October 20, 2017

Abstract for ammonia conference: New and Old in the Ammonia World – 2017

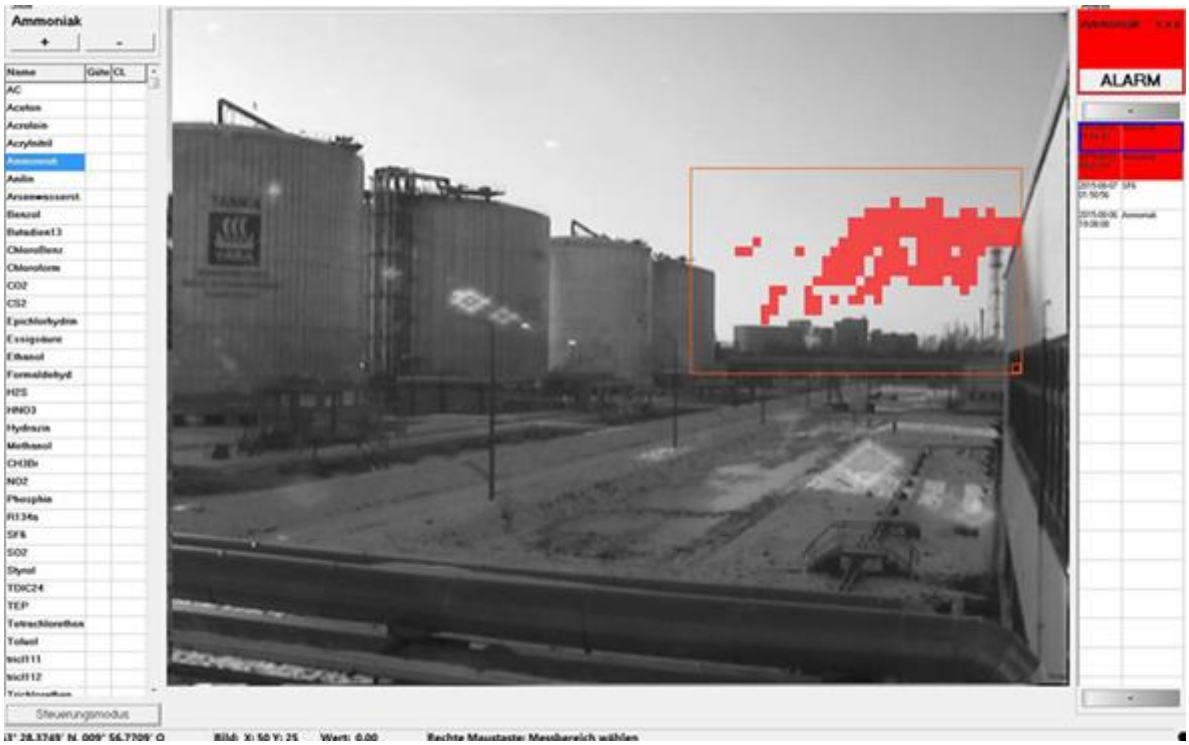
After an accidental release of ammonia in 2014, YARA, one of the biggest players in fertilizer production worldwide, was looking for a ready-to-install solution of an early-warning system for airborne TICs (toxic industrial chemicals). Bruker suggested monitoring the site with their scanning imaging spectrometer SIGIS 2 for remote identification of airborne compounds. The system is in use routinely by emergency response forces and first responders all over the world to identify hazardous chemical gas clouds. After a successful demonstration, the system was installed as an industrial monitoring solution for permanent monitoring. It is running since then at YARA Rostock (Germany) and other industrial sites worldwide are following the example.

The presentation discusses imaging remote early warning systems for TIC gas leaks and fugitive emissions at the YARA example.
A common monitoring approach for gas leaks is to install a high number of single point detectors all over the plant. Those sensors are however of no avail when a gas cloud chooses to pass over the highest sensor or between the grid of a sensor network. Remote sensing addresses these issues in an intuitive way: It is the identification of a gas from long distances using infrared radiation. The approach is comparable to a guard on a watchtower: One elevated place that oversees large parts of a facility and critical infrastructure.

The measurement principle is discussed and examples of application are shown. Based on Fourier-Transform spectroscopy the imaging remote sensing systems detect and identify a huge range of potentially toxic gases over long distances of up to several kilometers from the point of release. The technique is based on the spectral analysis of infrared radiation in the so-called fingerprint region of the electromagnetic spectrum. Here natural temperature differences between the atmosphere and the background to the measured point of interest create the necessary contrast. Thus the system can work completely passively throughout the day and during the night. The measured spectra are analyzed for signatures of all target compounds that are stored in the system library. As every target gas leaves its own specific fingerprint in the measured spectrum, a large number of completely different chemicals can be detected with only one system. Routinely in use by first responders all over the world it was designed to provide a plain yes/no information on the presence of a target gas. A dedicated control room software automatically alarms the operator upon a TIC is identified. In order to compile the information in the most intuitive way the cloud of the identified gas is displayed in a 2D or 3D visualization on the operator's screen.

In detail the presentation shows measurement approaches that address the need of rapid detection in SEVESO type sites. Fast scanning patterns and real-time measurements for entire sites, or critical infrastructure and pipeline are presented.
The presentation was originally held at the 2017 conference of The Ammonium Nitrate / Nitric Acid Producers Study Group (ANNA) in Austin, Texas.

3-Dimensional distribution of an ammonia cloud around an emission stack calculated from the tomographic reconstruction of the simultaneous measurement of the cloud with two SIGIS 2 systems (viewed in Google Earth™, light colors indicate high concentrations, dark colors low concentrations)



Screenshot of the OPUS RS software: The system automatically identifies and visualizes an ammonia cloud. The plant operator is warned visually and acoustically. The screenshot shows the video image of the scenery and marked orange the scan area. On the left the target library is displayed, all compounds in this list are searched for automatically within each measurement.