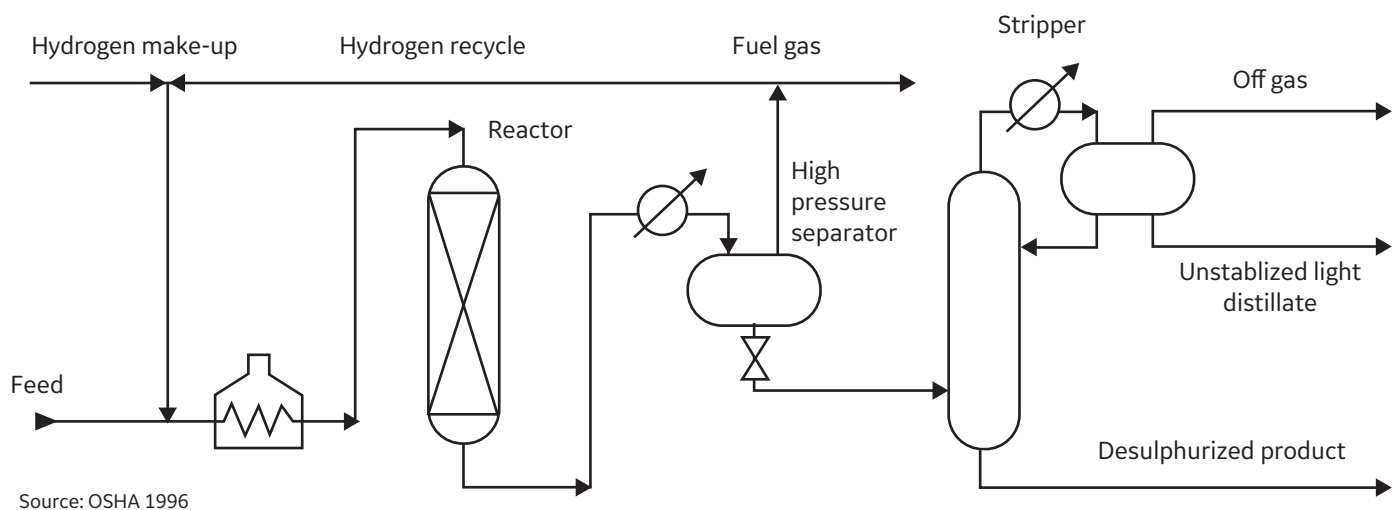




Moisture Measurement – Refinery H2 Recycle Gas – Repsol Tarragona



Introduction

The objective of the refining process is to convert crude oil to useful and profitable end products, such as gasoline, jet fuel, diesel oil, liquefied petroleum gas and fuel oils. Hydrogen is widely used in refining processes:

- to increase the efficiency or throughput of the chemical reaction,
- to optimize the yield of the desired end product,
- to improve quality of end product,
- to remove undesired contaminants in fuels, such as sulfur, and
- to maximize catalyst life.

There are many sub-processes which utilize hydrogen, including hydrotreating, hydrocracking, catalytic reforming, fluid catalytic cracker, isomerization, and alkylation. These sub-processes vary depending on the input feed stock and the desired modification to that feedstock, such as sulfur removal, or need to produce specific end products, such as diesel oil. Hydrogen consumption by oil refineries is growing due to low sulfur in diesel requirements, increasing use of low quality heavy crude oil which requires more hydrogen to refine and increasing global oil consumption. Therefore, management of hydrogen and its associated cost is critical. For catalytic reforming applications, moisture is a necessary component of the chemical reaction and must be maintained at a level of 15–20 ppm.

Background

In September 2014 Repsol released an inquiry for a replacement moisture analyzer for the hydrogen recycle gas line for their refinery in Tarragona, Spain. The main process characteristics were as follows:

Process Data							
Fluid and Phase	H2 + HC	Gas		MIN	NORM	MAX	UNITS
Density	299 kg/m ³		Moisture	0	25	1000	ppmv
Viscosity	0.0065 cP		Other data	Design pressure: 21.8 kg/cm ² g Design Temperature: 121°C Composition HCs: 3.5% C1, 3.5% C2, 3% C3, 2% C4, 1.5% C5+.			
Temperature	37°C						
Pressure	17.5 kg/cm ² g						
Transmitter							
Electronics	4–20 mA 2 wire	Area Rating	EEx-ia IIC T3				
Power	2 hilos 24 Vcc	EX class	EEx-ia IIC T3				
Calibrated Range	0–1000 ppmv	Environmental Protection	Min. IP65				
Material	SS or PVC covered Aluminium	Connection	3/4" NPT-M				

