



Setting the Standard for Automation™

BEST PRACTICES FOR ANALYTICAL SYSTEMS

- A Commitment not a choice

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ABOUT AUTHOR

Zaheer Juddy, MD of Analytical Instrumentation & Maintenance system (AIMS) and one of the brightest young entrepreneur in the region and brings with him a vast experience of over 19 years in Analytical field. Being an Analyzer Expert provides consultancy and training's to End-users/Customers in Oil & Gas industry

Zaheer has taken several initiatives for introducing new Technologies, Applications and Analyzer Sampling System designs for online Analyzers



ABOUT AUTHOR

LEELA VENKAT, Sr. Analyzer Engineer of Analytical Instrumentation & Maintenance system (AIMS) brings with him a vast experience of over 12 years in Analytical field. Being an Analyzer Expert provides Custom Solutions and training's to End-users/Customers in Oil & Gas industry

Leela Venkat has made several developmental activities adding VALUE to OEM and CUSTOMER by introducing new Technologies, Applications and Analyzer Sampling System designs for online Analyzers



WHAT ARE WE GIVING TO OUR NEXT GENERATION !...



BEST PRACTICES IN ANALYTICAL SYSTEMS

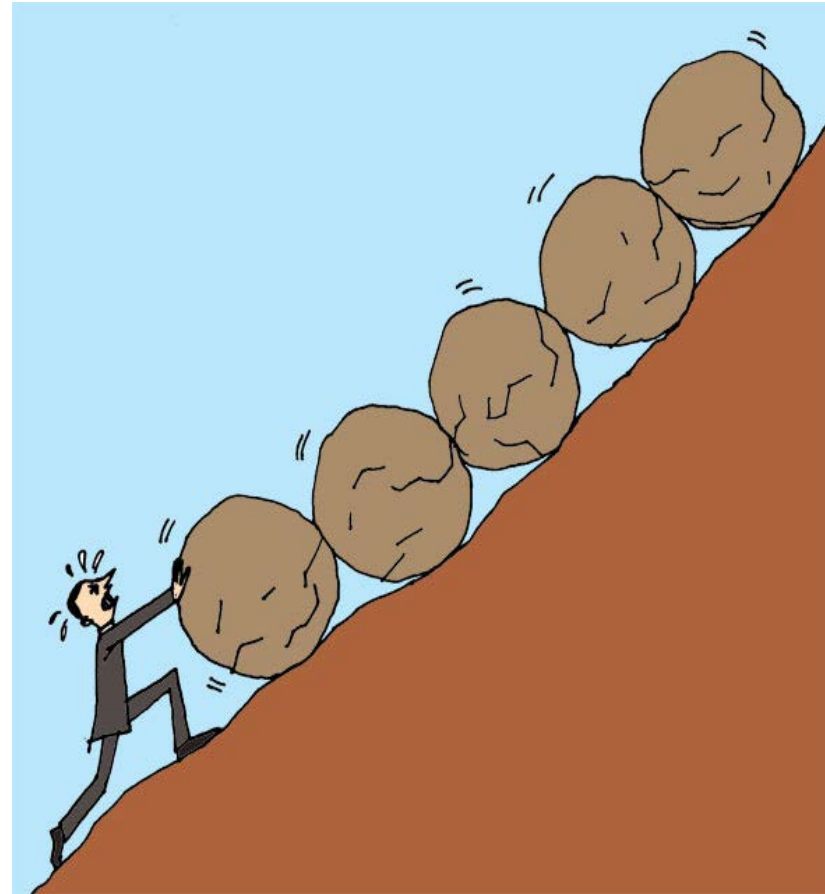


**“THE POINT OF BEST PRACTISE IS TO DISCOVER
AND CLOSE THE PERFORMANCE GAPS”**



COUNTING THE COUNTLESS.....!

