On-line Process Analyzers - Quo Vadis?

(about prima donnas, dinosaurs, etc.)

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SpectraSensors/Kaiser Analytics
Jan 20, 2011
Process Analysis Value Proposition

- Cost to Buy/Build/Install
- Cost to Own

$Measurement value$
“Analyzer Credits”

TCO

$Bottom-line Value$

- Profit Center?
- Cost Center?

- Safety
- Efficiency (Control/Optimization)
- Environmental
We treat our Analyzers nicely, with respect, TLC etc.
A Lot of Infrastructure
(Brute Forcing the Installation)

Analyzer Shelter

A/C

Sample Conditioning Systems

Sample Transport Lines

Picture Courtesy ExxonMobil Chemical

Process Analytics - Quo Vadis?

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TCO Considerations
Sample Conditioning Systems:
* Custom designed, engineered and built
* Poor standardization

TCO Considerations

Picture Courtesy ExxonMobil Chemical
Sample Conditioning Systems:
* Custom designed, engineered and built
* Lots of tubing/fittings
* Many man-hours designing/building it
* Lots of discrete components

Cost Issue – Irritates the Bean Counters

* Typically not Smart
  (Smart = knowing if p, t, f of sample are normal, i.e. validating representative sample)

“Quality of Measurement Issue” - Credibility of analysis

Picture Courtesy
ExxonMobil Chemical
Analyzers treated like Prima Donnas
We change the environment to meet their needs
<table>
<thead>
<tr>
<th>Real Prima Donna</th>
<th>Analyzer Prima Donna</th>
</tr>
</thead>
<tbody>
<tr>
<td>His/her Own Dressing Room</td>
<td>Same</td>
</tr>
<tr>
<td>+ a big  on the door</td>
<td>on the outside door missing</td>
</tr>
<tr>
<td>All the necessary facilities to make the room meet all his/her needs: Air conditioning</td>
<td>Air conditioning, own instrument air, hazardous area adaptation etc., vent lines, headers</td>
</tr>
<tr>
<td>His/her own bar (food, drinks etc.)</td>
<td>Its own sample at the right pressure and temp</td>
</tr>
<tr>
<td>Has his/her own entourage: Hairdresser, pedicurist, manicurist etc.</td>
<td>Technicians, analyzer engineers etc.</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Gas chromatographs</td>
<td>50</td>
</tr>
<tr>
<td>Other analysers</td>
<td>75</td>
</tr>
<tr>
<td>Sample systems</td>
<td>125</td>
</tr>
<tr>
<td>Sample transport</td>
<td>125</td>
</tr>
<tr>
<td>Analysers houses</td>
<td>8</td>
</tr>
<tr>
<td>Data system</td>
<td>1</td>
</tr>
<tr>
<td>Installation costs</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
</tr>
</tbody>
</table>

Lifetime 15 years  
Number of equivalent analysers 250  
Equivalent analyser per technician 50  
Cost of spares per equivalent analyser / yr 1200 USD

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>USD / hr</th>
<th>K USD / yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technician</td>
<td>5</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>Engineer</td>
<td>1</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Spares</td>
<td>1</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>Consumables</td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td><strong>TOTAL / yr</strong></td>
<td></td>
<td></td>
<td><strong>800</strong></td>
</tr>
<tr>
<td><strong>TOTAL / life</strong></td>
<td></td>
<td></td>
<td><strong>12000</strong></td>
</tr>
</tbody>
</table>

J.J. Gunnell and P. van Vuuren, “PROCESS ANALYTICAL SYSTEMS: A VISION FOR THE FUTURE”  
Plenary Session Paper, IFPAC2000, Las Vegas, NV
Total Cost Of Ownership – A More Detailed Look

**Buy/Build**
- Analyzer $/ Spare Parts
- Sampling Systems
- Shelters/Panels
- Data System
- Sample Tap / Transport Lines
- Utilities (IA, Carrier Gases etc.)
- Power
- Cabling

**Install**
- Shelters/Panels
- Hookups: Utilities, Power, Cabling, Sampling Systems
- Start-up & Commissioning

**Own**
- EQAT (Manpower)
- Consumables
  - Standards
  - Support Gases
- Spare Parts

**Failure**
- Off-line Time
- Missed Opportunity
- Process Upset
- Loss of Production

Cost to Buy/Build & Install

Cost to Own/Operate

$ = X2
"When men got structural steel, they did not use it to build steel copies of wooden bridges."

"When analyzer men got NeSSI they did not use it to build duplicates of legacy sampling systems"
NeSSI = Sampling & Communications Platform

GP Area

Field – Classified Area

DCS

Ethernet LAN

Sensor/Actuator Manager (SAM)

IS NeSSI bus

Flow Channel Substrate

Programmable Substrate Heater

Auxiliary Heating/Cooling

Micro- Climate enclosure

PDA

Microclimate enclosure

GP Area

Field – Classified Area

DCS

Ethernet LAN

Sensor/Actuator Manager (SAM)

IS NeSSI bus

Flow Channel Substrate

Programmable Substrate Heater

Auxiliary Heating/Cooling

Micro- Climate enclosure

PDA

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Connecting the DOTS

Field – Classified Area (Typically ZONE2)

Analyzer House

Field LAN

GP Area

DCS
Control Room

Instrument Room

Analyzer Shop

o&m user

Process Stream

Process Analytics - Quo Vadis?

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Moving the DOTS

Field – Classified Area (Typically ZONE2)

Analyzer House

Field LAN

GP Area

DCS
Control Room

Instrument Room

Analyzer Shop

o&m user

Process Stream

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Enabling Topographical Changes: FUTURE

Field – Classified Area (Typically ZONE1)

Enabled by:
e.g. NeSSI Platform
Miniaturization
IS Design

Fiber

DCS

Control Room

NDIR/RAMAN

Analyzer Shop

o&m
user

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Total Cost of Ownership - Gen III Vision

Intensive/Major Infrastructure Requirements

Macro-House

Legacy SS

Macro-Analyzer

Minimal Infrastructure Requirements

Micro-House @ Sampling Point

NeSSI Platform Intrinsically Safe Micro-Analyzers Fiber-Optic probes

Courtesy of Dow Chemical, Freeport, Texas

Process Analytics - Quo Vadis?

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Process Analytics Value Proposition - TCO Optimized

Perception of Process Analytics: Profit Center

Process Analytics - Quo Vadis?

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If we look down the road:

What should the attributes of the ideal next generation analyzer system be?
Attributes of the ideal next generation analyzer system?

**Sample probe**
- In the pipe or at the pipe
- High temp and flows
- Filtering of particulates
- Removal or rejection of condensables
- No or limited sample removal (in/ex situ sampling)

**Sample handling**
- At line or near line pressure
- Minimal sample conditioning
- No sample transport
- No sample return required
- Ports for calibration/validation
- Pressure and Temperature (and Flow Measurement)
**Analyzer sensor/controller**
- Poles to tropics operation
- Does not require an analyzer shelter
- Intrinsically safe or flame proof (miniature)
- No or few moving parts (inherently reliable)

**Communications**
- With DCS
  - Serial data links OPC, Modbus TCP/IP
  - Future wireless
- With maintenance LAN
  - Separate and firewalled from DCS and other plant devices & LANS
  - Diagnostics/history/setup
  - Remote access/operations (off-site maintenance)
  - Wired or Wireless
• We must change if we want to avoid becoming a dinosaur technology.

• It’s now time to move ahead with Generation III
  – A scorecard to set the stage for on-line methodologies is underway.
  – microAnalytical is our future - now
Thank You