

## Retrospective Case Studies – Raton Basin, Colorado

### EPA's Study of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources

#### Case Study Background

EPA conducted a retrospective case study in the Raton Basin of Colorado to investigate reported instances of contaminated drinking water resources in areas where hydraulic fracturing activities occurred. EPA examined potential drinking water impacts and potential sources. This region is undergoing increasing development of its coalbed methane (CBM) resources. Hydraulic fracturing practices within this area focus on recovering gas from CBM formations that are sometimes in close proximity to drinking water aquifers. The selected study sites are located within the Colorado portion of the basin and include parts of Las Animas and Huerfano counties.

#### Goals and Scope of Research

EPA set out to determine if homeowner drinking water wells were impacted, and if so to better understand potential sources of the contamination. The case study was not intended to identify all source(s) of potential impacts in the study area nor conduct detailed contaminant transport and fate studies related to any potential impacts found.

#### EPA Research Approach

To determine if an impact in Las Animas and Huerfano counties occurred, EPA collected samples on four separate occasions. Sampling locations are shown on the map below. EPA analyzed water samples for over 245 constituents, ensuring that a broad spectrum of indicators associated with various land use activities, including but not limited to CBM development, extraction, and production was covered. EPA then evaluated the water quality data and the results from this study against the historical background data which helped determine if potential impacts existed. EPA researchers also analyzed for any changes in general water quality, geochemistry, and isotopic parameters (also used to identify sources of ground water) of samples collected from domestic wells, monitoring wells, production wells, and surface water bodies in the Raton Basin.

#### Key Findings from Research

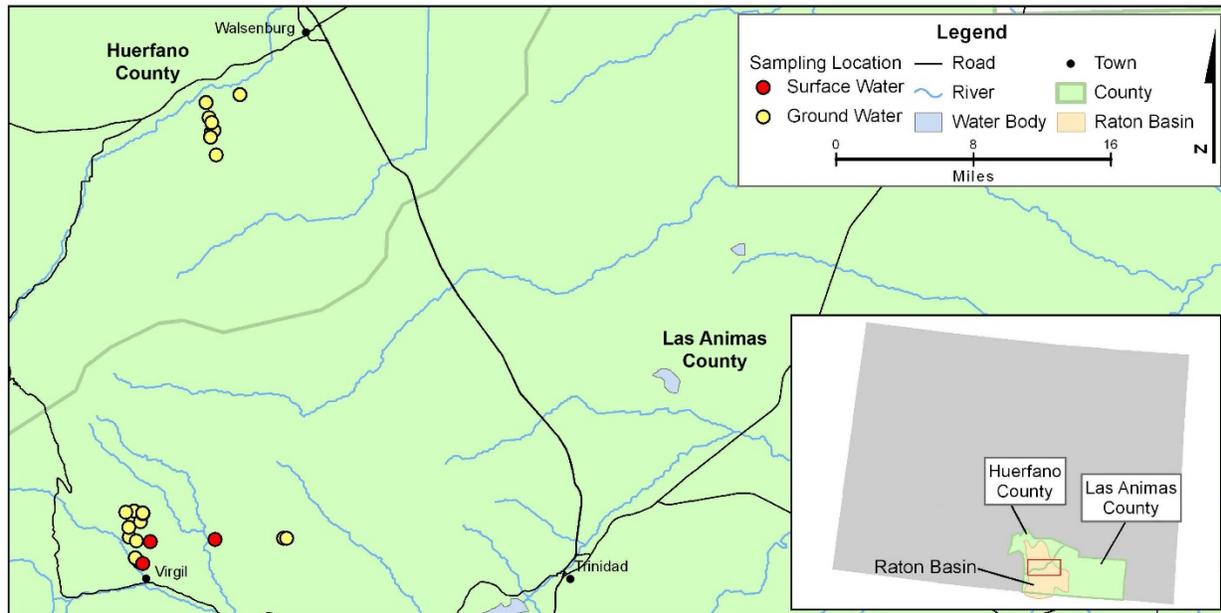
Most of EPA's findings in this area were either consistent with background levels or could not be definitively linked to hydraulic fracturing activities.

- Background data indicates that dissolved methane is naturally present through-out the Raton Basin and EPA detected it in all samples collected from the domestic wells.
- In one of the sampling areas (Little Creek Field; Huerfano County), gas migration had occurred but cannot be definitively linked to hydraulic fracturing.
- Tertiary Butyl-Alcohol (TBA) was also detected in samples from domestic, monitoring, and production wells; however, we were not able to confirm the specific source(s) of the TBA.

#### Sampling Activities

EPA completed four rounds of water sampling from October 2011 to May 2013. Samples were collected from domestic wells<sup>1</sup>, monitoring wells<sup>2</sup>, production wells<sup>3</sup>, and surface water<sup>4</sup> bodies in Las Animas and Huerfano counties where homeowners expressed concerns regarding potential adverse impacts on well water associated with hydraulic fracturing and/or coalbed methane development.

A full listing of sampling results can be found in EPA's report: *Retrospective Case Study in the Raton Basin* at <http://www2.epa.gov/hfstudy/published-scientific-papers>.



- <sup>1</sup>Domestic well – A homeowner well that serves as source of potable and/or irrigation water for the household.
- <sup>2</sup>Monitoring well – A well installed to obtain water quality samples or measure groundwater levels.
- <sup>3</sup>Production well – A well used to retrieve petroleum or gas from an underground reservoir.
- <sup>4</sup>Surface Water – Water naturally open to the atmosphere (e.g. lakes, streams, ponds, etc).

### What are Retrospective Case Studies?

EPA conducted retrospective case studies at locations where hydraulic fracturing had already occurred, and where residents had reported concerns about contamination of drinking water resources. The retrospective case studies may provide information about which, if any, specific geologic and hydraulic fracturing conditions could contribute to impacts on drinking water resources by hydraulic fracturing activities. This is important because the conditions under which hydraulic fracturing occurs may vary between sites, so that the potential for impacts on drinking water resources could also be different. As part of this effort, scientists have looked for evidence of contamination to drinking water resources, and the possible cause(s) of such impacts, if applicable.

### How Were They Selected?

To select the retrospective case study sites, the EPA invited stakeholders from across the country to participate in the identification of locations for potential case studies through informational public meetings and the submission of electronic or written comments. Over 40 locations were nominated for inclusion in the study.

These locations were prioritized and chosen based on a rigorous set of criteria, including proximity of population and drinking water supplies, reported evidence of impaired water quality, health and environmental concerns, and knowledge gaps that could be filled by a case study at each potential location. Sites were prioritized based on geographic and geologic diversity, population at risk, geologic and hydrologic features, characteristics of water resources, and land use.

**Study Limitations:** Retrospective case studies are often constrained by a lack of baseline data (e.g., site-specific water quality data) which limited the EPA's ability to link drinking water resource impacts to definitive causes or sources. Despite the difficulties in determining the specific sources of potential impacts, scientists were still able to use the data collected to shed light on potential vulnerabilities to drinking water resources.