- **AWARENESS**
- **CHOKING ISSUES**
- **TEMPERATURE ISSUES**
- **SULPHUR VAPOUR ISSUES**
- **ASPIRATION**
- **TEMPERATURE COLD POINT**
- **CONTROL ISSUES**
- **PROCESS BY-PASS**
- **SPARES AVAILABILITY**
- **ADAPTABILITY..... SO ON.....**



AWARENESS..... AWARENESS



- **AWARENESS** is the only **WORD** which is a Question and an Answer to itself
- **Process Awareness** is a **MUST** for **Analytical People**
- **Continuous Training** to be **Emphasized** in all stages
- **Identify the CHAMPION**



- **Evaluation - KNOWLEDGE**

Need to know the **Sins** that cause lost efficiency in SRU

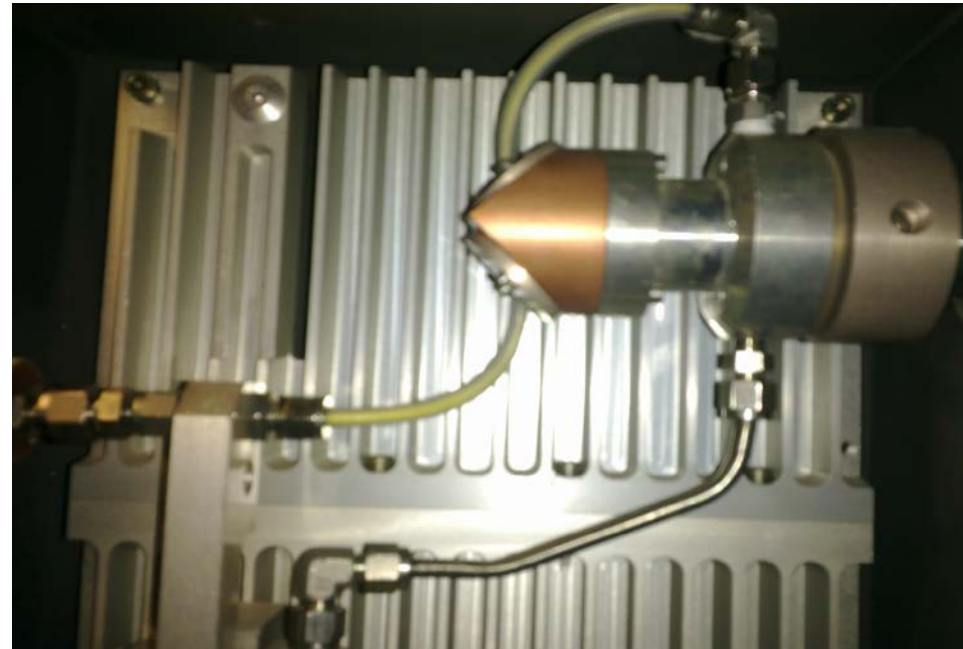
- Catalyst deactivation
- Poor ratio control
- Un-optimized COS/CS₂ hydrolysis conditions
- Un-optimized dew point temperatures
- Bypassing of sulphur components
- Un-optimized sulphur vapor losses
- Liquid sulphur entrainment losses

- Need to look for root causes

CHOKING ISSUES



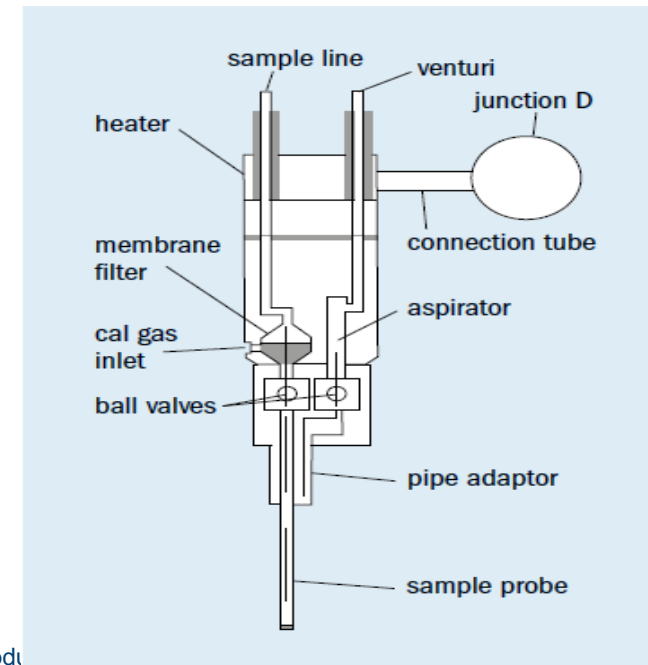
- CHOKING is one of the LOUD words in case of Sulphur Analyzers
- CHOKING is the FIRST Problem to be suspected in SRU Analyzers
- The Worst Conditions are lead if Choking is not avoided
- CHOKING always a concern as a consequence RELIABILITY and AVAILABILITY is ??????????



