Setting the Standard for Automation™

7 Liabilities of NON PERFORMING Analyzers in Process Plant

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Standards
Certification
Education & Training
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Conferences & Exhibits

Zaheer Juddy

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

OMANI HOSPITALITY

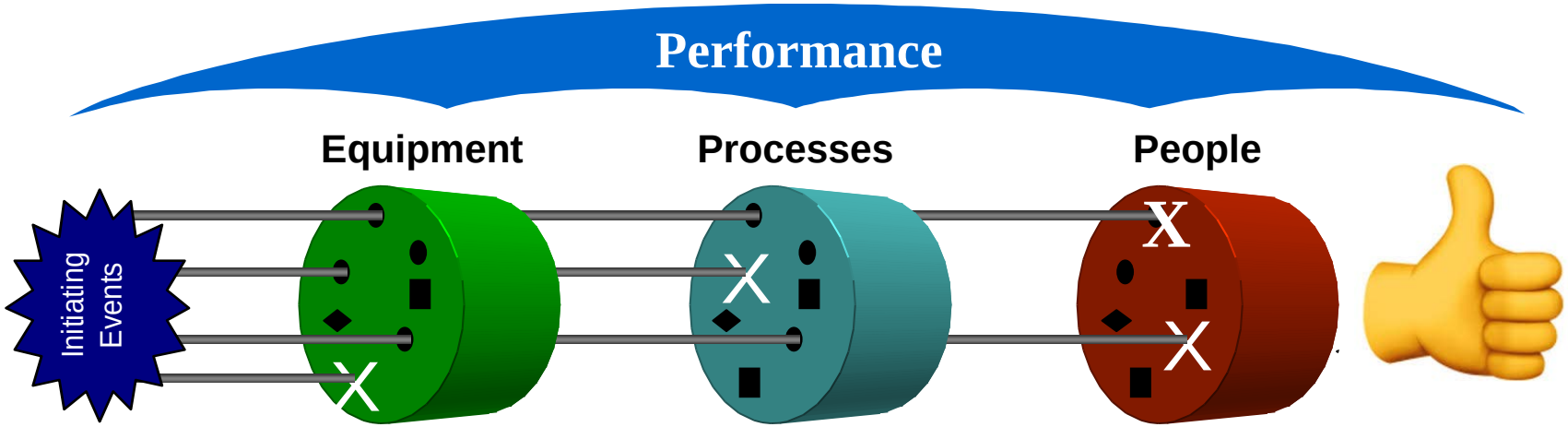
Disclaimer

This Presentation is dedicated to all the Analyzer Technicians Engineers who have not been promoted to managerial levels for years as they work for QMI department and not seen as doing anything !!!

This presentation is not intended for DCS engineers who makes graphic tag list and special colors on the panel to make plant look good.

This presentation is also not intended for analyzer sales personel who sold analyzer for years on basis of weight, price, color and catalogue based accuracy and being in the vendor list!!!

Thumb Rule



Equipment	Processes	People
Design Standards	Operating Procedures	Leadership
Equipment Strategies	Work Management	Communication
Facilities Surveillance	Hazard ID (HAZOP/Security)	Personal Accountability
Facility Integrity	Change Management	Competency and Training
Well Integrity	Risk Assessments	Enabling People to Act
	Contractor Management	
	Project Management	

