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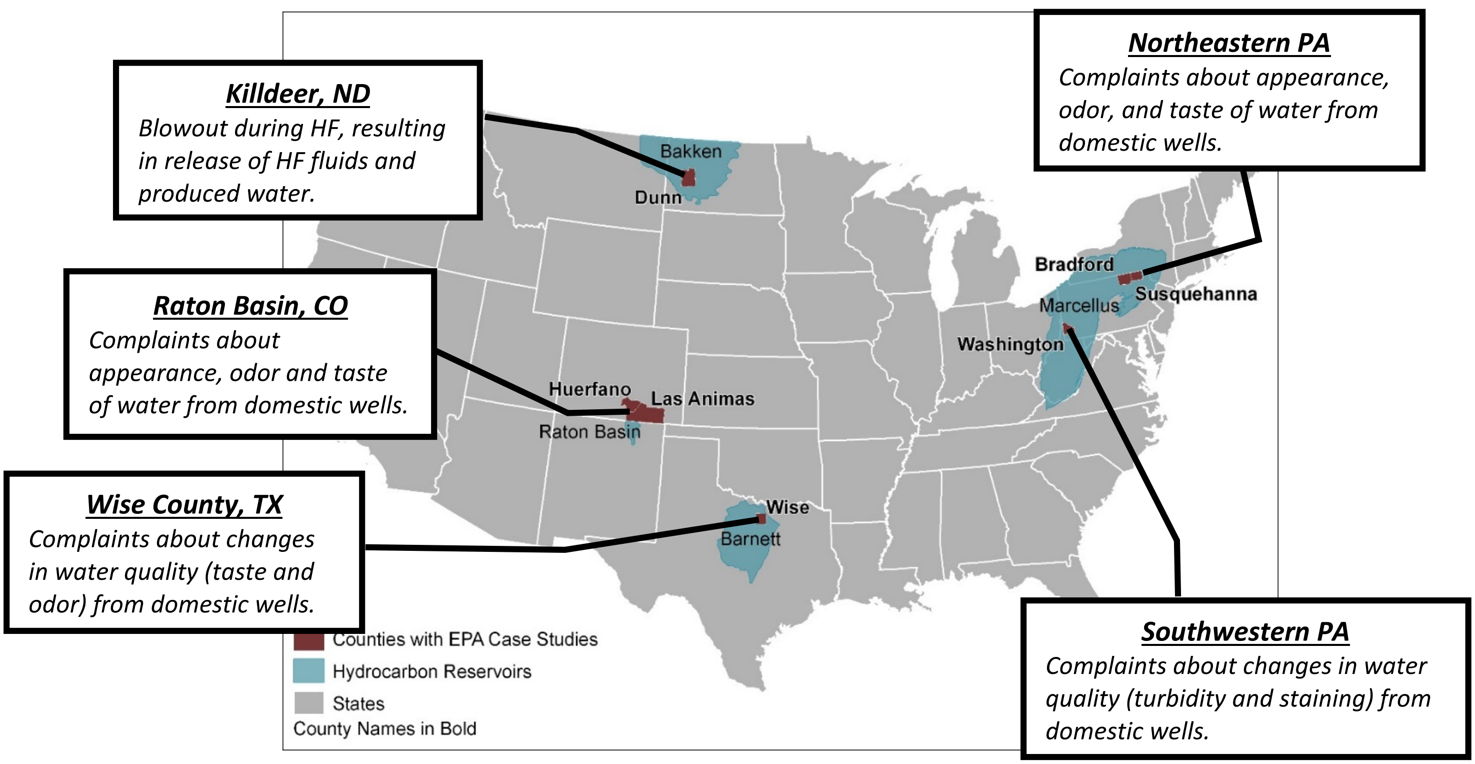
EPA's Hydraulic Fracturing Study: Retrospective Case Studies

Introduction: As part of the EPA's broader study of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources, the EPA conducted retrospective case studies at five locations where hydraulic fracturing had already occurred, and where residents had reported concerns about impacts to drinking water resources. Through these case studies, the EPA sought to identify whether an impact had occurred, and if so, to better understand the potential causes of those impacts.

The case studies provide valuable insights into vulnerabilities and potential pathways for impacts to drinking water from hydraulic fracturing activities, such as; surface activities (including impoundment, well pads, and associated spills), and well construction and integrity. The case studies highlight the value of site-specific background data, including the chemicals used on site, and local geological information. States worked cooperatively with the EPA on these case studies, and have independently taken follow-up steps to protect water resources at all the case study locations.



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.

Key Findings: The key findings of each retrospective case study relied on the best available science and incorporated historical water quality datasets, publicly available information for drilling and hydraulic fracturing operations within each study area, environmental site assessments, and the results of data collected during the case study sampling events. A summary of the key findings is below:

Location	Key Findings
Killdeer, ND	The drinking water wells sampled did not show the presence of chemicals or brine associated with the blowout. However two monitoring wells screened in the Killdeer aquifer showed the presence of brine and tert-butyl alcohol (TBA). Based on the data analysis performed, the only potential source consistent with the TBA and brine at the two monitoring wells was the blowout during hydraulic fracturing that occurred in Killdeer, ND.
Northeastern PA	Background data showed that methane is naturally occurring in the study area; however, using multiple lines of evidence EPA concluded that up to nine of the 36 drinking water wells are impacted by stray gas (methane and ethane) associated with nearby hydraulic fracturing activities.
Southwestern PA	Increased levels of chloride in ground water at locations near an impoundment site which contained hydraulic fracturing wastewaters and drilling waste. The chloride contamination likely originates from the impoundment site based on multiple lines of evidence. Background data showed that methane is naturally occurring in this area and was detected in 24% of the samples collected from domestic wells. The isotopic signature of the methane present in domestic wells was not similar to that of gas produced from the shale being hydraulically fractured.
Wise County, TX	In one of the three study areas, two domestic wells were impacted. Based on the screening of potential sources of impacts, brines associated with the specific geological formation were the only source that was consistent with the observed impacts to two of the study wells. Screening also identified a third well located at an industrial facility that was potentially impacted by brines and/or landfill leachate.
Raton Basin, Co	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.

For detailed information on the individual case studies, visit http://www2.epa.gov/hfstudy/case-studies-epas-hydraulic-fracturing-study.

Approach and Sampling Activities: To help determine if an impact occurred, researchers conducted literature reviews and analyzed historical background geology and hydrology data for each site. From summer 2011 to spring 2013, the EPA collected water samples from domestic wells, monitoring wells, municipal wells, water supply wells, production wells and surface water sources during multiple sampling trips at the five case study locations. EPA scientists analyzed the water samples for a broad range of water quality parameters and chemicals. The water quality results were used to evaluate potential impacts to drinking water resources, and if possible, identify potential sources of the identified impacts. Quality assured data from the retrospective case studies have been made publicly available in a usable format on the study's website along with the peer reviewed case study reports.

Case Study Selection: 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. Locations were then 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.