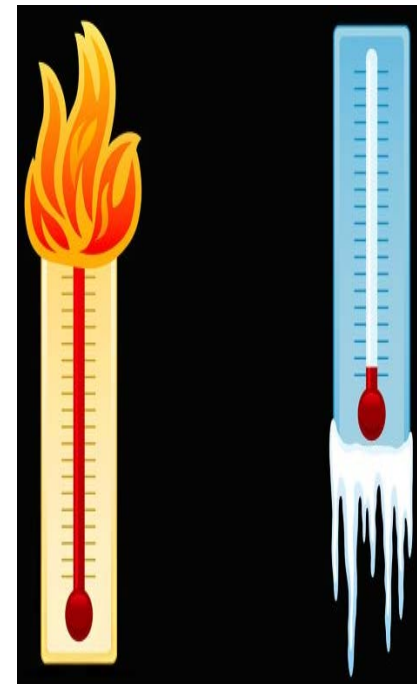
PREVENTION



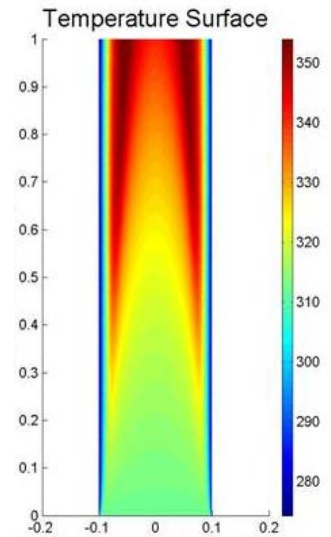
- Ensure NO or LOW Sulphur Vapor Present in Sample
- Maintain Your Stream always above the DEW POINT
- Perform Periodic Flushing
- Use Special Probes such as ASR with Double Isolation System
- Avoid Cold Spots Completely
- Perform all Preventive Maintenance Checks



- Sulphur freezes at a range of 113°C-119°C (235°F-246°F) and the range is a function of the different molecular forms of both liquid and solid sulphur
- Lack of Temperature Profiling is one of key issues being faced for finding the Cold Spot
- SO₂ Analysis in Stack SRU is very relatively affected with temperature
- SO₃ Dew-Point is the biggest CONCERN is SRU Stack Analyzer

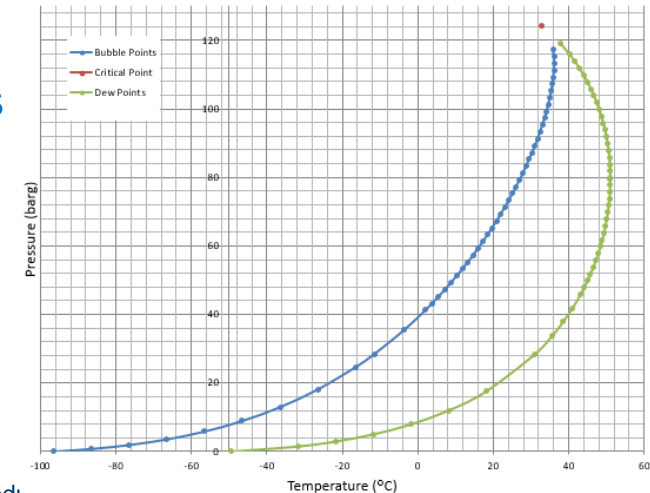


- Temperature Monitoring to be done at several needed points to define the profiling. Eg: Tail Gas Analysis
 - Probe Temperature
 - Flange Temperature
 - Sample Line Temperature
 - SHS Temperature
 - Eductor Outlet Temperature
 - Analyzer Oven Temperature



