquakes caused by the hydrofracturing of 6 horizontal wells in the Marcellus, (2) monitoring conventional gas reservoirs above the hydraulically fractured wells for pressure changes, (3) injecting a tracer detectable at ppt levels in one of the hydraulically fractured wells and sampling the overlying reservoir waters, and (4) examining fluid signatures unique to the Marcellus formation for entry of gases or waters into the conventional reservoirs. A more thorough test for migration is hard to imagine. No evidence of fluid (gas or water) escape from the Marcellus was found, and although micro-seismicity extended above the Tully limestone “barrier”, the uppermost events were at least 1800 ft below the monitoring wells in the conventional gas reservoir and 5,500 ft below the drinking water aquifers.

In more detail, the potential for contamination of drinking water from hydrofracking the Marcellus ~8000 ft below was assessed by:

- Collecting 3-component seismic data in two vertical wells penetrating to Marcellus depths and imaging in 3D the microseisms produced during the hydrofracturing of 6 horizontal Marcellus wells.
  - Although microseisms occurred above the Tully Limestone “barrier”, with some clusters of microseisms 1000 to 1900 above the Marcellus, the uppermost events were at least 1800 ft below the monitoring wells in the conventional gas reservoir and 5,500 ft below the drinking water aquifers.
- Monitoring pressure changes that occurred during hydrofracturing in a conventional gas field lying ~4000 ft above treated parts of the Marcellus.
  - No changes in pressure during hydrofracturing were observed.
- Collecting water in the conventional gas field to detect if fluids or gas had been introduced as the result of the hydrofracturing.
  - No evidence was found for incursion of carbon and hydrogen isotopically distinct Marcellus gas into the Upper Devonian (UD) gas reservoirs. 10% introduced gas could have been detected.
  - No evidence was found from their distinctive (compared to UD waters) Sr isotopic signature that Marcellus water had been introduced into the conventional gas field. A >0.5% incursion would have been detected.
  - No evidence was found that PFC tracers introduced into the treatment waters in one of the 6 wells reached the conventional reservoir. The PFC tracers were detectable at 1
ppt concentration. PFC tracer was easily detected in a horizontal treatment well 750 ft from the treatment well where the tracer was injected.

The authors conclude:

“Current findings are: 1) no evidence of gas migration from the Marcellus Shale; and 2) no evidence of brine migration from the Marcellus Shale.

**Figure 1.** A summary diagram showing the drinking water aquifers, the conventional gas fields where the monitoring wells were deployed, and the Marcellus shale and the extent of the fractured interval.

**Figure 2.** The microseisms observed and the Marcellus (MW) vertical wells in which the seismometer array was deployed, and 3 of the 7 Upper Devonian monitor wells.
Figure 2. Microseisms induced by the hydraulic fracturing of the 6 Marcellus horizontal wells shown in the top diagram. The cluster of microseisms 800 ft above the treated interval is probably a fault zone.