APPLICATION BULLETIN No. 160

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UNISEARCH ASSOCIATES INC.

LasIR®

Monitoring Emissions of Hydrogen Chloride (HCl)

1. INDUSTRIAL EMISSIONS OF HYDROGEN CHLORIDE

Hydrogen Chloride (HCl) is a colorless gas with a strong irritating odour. It is heavier than air and diffuses relatively quickly.
Hydrogen chloride can enter the body either by inhalation of air containing hydrogen chloride or by dermal contact with hydrochloric acid (dissolved form of hydrogen chloride). Dermal contact with hydrochloric acid occurs mainly in the occupational setting. Inhalation of air containing hydrogen chloride can cause irritation of the eyes, nose and throat. Exposure to high levels may cause muscle spasms and can damage the lungs and heart and in extreme cases can result in death. Dermal contact with hydrochloric acid can cause severe skin burns. The skin may initially be red and painful while severe burns and internal tissue damage can develop over time following exposure. Absorption of large quantities of hydrochloric acid through the skin can affect the heart and lungs and in extreme cases may result in death[1].
Hydrogen chloride is extensively used in various industrial processes: as a chemical intermediate; in the hydrochlorination of rubber; as a babbitting flux; in the production of vinyl and alkyl chlorides; the separation of cotton from wool; in the delinting of cotton; in the manufacture of inorganic chlorides; as a catalyst and condensing agent; as a catalyst for adding viscosity to oils and for etching in the semiconductor industry.
Most of the Hydrogen Chloride present in the air depends on human activities. Important sources are, for instance, municipal waste and special waste incinerators, cement production, fossil fuel power production, steel and copper industries, as well as brick and clay production facilities.

Many of the above listed processes and industries are requested to monitor their HCl emissions.
An instrument that uses a tunable diode laser, such as LasIR® from Unisearch, represents a perfect **HCl analyzer** (chloride analyzer). When configured for chloride monitoring, LasIR® is able to provide continuous updates on the concentration of the gas in a given area.

Unisearch has pioneered the use of Optical Spectroscopy in monitoring toxic gases for more than 30 years, and provided world-wide industries with effective gas monitoring systems.
The **LASIR®** technology has proven to be universally applicable in relation to gases that have a signature in the near infrared region. With HCl emission and process control monitoring at Coal Fired Power Plants, Incinerators and Cement Kilns, the application of the LASIR® to HCl has just begun.

Unisearch offers a wide range of technologies to provide the right solution for all your gas measurement needs. The **LasIR®** is the technology (TDL spectroscopy) of choice for HCl and other gases such as HF, NH_3, H_2S, H_2O, CH_4, CO and CO_2. Unisearch also offers **mid-infrared TDL** systems for other gases such as NO, SO_3, perfluorocarbons, and a dedicated ultraviolet system (**DOAS**) as the best instrument for measuring SO_2.

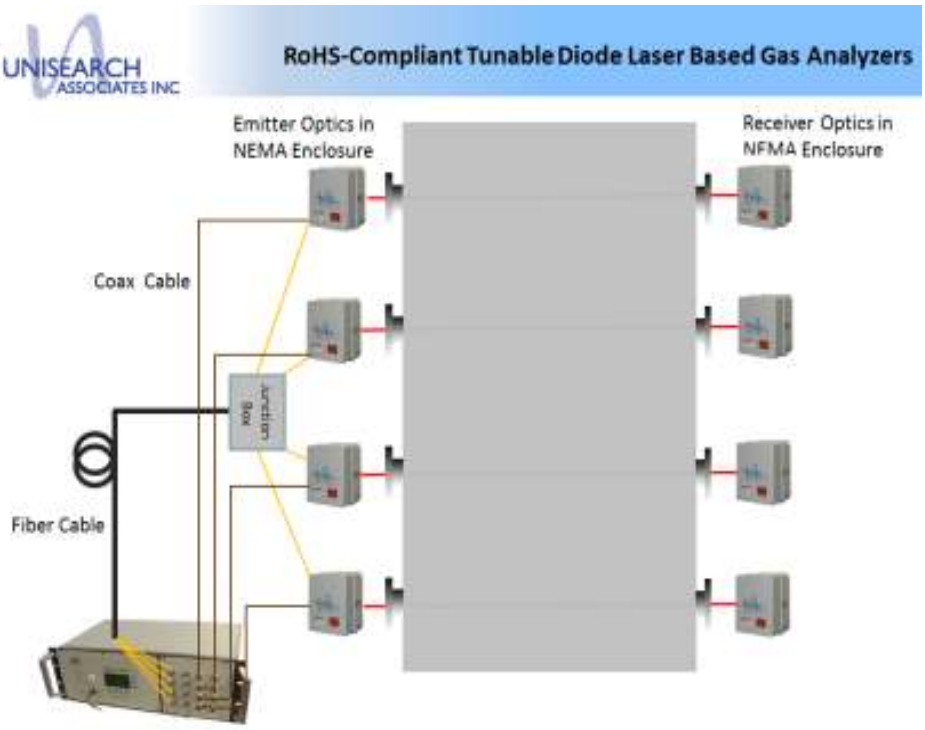
[1] Matheson Gas Data Book Sixth Edition

LasIR® Description:

The LasIR® is a gas monitoring system based on the absorption of light emitted by Tunable Diode Lasers, which emit monochromatic laser light at very precise wavelengths. The Tunable Diode Lasers used for the LasIR® are similar to those used in telecommunication. For HCl measurements, the TDLs selected emit a very narrow beam of light that is specific to HCl and the laser is tuned on the absorption band by applying a specific electrical current. The laser is fiber coupled to single mode optic fiber allowing for remote monitoring of gases in open path ambient monitoring and/or stacks and from up to 16 different locations with a single controller.