SO₃ Dew-Point to be calculated for Stack Measurements to avoid Sulphuric Acid Formation

Maintain the temperature above SO₃ Dew-Point through Out the sample loop



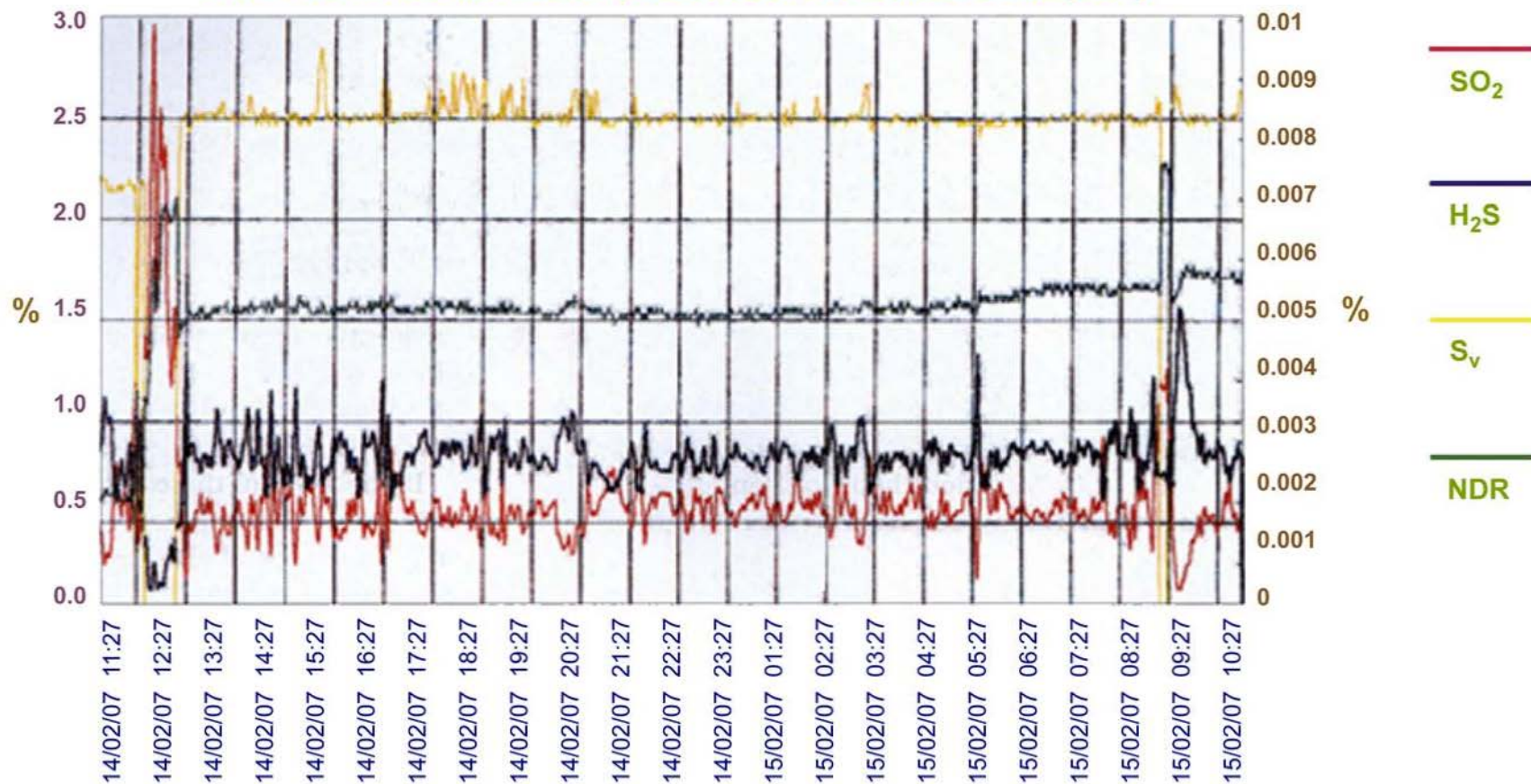
- Sulphur Vapor is always a Concern and a **BIG CHALLENGE**
- **SV plugs the lines as carried away at the cold spots**
- Sulphur Vapor is BIGGEST Interference for Measurements
- The Carry of Vapor gets condensed and the vapor gets solidified.

