Technology of natural gas

Lecture 3

Dr. Semaa I. Khaleel

Petroleum and Refining Engineering Department

Email: semaaibraheem@uomosul.edu.iq

Methane (CH_4 or C_1)

This is the prime compound in natural gas.

Ethane (C_2H_6 or C_2)

This compound occurs as the second largest component of all natural gases. It has a considerably higher gross heating value than methane (1769 BTU's/SCF versus 1010 BTU's/SCF of gas or 66.0 MJ/m versus 37.7 MJ/m).

Propane (C_3H_8 or C_3)

This compound is a significant part of pipeline gas. However, if there is much present in the raw gas, say 2.0% or greater, then it is generally more economical to absorb it and recover it as a liquid and sell it as a liquid fuel.

Isobutane ($i\text{-}C_4H_{10}$ or iC_4)

This compound is normally extracted as liquid. It is used as a component in the manufacture of high-octane gasoline (alkylate).

n-Butane ($n\text{-}C_4H_{10}$ or nC_4)

This compound is normally extracted as a liquid. It is generally used as a blending agent in motor gasoline.

Pentanes and Heavier (C_5H_{12} or C_5 or heavier)

These compounds appear in pipeline gas only in small quantities. They are mostly in the form of liquids when entering the processing plant. They are separated and are the primary compound in condensate.

Mercaptans (CH_3SH -methyl mercaptan or C_2H_5SH -ethyl mercaptan)

These are very foul-smelling compounds that, in very small quantities can be used as gas odorants, but in larger quantities make the gas offensive to certain consuming areas.

Natural gas is considered **"dry"** when it is almost pure methane, having had most of the other commonly associated hydrocarbons removed. When other hydrocarbons are present, the natural gas is **"wet"**. The composition of natural gas varies depending on the field, formation, or reservoir from which it is extracted.

1.5 Gas Specifications

Market sales of natural gas require some specifications set by the consumers regarding the maximum contents allowable for the following: acidic gases and sulfur, oxygen and carbon dioxide, water vapor, and liquefiable hydrocarbons. The thermal heating content of the gas sets another value to be met as a minimum. Irrespective of the source of natural gas, the final specifications set for market sales requirements are usually the following:

H$_2$S	0.25-0.3 grain per 100 ft3
Total sulfur	20 grains per 100 ft3
Oxygen (air)	0.2% by volume
Carbon dioxide	2% by volume
Liquefiable hydrocarbons	0.2 gal per 1000 ft3
Water content	7 Ibs/MSCF (in a 1000-psia gas line)
Thermal heating value	1150 Btu/ft3

What is the meaning of MMSCF or Mmscf?

Million standard cubic feet per day is a unit of measurement for gases that is predominantly used in the United States. It is frequently abbreviated MMSCFD. So, Abbreviation for million standard cubic feet, a common measure for volume of gas. Standard conditions are normally set at 60°F and 14.7 psia.

What is MSCF unit? Abbreviation for a thousand standard cubic feet per day, a common measure for volume of gas.

What is grain unit? The grain per cubic foot density measurement unit is used to measure volume in cubic feet in order to estimate weight or mass in grains.

1.5.1 Special specifications

1. Wobbe index

$$Wobbe\ No. = \frac{Gross\ Heavy\ Value\ in\ BTU\ /\ SCF}{\sqrt{Specific\ Gravity}} \quad \dots\dots\ Equation\ 1\text{-}1$$

This is a measure of the burning qualities of the gas. Gases mixed together should have Wobbe number within 10%. The Wobbe index is a measure of the interchangeability of gases when they are used as a fuel. It compares the energy output of different gases during combustion. The Wobbe index is essential for analyzing the impact of a fuel changeover and is also a common specification of appliances that use gas and of devices that transport gas. The Wobbe index may be calculated from the higher heating value (HHV) and the specific gravity of the gas.

$$Wobbe\ Index = \frac{HHV}{\sqrt{SGgas}}$$