- Barriers that fails

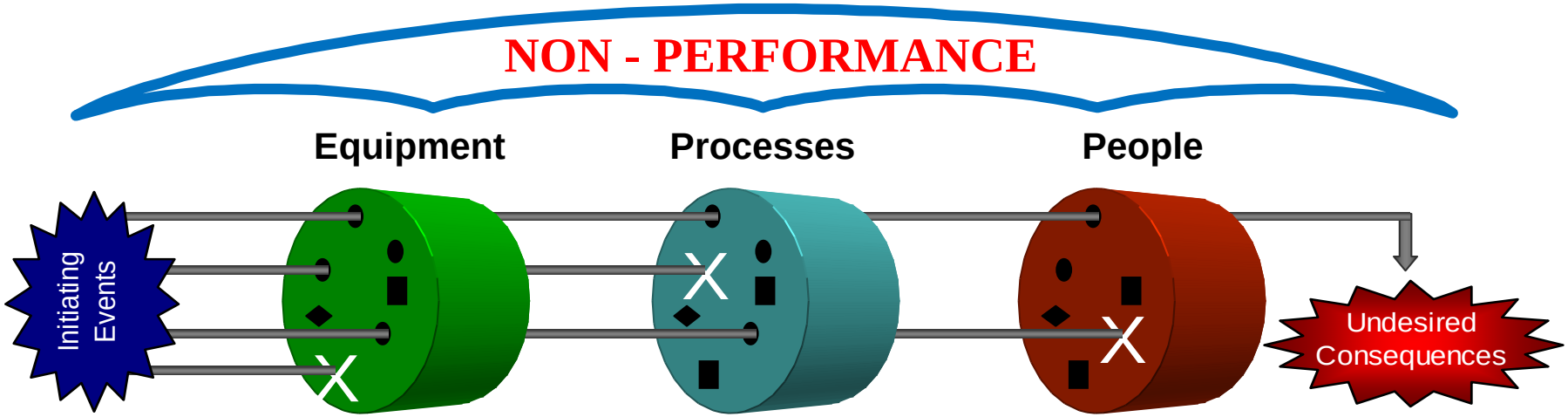
Outcome

=

The Cost could be your

Property Loss, People Loss, Volumetric Downtime, Rapport in the market

Non - Performance



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7 Liabilities

A NON_PERFORMING Analyzer in your process will directly IMPACT on the following:

1. **Cost of Ownership** – Cost to Benefit will be Poor– Low IRR – High Maintenance
2. **Process Optimization** – Poor Outcome – Undesirable Results
3. **Product Specifications** - Off Spec Product (false cases)
4. **Process Safety** – High Risk – Loss of Property
5. **Environmental / Emissions** – Poor control – Damaging events
6. **Personal Safety** - High Risk – Incidents / Loss of People
7. **PCN security** – Overall Volumetric Down Time High.

These above liabilities will be discussed well in detail in this presentation.

1.Cost of Ownership

Cost of Ownership

Capital Expenses (CAPEX)

Operational Expenses (OPEX)

Hidden Costs

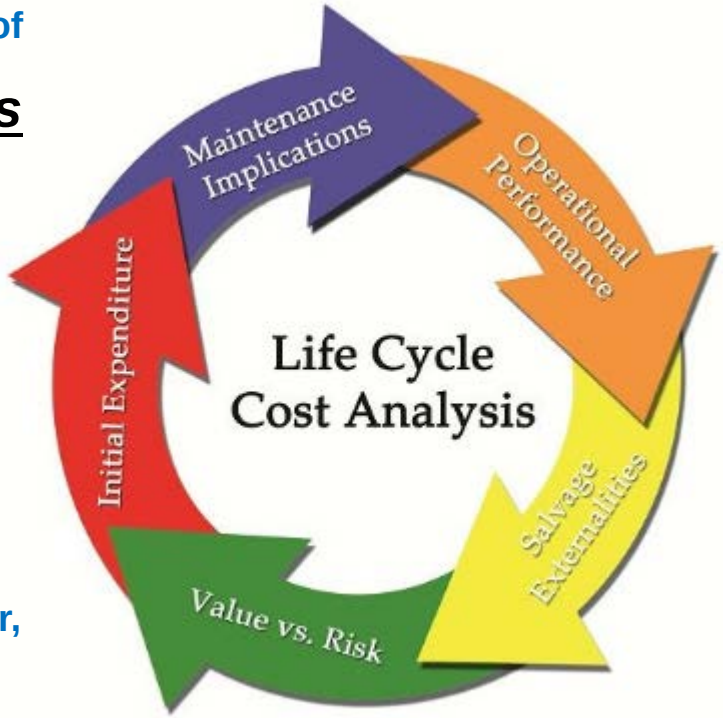
However in actual situation when an analyzer is non-performing, the outcome is very very SURPRISING!

HOW???

Cost of Ownership

Let us assume Life Cycle of the analyzer is at an average of 15~20 Years, a non performing analyzer still ***consumes***

1. **Capital Cost** (CAPEX) was well utilized, however the design should have taken care of the performance - FEED, EPC etc.
2. **Operation Cost** (OPEX) - Utilities like Inst. Air, Calibration cylinders, Carrier Gasses, Reagents, Cooling Water, Consumables, Spare Parts etc.,
3. **Allocation Costs** –Workforce like Planer, Engineer, Supervisor, Techs, Etc.
4. **Space Occupied** – much More expensive house in the plant area.