Sulphur Vapor carryover happens as

- Diffusion of sulfur vapor from a hot place to a cold place.
- Knock out of entrained sulfur (mist, slugs)
- Overflow of liquid sulfur from one unit to another connected unit via connected rundowns or connected tail gas lines.



SRU TAIL GAS ANALYSIS (Model 900 Air Demand Analyzer)



Refinery SRU Tail Gas Analysis (Model 900 Analyzer) Showing Steady State Conditions

- Differential Temperature to be used for removal of SV, Ensure to operate above Dew-Point of Sulphur
- Do it in the pipeline with the help Demistor Technology as part of the analyzer
- NO SAMPLE LINE ANALYZERS ARE TO BE PREFERRED.
- Avoid HTL cold spot issues
- AUTO ZERO CAPABILITY Analyzers to be preferred.
 - Auto-Zero Functionality is made as Analyser default option
 - Auto-Zero setting is defined as per the steady and unsteady conditions
 - Scheduled Auto-Zero RUNS When Analyser is in ANALYSIS

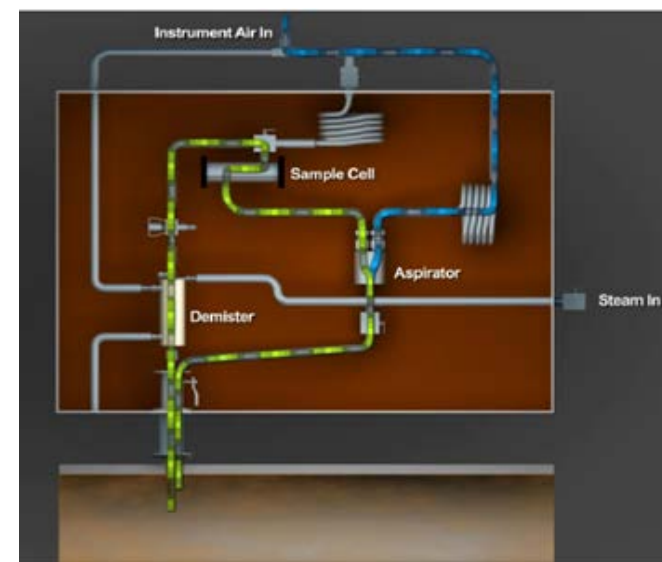
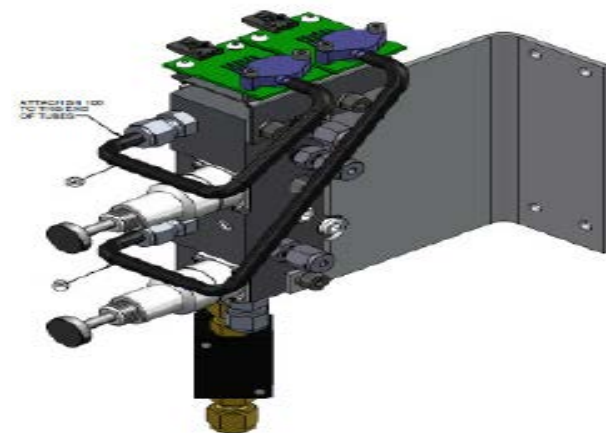
AUTO ZERO ensures Periodic Flushing to eliminate the entrained Sulphur in regular intervals

Most ASPIRATION Issues results in

- SV controlling becomes HAVOC with Manual Aspirations
- Flow Control is also affected by Aspiration.
- Optimal Flow to be emphasized all the time to avoid choking or plugging issues
- Aspiration will also increase the DUTY cycle of the Probe heater

AUTO ASPIRATION SYSTEM

- Auto Aspiration is the Key feature employed in new versions of analyzers which counts for overall system reliability and performance criteria
- Auto Aspiration system ensures the limited sample sucking required and further avoids clogging or choking due to SV, Ammonia salts formation etc
- Auto-Aspiration also reduces the human intervention as this auto adjusts to the set DP measuring the process temperature



