Method for the Analysis of Natural Gas Condensate Mixtures Containing Nitrogen and Carbon Dioxide by Gas Chromatography

GPA Midstream Association
Sixty Sixty American Plaza, Suite 700
Tulsa, Oklahoma 74135

DISCLAIMER

GPA Midstream Association publications necessarily address problems of a general nature and may be used by anyone desiring to do so. Every effort has been made by GPA Midstream to assure accuracy and reliability of the information contained in this publication. Each person who uses or refers to this publication will need to make their own decisions based on consideration of their own internal best practices, recommendations, and engineering judgment. GPA Midstream and its members do not guarantee the accuracy, completeness, efficacy, timeliness, or correct sequencing of such information, including without limitation, the reference material and information of the various other industry associations that may be provided herein. Use of the information provided in this publication is voluntary, and reliance on it should only be undertaken after an independent review of its accuracy, completeness, efficacy, timeliness, and consideration of the applicability of any local, state, and federal laws and regulations.

It is not the intent of GPA Midstream to assume the duties of employers, manufacturers, or suppliers to warn and properly train employees, or others exposed, concerning health and safety risks or precautions. Reference herein to any specific commercial product, process, or service by trade name, trademark, service mark, manufacturer, or otherwise does not constitute or imply endorsement, recommendation, or favoring by GPA Midstream.

GPA Midstream makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state or municipal regulation with which this publication may conflict, or for any infringement of letters of patent regarding apparatus, equipment, or method so covered.

ACRONYMS

API – American Petroleum Institute

ASTM – American Society for Testing and Materials

BTEX – Benzene, Toluene, Ethylbenzene and Xylenes

CO_2 – Carbon Dioxide

FID – Flame Ionization Detector

GC – Gas Chromatograph or Gas Chromatography

GPSA EDB – GPSA Editorial Databook

ISO – International Standards Organization

MeABP – Mean Average Boiling Point

MPMS – Manual of Petroleum Measurement Standards

RR – Round Robin

SOP – Standard Operating Procedure

TCD – Thermal Conductivity Detector

DEFINITIONS

Plus Fraction - Abbreviated term to refer to the heavier portion of hydrocarbons in the sample shown as a single peak on the chromatogram. In GPA 2103 this is either hexanes and heavier (C_6+) or heptanes and heavier (C_7+)

Molar mass – The mass of a substance divided by the number of moles of that substance. Historically, molar mass is expressed in the units of grams per mole (g/mol). When expressed in g/mol units, the numerical value of molar mass is equal to the numerical value of the lbs/lbmol, molecular weight, molecular mass (both now more correctly called relative molar mass), formula weight, or daltons (Da) of a compound. For the purposes of this document, molar mass is expressed in lbs/lbmol units.

REFERENCES

ASTM D1015 – Test Method for Freezing Point of High Purity Hydrocarbons

ASTM D2001 – Standard Test Method for Dependanization of Gasoline and Naphtha's

ASTM D287 – Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)

ASTM D4052 – Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

ASTM D5002 – Standard Test Method for Density and Relative Density of Crude Oils by Digital Density Analyzer

ASTM D86 – Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure

ASTM MNL50, Chapter 3 – Characterization of Petroleum Fractions

API MPMS Chapter 12.2 Part 3 – Calculation of Petroleum Quantities: Calculations of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors

API MPMS Chapter 20.1 – Allocation Measurement

GPA 2174 – Obtaining Liquid Hydrocarbons Samples for Analysis by Gas Chromotography

GPA 2177 – Analysis of Natural Gas Liquid Mixtures Containing Nitrogen and Carbon Dioxide by Gas Chromatography

GPA 2186 – Method for Extended Analysis of Hydrocarbon Liquid Mixtures Containing Nitrogen and Carbon Dioxide by Temperature Programmed Gas Chromatography

GPA 2198 – Selection, Preparation, Validation, Care and Storage of Natural Gas and Natural Gas Liquids Reference Standards Blends

Method for the Analysis of Natural Gas Condensate Mixtures containing Nitrogen and Carbon Dioxide by Gas Chromatography

1. SCOPE

1.1. This method is intended for the analysis of hydrocarbon liquids containing nitrogen/air and carbon dioxide that fall within the compositional ranges listed in Table 1. The round-robin data includes a sample containing 62 mole percent of hexanes plus with a molar mass of 93. Therefore, for samples containing a hexanes plus with a molar mass over 93, GPA 2103 should be the test method. Refer to Section 5 for the precision statement.

Note 1 – This method can be used for a hexanes plus or heptanes plus analysis by adjusting the timing of the precut event to occur following the elution of n-pentane or n-hexane from the precut column. The term plus fraction in this document is applicable to either the hexanes plus or heptanes plus version of this analysis.

Table 1 – Components and Compositional Ranges Allowed (mole %)

Component	Lower Range [1]		RR Range		Upper Range [1]	
Nitrogen	0.01	0.11	0.12	4.90	4.91	5.00
Carbon Dioxide	0.01	0.02	0.03	5.29	-	-
Methane	0.01	0.04	0.05	25.77	25.78	40.00
Ethane	0.01	0.06	0.07	24.80	-	-
Propane	0.01	0.04	0.05	25.43	-	-
i-Butane	0.01	0.05	0.06	25.11	-	-
n-Butane	0.01	0.04	0.05	25.09	-	-
i-Pentane	0.01	0.20	0.21	26.02	-	-
n-Pentane	0.01	0.19	0.20	25.07	-	-
Hexanes + [2]	20.00					100.00

[1] Range of original scope but not evaluated in the round robin

[2] Included in blends but not included in the round robin since these values are calculated and not determined in the gas chromatography portion of the analysis

1.2 The components listed in Table 1 are determined by GC, with the exception of the plus fraction which is either ignored or precut to vent and determined volumetrically (refer to API MPMS Chapter 20.1). Physical properties for the plus fraction can either be determined by measurement or calculated from measured values." An extended analysis version of this method can be accomplished by performing GPA 2186 and mathematically combining the TCD analysis with the