

## Application Note

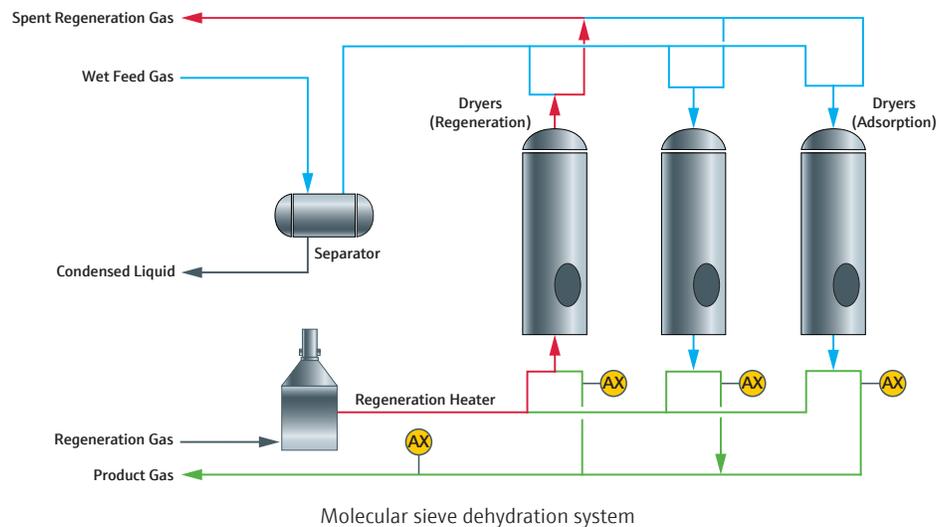
# Water measurement in dry LNG feed gas

**Industry:**  
Liquefied Natural Gas (LNG)  
Application Note 44201

### Key Points

- Fast response to H<sub>2</sub>O concentration changes
- Patented\* Differential Spectroscopy technique measures H<sub>2</sub>O at sub-ppm levels in LNG feed gas
- Integrated permeation tube supports automated validation checks
- Laser-based measurement is highly selective and accurate for H<sub>2</sub>O in LNG feed gas

**Molecular sieve dehydration** Molecular sieve dehydration is used to meet the stringent specifications (< 0.1 ppm<sub>v</sub>) for H<sub>2</sub>O concentration in LNG feed gas. Performance of the molecular sieve dehydration system is an important factor in the efficient, un-interrupted operation of an LNG plant. On-line monitoring of the H<sub>2</sub>O concentration in the outlet gas of a dryer vessel provides real-time indication of adsorbent bed breakthrough to prevent gas containing an elevated level of H<sub>2</sub>O from reaching the cryogenic liquefaction train.



**Process control and optimization** Three or four molecular sieve dryer vessels are typically operated in parallel with a piping system that allows a saturated adsorbent bed to be taken off line for regeneration with heated gas. Measuring the moisture level in the outlet gas from each dryer vessel enables the operator to rapidly detect moisture breakthrough in the adsorbent bed and switch gas flow to a vessel with a freshly regenerated adsorbent bed.

**SpectraSensors' solution** SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective for this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H<sub>2</sub>O concentration, an important performance characteristic for detecting breakthrough in molecular sieve beds. SpectraSensors patented differential spectroscopy technique enables detection and quantitation of sub-ppm levels of H<sub>2</sub>O in LNG feed gas. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when H<sub>2</sub>O is not present in the outlet gas from a molecular sieve vessel. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corrosion and ensuring stable long-term operation and accurate measurements in the field.

\*[www.spectrasensors.com/patents](http://www.spectrasensors.com/patents)

## Application Data

Target Component (Analyte)	H <sub>2</sub> O in Dry LNG Feed Gas
Typical Measurement Ranges	0-10 ppm*
Typical Accuracy	±50 ppb at 0.5 ppm ±240 ppb at 10 ppm
Typical Repeatability	±0.03 ppm*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H <sub>2</sub> O dryer included)
Validation	Integrated Permeation System

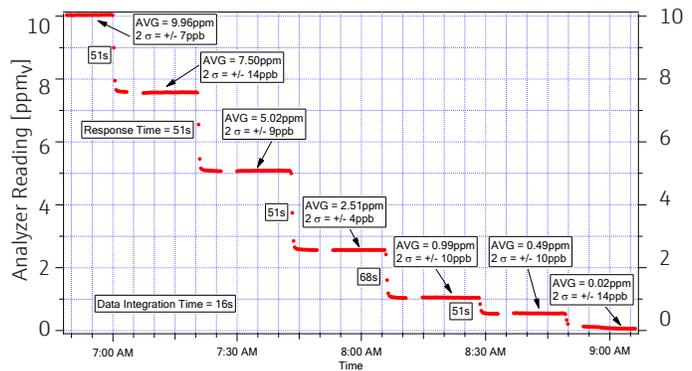
\*Consult factory for alternate ranges.

## Typical Background Stream Composition

Component	Minimum (Mol%)	Typical (Mol.%)	Maximum (Mol%)
Water (H <sub>2</sub> O)	0	< 1 ppm	10 ppm
Nitrogen (N <sub>2</sub> )	0	0.1	3
Oxygen (O <sub>2</sub> )	0	0	1
Methane (C <sub>1</sub> )	60	75	100
Carbon Dioxide (CO <sub>2</sub> )	0	0	3
Ethane (C <sub>2</sub> )	0	15	20
Propane (C <sub>3</sub> )	0	6	13
Butane (C <sub>4</sub> )	0	4	5

The background stream composition must be specified for proper calibration and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component, especially water, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

**Step test H<sub>2</sub>O in LNG feed gas** The accompanying graph shows results of a Step test in which the concentration of H<sub>2</sub>O was decreased from 10 ppm down to 0 ppm. Measurement repeatability at all concentrations is well within specifications (+/- 30 ppb).



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