TEMPERATURE COLD SPOTS

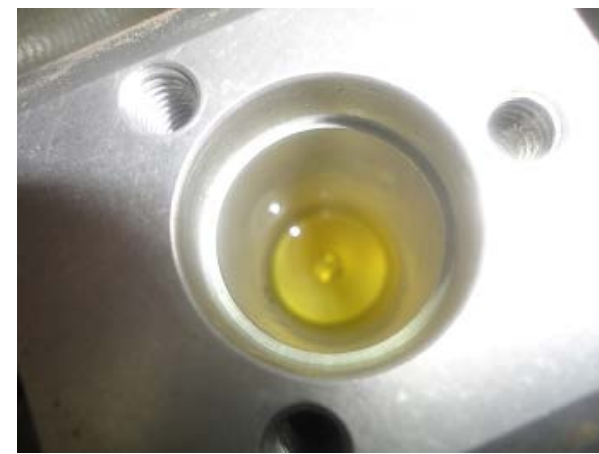


Repeatedly mistakes are made in the Installation of HTL lines for Sulphur lines

Cold Spots in the Analyzer loop for Sulphur Analyzers will result in CHOKING

Remember the RULE

COOL HERE PLUG THERE.....





- Keep the nozzle as short as possible, steam jacket the nozzle
- Do not wrap with tubing; it does not work as it just expands away from the nozzle.
- Use 2" 150# flange, 3" maximum 4" flanges have more area).
- Insulate and cover all steam jacketed components.

Sample line type analyzers using an “ASR” probe, come with a designed insulating cover. Be sure to cover to prevent ingress of water.

Remember the rule . . . **cool here, plug there.**

Heat loss typically takes place at the process connection but the plugging occurs downstream in the analyzer.

TAIL GAS: H₂S and SO₂ Ratio
Control is the key factor

A Problem ...Transport Lag

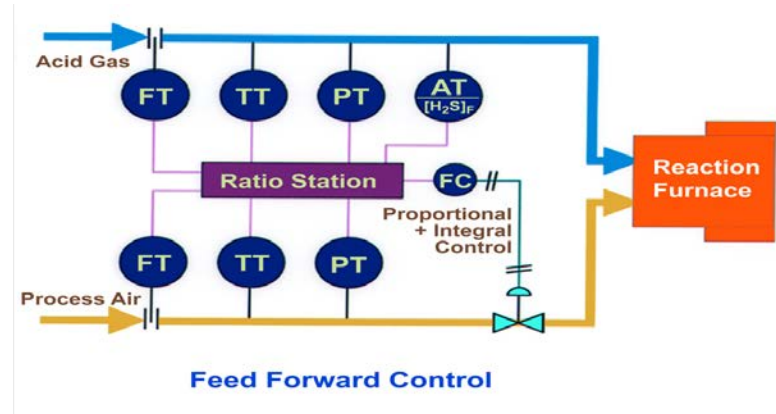
The control range is (only) 10% of the total air flow

- Trim valve is positioned at mid-range, effective control is 5% of air flow
- Set by the designer, more than 10% can destabilize the process
- Process upsets (eg HC) can easily exceed these control limits
- In these case extended range of the indicating outputs is useful



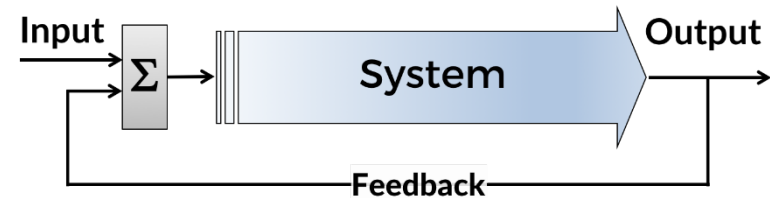
FEED FORWARD CONTROL

- No Process Lag Time
- Immediate response to FEED Changes
- IDEAL Control



FEED BACK CONTROL

- 10% of Total Air Flow Control
- Adaptive Gain for Advanced Control
- Feed Forward Analysis/Control is NO substitute for Feedback