Solution - Aurora

Historically the moisture sensor technology used in the application was aluminum oxide or quartz crystal. Finally, Repsol decided to install a laser-based analyzer because the optical technology had a number of advantages over other types of sensor technologies:

- Rapid speed of response, typically in seconds, to changes in process moisture, in both dry-to-wet and wet-to-dry conditions.
- With no drift in calibration, tunable diode laser absorption spectroscopy (TDLAS) technology does not require recalibration, resulting in lower maintenance requirements and cost.
- Non-contact measurement which eliminates the wear and tear on the optical sensing system from HCl or other process contaminants.
- Integral sample system minimizes interference on the moisture measurement from other components in the process.



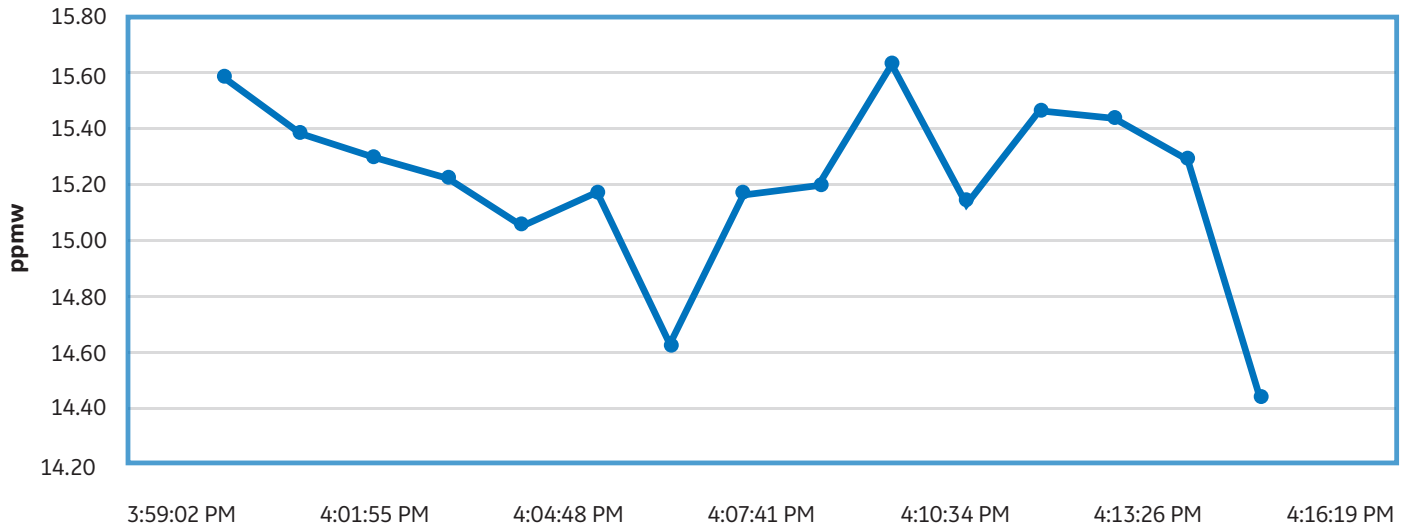
Critical Aurora specifications	
Accuracy	For H2 recycle applications up to 10% H2 and 1% C2H6 variation from nominal: +/-1% of reading or 2 ppmV
Repeatability	± 0.2 ppmV or $\pm 0.1\%$, whichever is greater
Hazard Area Certification	US/Canada: Explosion-proof for Class I, Division 1, Groups B, C, D
	ATEX and IEC Ex: Ex de IIB+H2 T6 -20°C to +65°C Flameproof with increased safety compartment

Results

From commissioning on February 10, 2016, the analyzer gave the expected process moisture readings. On March 1, 2016, GE connected Auroraview software to the unit and logged the following results:

System Time	Concentration PPMv
16:00:22	15.59
16:01:22	15.39
16:02:23	15.31
16:03:23	15.23
16:04:24	15.06
16:05:24	15.17
16:06:24	14.63
16:07:25	15.17
16:08:25	15.20
16:09:26	15.63
16:10:26	15.14
16:11:26	15.47
16:12:26	15.45
16:13:27	15.29
16:14:27	14.43

Moisture concentration in H2 Recycle Gas
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