

Retrospective Case Studies – Killdeer, North Dakota (Dunn County)

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 near Killdeer, North Dakota to investigate potential impacts to drinking water resources after a known blowout of a well. The blowout occurred during a hydraulic fracture in September 2010 and released hydraulic fracturing fluids, oil, and flowback water onto the surrounding area and possibly into the Killdeer aquifer. After the blowout, the state initiated remediation efforts.

Goals and Scope of Research

EPA set out to determine whether drinking water resources were impacted, and if so to better understand the 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 whether drinking water resources were contaminated in the Killdeer aquifer, EPA collected samples on three separate occasions. Sampling locations are shown in the map below. EPA analyzed water samples for over 225 constituents, ensuring that a broad spectrum of indicators associated with various land uses, including but not limited to shale-gas drilling 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 (used to identify sources of impacts to ground water) at the ground water locations sampled in the Killdeer aquifer that may have resulted from the blowout or other land use activities or other potential sources of contamination. Since pre-development water quality information near the well pad was available, this provided historical, pre-drilling information.

Key Findings from Research

- 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.

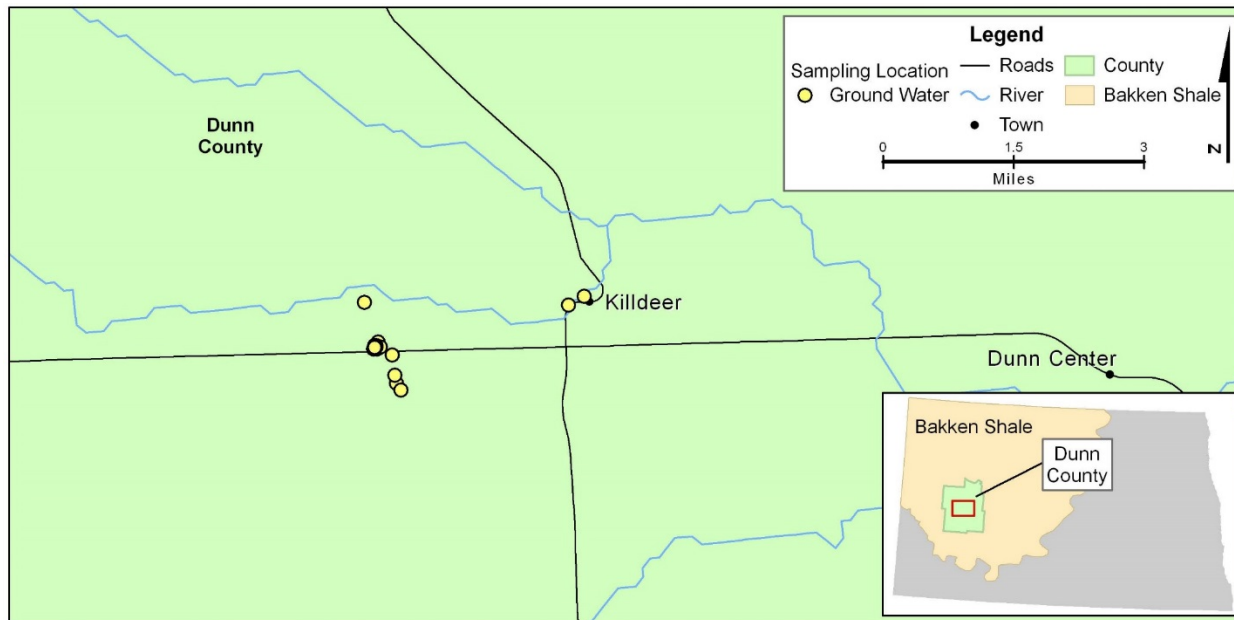
State Activities at the Case Study Location

North Dakota responded to the blowout and the site remediation is complete. No further actions are required for this site.

Sampling Activities

EPA completed three rounds of water sampling from July 2011 to October 2012. Ground water samples from the Killdeer aquifer were collected from domestic wells¹, monitoring wells², one state well, one municipal well³, and water supply wells⁴.

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



¹Domestic well – A homeowner well that serves as source of potable and/or irrigation water for the household.

²Monitoring well – A well installed to obtain water quality samples or measure groundwater levels.

³Municipal well – A water supply well operated by a city, town agency or government.

⁴Water supply well – A well operated to supply water for oil and gas activities.

What Are Retrospective Case Studies?

EPA conducted retrospective case studies at locations where hydraulic fracturing had already occurred. This case study differs from the other EPA retrospective case studies in that it focuses on an oil well where a known release occurred during the hydraulic fracturing process and resulted in a release of hydraulic fracturing fluids, oil, and flowback water onto the land surface and possibly into the Killdeer aquifer. 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.

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 submission of electronic and 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.