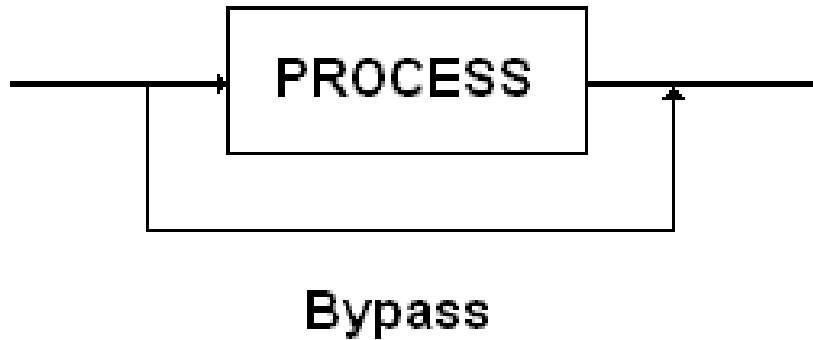
BENEFITS OF GOOD CONTROL



- ✓ Extended catalyst life
- ✓ Increased sulphur production
- ✓ Reduced sulphur emission
- ✓ Reduced incinerator fuel consumption
- ✓ Reduced plant operating problems
- ✓ Reduced size of tail gas clean-up unit



PROCESS BY-PASS



TGTU Bypass condition is seen quite often

The measurement ranges will drastically increase giving TASK to analyzers for HIGH TURN UP Conditions

Emissions are also often seen VERY HIGH

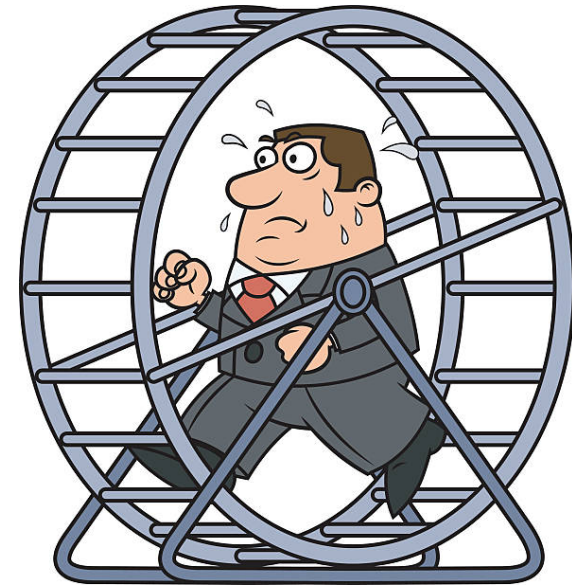
- DUAL RANGE Analyzer to be Selected for BY-PASS Situation
- Analyzer Accuracy and repeatability to be maintained for both the ranges
- BY-PASS process conditions to be identified in the datasheet



- SPARES INVENTORY Maintenance is always CHALLENGE
- Less trained maintenance crew utilizes more spares.
- Standardization of equipment across the plant results in repetitive spare consumption.
- Replace – philosophy entertains spares consumption
- Cost optimization directive from Client's management ends up in less spare part inventory.
- Obsolescence / Life cycle management not in place results in low spare part inventory.



- Ensure spare part review is conducted and all critical spare parts identified and available considering LCM / Obsolescence.
- Training to the maintenance crew is essential to utilize the right spare for the right reason.
- Equipment with substantial BAD ACTORs should be replaced with an upgraded better performing analyzer - break the Standardization concept.
- Repair shall be considered without compromising the safety part
- Cost optimization – cost cutting can be distinguished, where the OEM & Contractor recommendation for the spare part shall be considered.



CHANGE IS INEVITABLE

Technology changes to be adapted for meeting the needs in better and more optimized way.

