



## On-line waste water analyser applications in the EX hazardous zone ATEX Zone 1

**Project** : TOD-analysis of Process Water  
**Type of Industry** : Chemical  
**Delivery** : Q3 2006

### General description of this TOD-analyser system:

This analyser system is used to generate accurate and reliable input for process control. The average concentration is about 30.000 mg/litre COD. The analyser range is 50.000 mg/litre COD. The main components in this process water are sodium carbonate ( $\text{Na}_2\text{CO}_3$ ), sodium benzoate ( $\text{C}_6\text{H}_5\text{COONa}$ ) and sodium acetate ( $\text{NaCH}_3\text{COO}$ ). The analyser system is mounted in a big concrete analyser house which is located directly in the EX hazardous zone. Classification of the area, also in the analyser house, is ATEX Zone 1. ODS supplied the system including the ATEX certification, the CE-certification and a risk analyses.

### Special care is taken for:

- Complete Ex p certification documents
- Purge control and override
- Cooling of the cabinet
- Analytical aspects
- Easy access to the analyser parts for maintenance aspects
- Detection of leakage of fluids
- Enough space for adding special "tailor made" solutions and components
- Capability of adding full EX certified and air operated external analyser parts such as sample conditioning.

### Process conditions:

The sample temperature is about 30 to 40 degree Celsius at a slight overpressure. The customer has the experience that the sample contains components that "sweat out" pipe connections. In contact with air crystallisation takes place.

### The main projects parts are:

- Total Oxygen Demand Analyser; part of the delivery was a TOD-COD correlation research. Plant samples were analyzed. The TOD/COD correlation was excellent. Other big advantages of TOD-analysers are: oxygen demand method, no use of chemicals, 1200 degrees C. thermal oxidation without the use of a catalyst, rapid TOD-result within 3 minutes.
- Permeation box; part of the TOD analyser is a permeation box where a stable oxygen baseline is established. ODS re-designed the permeation box to an Ex design. It is mounted outside the Ex p cabinet for stability reasons.



The Ex p cabinet complete with external sample conditioning



ODS systems are suitable for the ATEX 1 and 2 hazardous zone



Good access for maintenance is "a must".



Analyser inspection and application fine tuning



A clear view via a window to the big display



The sample contains components that "sweat out" pipe connections

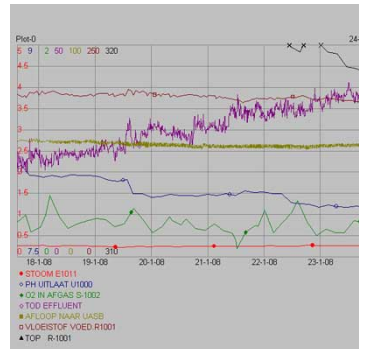


Hands on training



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- Ex p cabinet with vortec coolers (synonym: vortex coolers); the analyser is mounted into a stainless steel Ex p cabinet. The Ex p control unit controls and monitors the purging and operating cycle of standard Ex p enclosures. Purging gas input is switched via a digital free contact, 3 line LCD display, LED status display, modular design and failsafe control. The total solution is certified as Ex II 2G Ex p II T4 via certificate TUV. Via a Vortec cooler the cabinet temperature is controlled. Compressed air, normally 3 to 6 bar, is ejected tangentially through a generator into the vortex spin chamber. At up to one million roots per minute, this air stream revolved toward the hot end where some air escapes through the control valve. The remaining air, still spinning, is forced back through the centre of this outer vortex. The inner stream gives of kinetic energy in the form of heat to the outer stream and exits the vortex tube as cold air. The outer stream exits the opposite side as hot air.
- Sample conditioning panel; for maintenance and safety reasons the sample is diluted 25 times via a tailor-made external dilution panel. Dilution offers the next advantages:
  - The range of 0 - 50000 mg/litre  $-O_2$  (3%) will be diluted to 0 - 2.500 mg/litre  $-O_2$ . For analytical reasons this is a much better to handle range.
  - Whatever the sample hydrocarbon content is, after dilution its always below explosive limits.
  - High carbonate and salt concentrations in the sample will also be diluted to easy to handle levels.
 The dilution panel consists of: air operated 3-way valves, sample tube with fixed small volume, water container with fixed high volume, mixing vessel with air purge, pinch valve to drain.
- Fluid leakage detection and water lock; used water from the analyser is drained via a water lock. In this way water is drained while keeping the Ex p cabinet at a slight overpressure. In case of any leakage a thermal mass level switch will shut-off the sample pump. The sensor tips are positioned a few mm from lowest part (bottom) in the cabinet.



Thanks to high availability the analyser is used for process control



The purge air control unit

ODS Sampling and Analytical Systems Netherlands supplies complete TOC, TC, COD and TOD analyser systems for the Ex zone, ATEX zone 2 and zone 1.

In refineries and chemical factories it is common practice that analyser shelters are located in the hazardous Ex zone. The reason is that analyser sample lines should be as short as possible. Nowadays the regulations regarding ATEX certifications is very strict. Due to the complexity of a process water analyser, these systems cannot be designed and built as Ex i or Ex d. For these reasons ODS BV built these analysers in an Ex p cabinet. Using compressed air and a dedicated purge controller, the complete cabinet is kept under overpressure conditions. Prior to switching the power on, the complete cabinet and different analyser compartments are flushed during a calculated period.

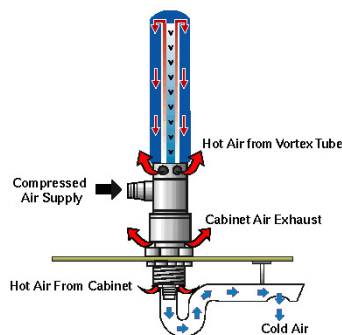
Revision 1-2009



An FCI level switch shuts off the sample pump in case of a leakage



A Vortec cooler is used to cool the cabinet < 30 degrees Celsius



Principle of a vortec cooler. It has no moving parts



Air inlets for cooling and purging



The TOD analyser uses an XY-robot and injection principle

