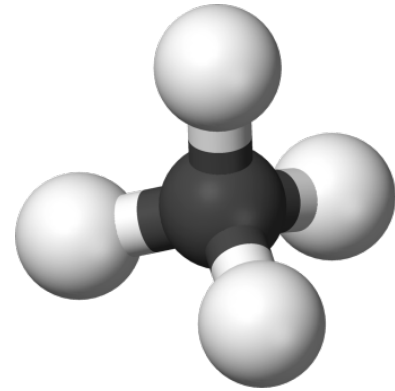


## COGCC Fact Sheet - Methane in Colorado Groundwater

### What is methane?

Methane (CH<sub>4</sub>) is a simple hydrocarbon molecule of one carbon atom and four hydrogen atoms. Methane gas is colorless, tasteless, and odorless. Methane is a naturally occurring hydrocarbon gas that is flammable and explosive in certain concentrations.

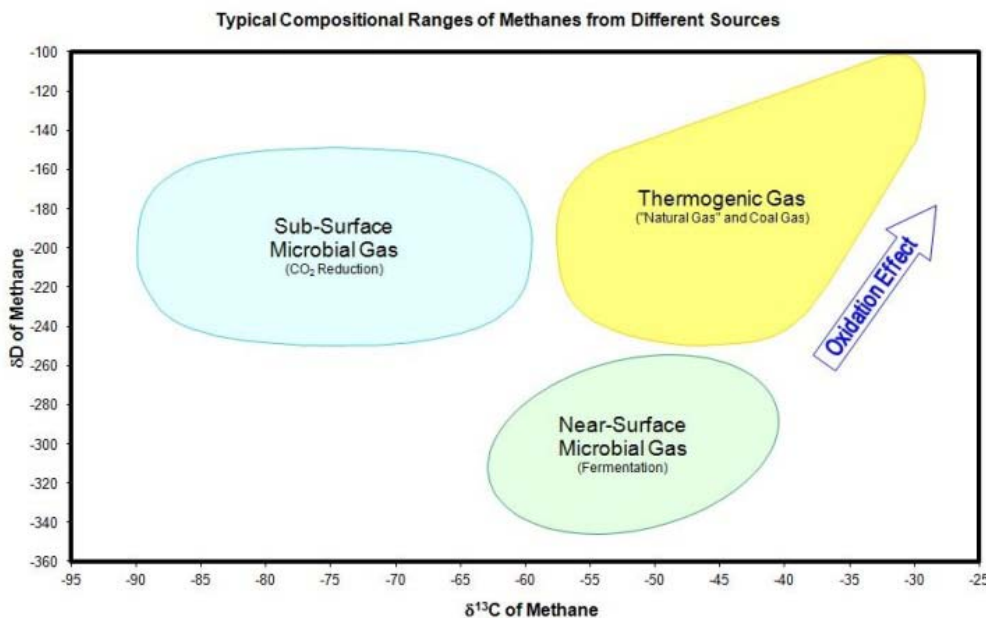


### Where does Methane come from?

Methane is produced either by bacteria, or by geologic processes involving heat and pressure. Methane gas can be **biogenic** or **thermogenic** depending on its origin. Biogenic methane is created by the decomposition of organic material through fermentation, as is commonly seen in wetlands, or by the chemical reduction of carbon dioxide. Biogenic methane is found in some shallow, organic rich water-bearing geologic formations, such as coal seams, into which water wells may be completed. Biogenic methane typically is not targeted for production in Colorado; however, the Niobrara gas field in Yuma County is an exception.

Thermogenic methane is created by the thermal decomposition of buried organic material. Thermogenic methane is typically found in rocks buried deeper within the earth than biogenic methane. In Colorado, thermogenic methane may be associated with oil and gas development. In certain regions of Colorado thermogenic methane may be naturally produced in water wells where formation rocks are at or close to the surface.

Different types of data analyses can be used in conjunction to help determine whether a methane gas is of biogenic or thermogenic origin, or a mixture of the two. The analytical methods used to differentiate between the two types of methane are well-known, scientifically accepted, and summarized in a [well-known presentation by Dennis Coleman](#) and [papers by I.R. Kaplan and Dennis Coleman](#). These works, in turn, cite nearly 75 other references related to the topics of methane generation, “fingerprinting,” forensic investigations, and stable isotope geochemistry.