POWER OF OPTICS have given us a wide range of Entries to meet Modern World Quests



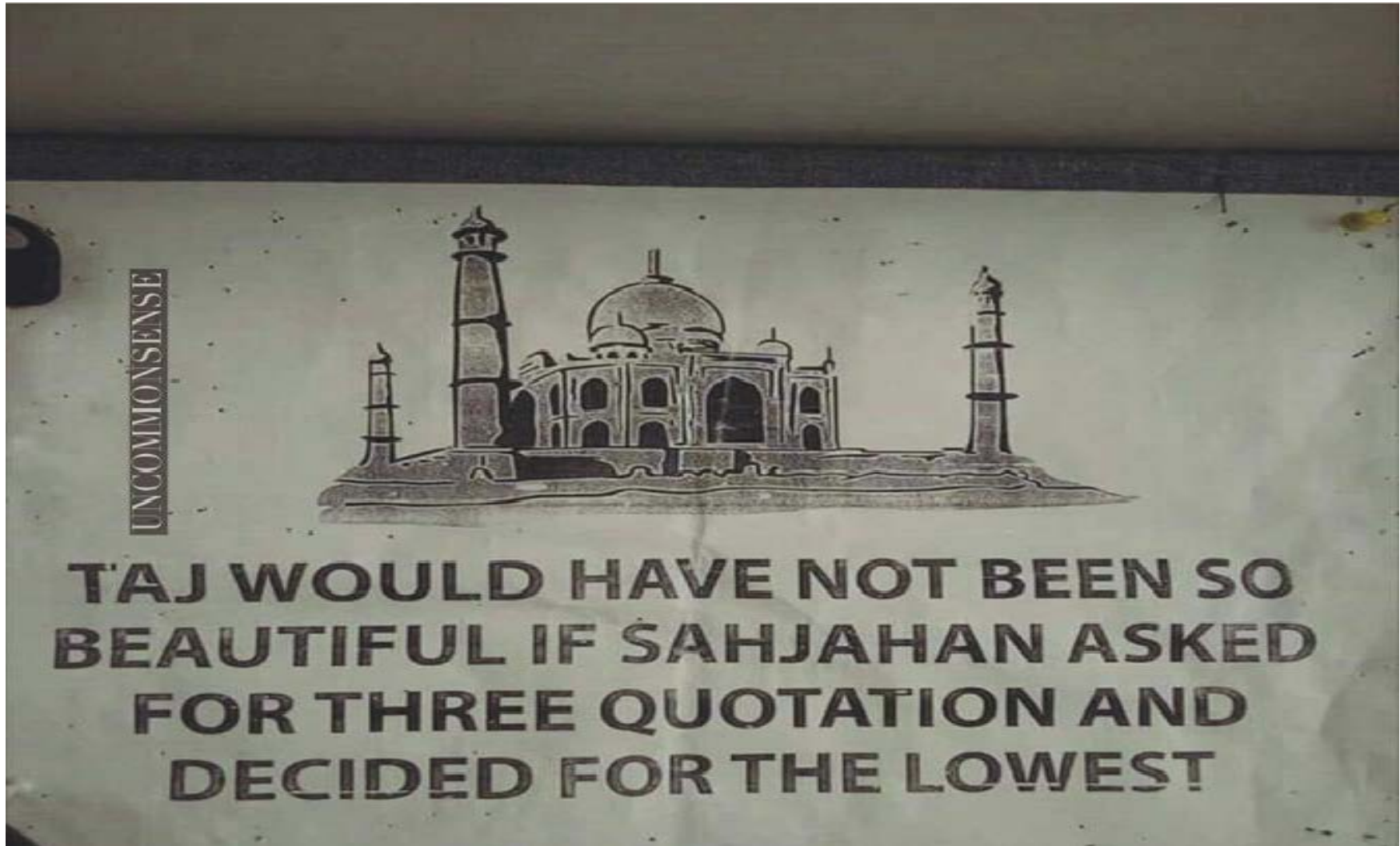
TECHNOLOGY SURROUNDS US



Advanced Technology in the market challenges the application
Trending Technologies uplifting the Needs in more better way

- Tunable Diode LASER (TDL)
- Tunable Filter Spectroscopy (TFS)
- RAMAN Spectroscopy
- Advanced Chemo metrics
- Vacuum UV and So..... On.....





MONITORING is the key for every process and ANALYZERS are the backbones – Make sure it is a Performing / Functioning Analyzer



BEST PRACTICES ARE BEST INVESTEMENTS

BEST PRACTICES – A COMMITMENT NOT A CHOICE

Time to decide before it is too late..





Who has the first question ???