2.Process Optimization

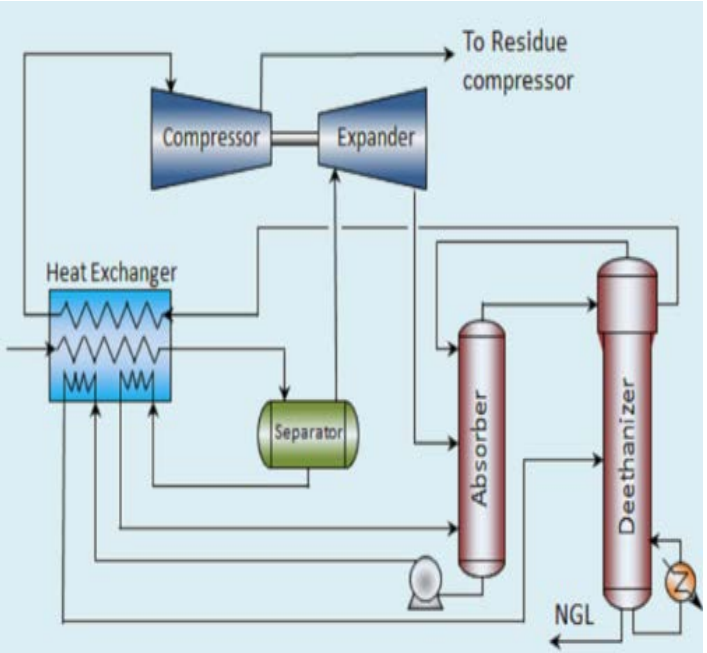
The end result of a **Nonperforming analyzer** in process will differ the objective and end up in **POOR** optimization.

Liabilities of poor process optimization will be

- Yield Enhancement
- Through put
- Production
- Quality Control & Improvement
- Cost Optimization
- Risk Reduction
- Rapport Failure in the market.
- product dump
- Failure to achieve Target KPIs.
- Lower evaluation of Product.

MONITORING is the key in Process optimization

Process Optimization -Example



Typical Gas Process Plant

De-Ethanizer Column

- **De-Ethanizer = C1 / C2 Recovery**
- **Monitoring C3 at PPM level <100 ppm at the Overhead.**
- **Optimization of De-Ethanizer Column Temperature plays a major role.**
- **Any C3 in the overhead is basically slippage ($ Lost)**

The only possibility of a Non Performing component will be the Analyzer :

Residue Gas Analyzer (C1 %, C2 % and C3 ppm)

A Non Performing Vapor Pressure Analyzer, again does not tell you how much C4 & C5 can be added … See LOSS.