Stable Isotopic data is used in the determination of whether a methane gas is biogenic or thermogenic. The figure to the left shows the typical isotopic ratios ( $\delta$ Deuterium/ $\delta$ Carbon<sup>13</sup>) for methane produced by biogenic and thermogenic processes.

In addition to the isotopic data, compositional analysis

can be used to determine the origin of a methane gas. Naturally occurring methane gas typically contains small amounts of ethane and other hydrocarbons as well as methane. The proportion of methane to ethane in a gas can help determine its origin. Biogenic methane gas typically contains much greater percentage of methane than ethane or other hydrocarbons.

**What is the Occurrence of Methane in Colorado groundwater?**

Methane gas occurs naturally in groundwater in sedimentary basins in Colorado and around the world. Colorado water wells that contain methane are frequently drilled into sedimentary formations that contain coal. Wells are frequently completed in coals seams in the San Juan basin in Southwestern Colorado, the Raton Basin in Southeastern Colorado and the Laramie Fox Hills Formation in Northeastern Colorado. The included drillers log clearly shows that the screened portion of the well is placed across several coal seams, and two of those coal seams are the primary sources of groundwater in the domestic well.

The occurrence of methane in the coal bearing sedimentary formations used as water sources in Colorado has been well documented in numerous publications. For example, a [1976 publication by the Colorado Division of Water Resources](#) states that the Laramie Fox Hills aquifer contains “troublesome amounts of . . . methane.” [The Raton Basin Baseline Study conducted by the COGCC from 2000 – 2003](#)

states “methane is widely distributed in the shallow aquifers across the basin.” In addition, the [BLM North San Juan Basin White Paper, December 1999](#), discusses the historic occurrences of methane in water wells completed in the Fruitland and Menefee formations.

**Is methane in groundwater a health risk?**

Studies have not linked ingestion of water containing methane to any short term (acute) or long term (chronic) health effects. When present at high concentrations, methane gas may act as an asphyxiant. Asphyxiants displace air and can cause breathing and other health problems.

At higher concentrations in the atmosphere methane gas can present an explosive hazard. Methane gas forms explosive mixtures in the atmosphere at concentrations between 5% and 15% by volume. If free methane gas or water with high concentrations of dissolved methane enter confined spaces, other factors such as water temperature, ventilation of the well, air movement inside the confined space, size of the confined space, and the percent composition

4. GROUND SURFACE ELEVATION _____ feet					DRILLING METHOD AIR ROTARY				
DATE COMPLETED 4/9/2006					TOTAL DEPTH 740				
5. GEOLOGIC LOG:					6. HOLE DIAM (in.)				
Depth	Type	Grain Size	Color	Water Loc.	8 3/4	0	39		
0-3	overburden	dirt	brn		6 1/8	39	740		
3-106	ss	med	gray		7. PLAIN CASING:				
106-153	sh	clay	gray		OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
153-192	ss	med	gray		6 5/8	steel	188	+1	39
192-197	coal/sh	/clay	blk/gray		4 1/2	pvc	200	8	280
197-239	sh	clay	gray		4 1/2	pvc	200	320	680
239-293	sh/ss	clay/med	gray		PERFORATED CASING: Screen Slot Size (in): 1/8th				
293-295	coal		blk	295	4 1/2	pvc	200	280	320
295-359	sh	clay	gray		4 1/2	pvc	200	680	740
359-364	coal		blk		37 interval 37-20's				
364-412	sh	clay	gray		8. FILTER PACK:				
412-422	ss	med	gray		Material	none	9. PACKER PLACEMENT:		
422-423	coal		blk		Size		Type	none	
423-531	sh	clay	gray		Interval		Depth		
531-533	coal		blk		10. GROUTING RECORD				
533-691	sh	clay	gray		Material	Amount	Density	Interval	Placement
691-693	coal		blk	691	cement	6bags	36gals	4-39	poured
693-740	ss	med	gray		Remarks:				

of combustible gas are factors that must be evaluated to determine if the methane gas or dissolved methane in water is capable of producing an explosive hazard.

**My water well has methane in it, what should I do?**

Further information regarding the treatment/mitigation of methane in groundwater can be found in [“How Well Do You Know Your Water Well?”](#) The information was prepared by Michael Matheson, P.G. with Plateau Environmental Services, Inc. and Joe Bowden, PhD, with CDS Environmental Services, LLC.