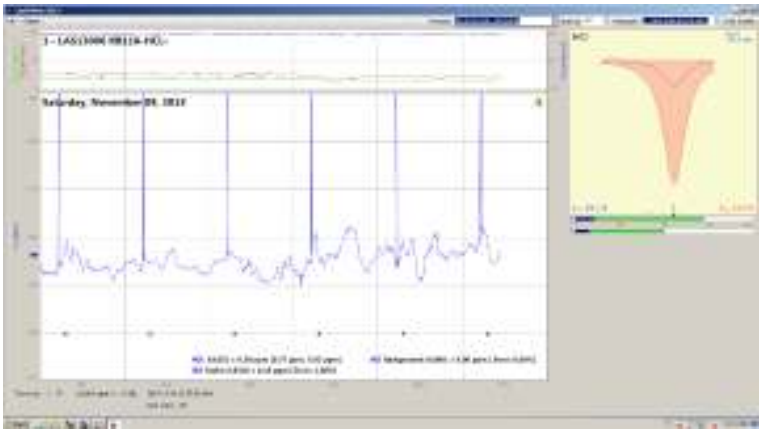
Gas concentrations are determined by proprietary software that allows for a high accuracy and sensitivity: the employed techniques provide sensitivities from the part per billion-volume meter to high concentrations of the target gas.

This provides a dynamic range for the measurements of more than 6 orders of magnitude.



Schematic of the in-situ monitor heads for continuous measurement of HCL

The hardware allows for non-intrusive measurements directly in the stack or ambient air. Extractive cells can also be used when required by the application.



HCl measurements in the stack emissions of a coal fired power plant

LasIR® Performance:

The LasIR® has proven to be a very useful tool for the measurement and control of industrial gas emissions. Unisearch LasIR® HF analyzer, differing only in the laser emission wavelength, has been tested and found to be suitable for use at combustion plants according to EC directive 2001/80/EC, at waste incinerator plants according to EC directive 2000/76/EC and other plants requiring official approval. Unisearch LasIR® HCl analyzer has participated in an EPA/EPRI sponsored inter-comparison of CEMS systems to assist in determining the requirements for continuous HCl measurements in the Power Industry and is in the process of being submitted for TÜF certification. The LasIR® is factory calibrated and does not require field calibration. Auditing is performed in compliance with applicable norms by means of an internal flow-through gas cell connected in-line via fiber optic cabling with the remote optical elements.

3. OPERATIONAL FEATURES OF UNISEARCH SYSTEMS

Advantages of TDL LasIR®

- Freedom from Interferences of other gases and particles.
- Fast real-time measurements: in milliseconds
- Sensitive: as low as sub-ppm levels.
- Versatile. Up to 16 different measurement points simultaneously with a single analyzer.
- Simple, compact, rugged, reliable, virtually maintenance free.
- Factory Calibration
- Remote Operation. The controller can be kept in the control room while measurements are taken across stacks and/or open path

For more information on the technology please consult the following articles:

1. Chuck Dene, John T. Pisano, Thomas D. Durbin, Kurt Bumiller, Keith Crabbe, and Lawrence J. Muzio, "Laboratory testing of a continuous emissions monitor for hydrochloric acid" Journal of the Air & Waste Management Association, 00(00):1–9, 2014. Copyright © 2014 A&WMA. ISSN: 1096-2247 print DOI: 10.1080/10962247.2014.880755
2. Alak Chanda, Gervase I. Mackay, Keith L. Mackay, John T. Pisano, Jean-Pierre Gagne, Pierre Bouchard "LasIR®™ -R – The New Generation RoHS-Compliant Gas Analyzers Based On Tunable Diode Lasers" TMS San Diego, Paper 29, February, 2011.
3. John T. Pisano, Claudia Sauer, Tom Durbin and Gervase Mackay "Measurement of Low Concentration NH_3 in Diesel Exhaust using Tunable diode Laser Adsorption spectroscopy (TDLAS)" Society of Automotive Engineers Conference, Paper 2009-01-1519, Detroit MI, February (2009).
4. H. A. Gamble[1], G. I. Mackay[1] J. T. Pisano[2] and R Himes "On-Line Ammonia Slip Process Monitoring in Post-Combustion NO_x Control Equipped Power Generating Stations"
5. Schiff, H.; Chanda, A.; Dwight, S.; Mackay, G.; Elfert M.; Anderson, W. 2002.*"The Application Of Tunable Diode Laser System For Monitoring H_2S In A Wastewater Treatment Plant"* IFPAC, January 2002.
6. H. I. Schiff, A. Chanda, D. R. Karecki, G.I. Mackay and J. T. Pisano, January 23-26, 2000, *"The LasIR®® - A Versatile System for Process Control and Continuous Emission Monitoring"* Fourteenth International Forum Process Analytical Chemistry (Process Analysis and Control) –IFPAC-2000 Las Vegas, NV, USA.
7. Partin, J.K. 1997. "*Real-Time H2S Monitor for application in geothermal plants*" Idaho National engineering and environmental laboratory.
8. H.I. Schiff, G.W. Harris and G.I. Mackay. 1986. *"Measurement of Atmospheric Gases by Tunable Diode Laser Absorption Spectrometry*". International Symposium, Freiburg. Monitoring of Gaseous Pollutants by Tunable Diode Lasers. R. Grisar, H. Prier, G. Schmidtke, G. Restelli, Eds., D. Reidel Publishing Company, The Netherlands, 4-16.

Please contact us for more information on installed systems and their performance

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