AVL

3.Product Specifications

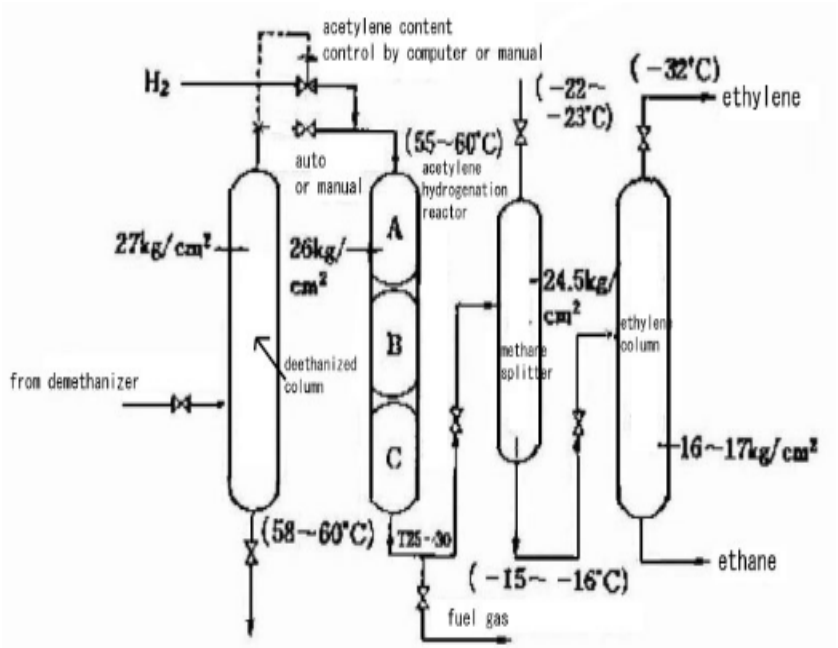
OFF SPEC PRODUCT

Reversible / Recyclable

Irreversible / Dump

Product specification: Off-Specs Product example REVERSIBLE

Acetylene Hydrogenation Reactor

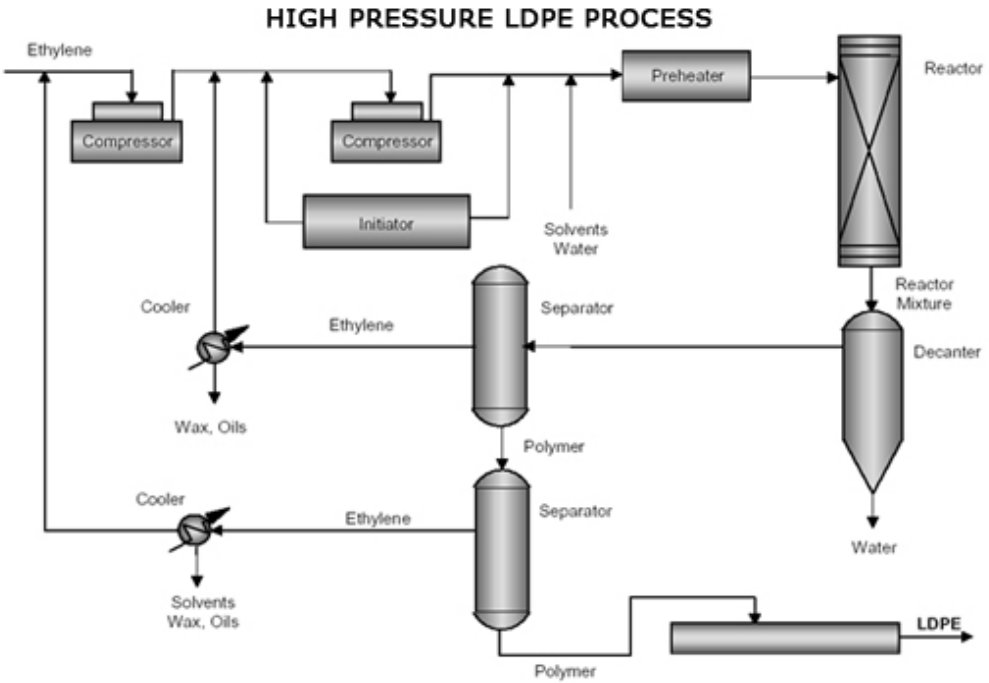


Acetylene Reactor:

- **C2H2 overhead limit < 1ppm.**
- **Optimization of Acetylene Hydrogenation Reaction.**
- **C2H2 slippage in a Ethylene process will force operations to Recovery / in worst scenario - Flaring of the Product (both ways $ Lost)**

The only possibility of a Non Performing component will be the Analyzer : C2H2 Analyzer with 5 ppm range <1ppm LOD

Off-Spec Product cases
IRREVERSIBLE

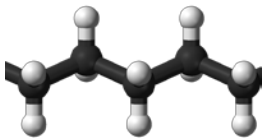


LDPE (Low Density Polyethylene)

LDPE Final Product:

- **Non Recyclable Product (Polymers)**
- **Only option is to sell the at low price**

The only possibility of a Non Performing component will be the Analyzer : False MFI or Color Analyzer

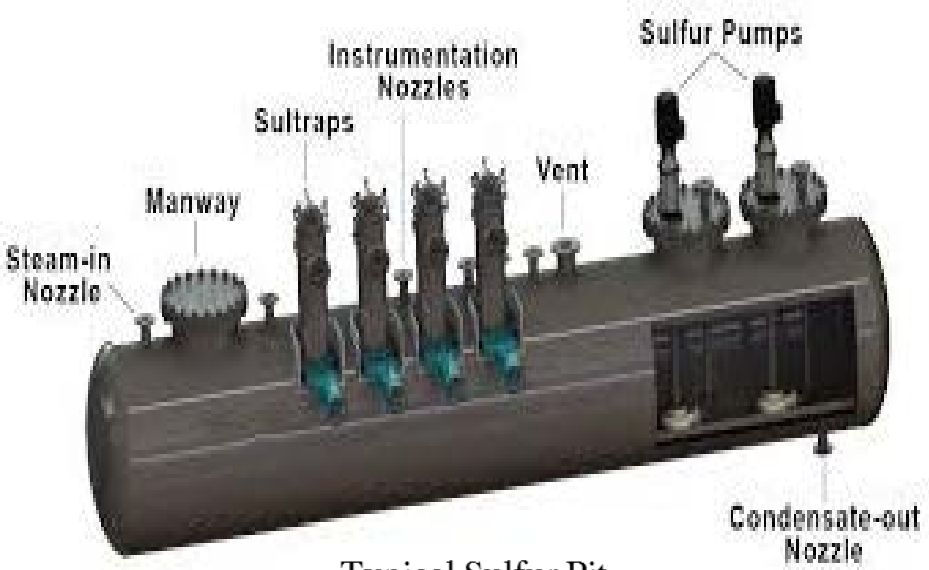


Solutions

Contractors Not Allowed

Analyzer People are not contractors, they shall be part of your team

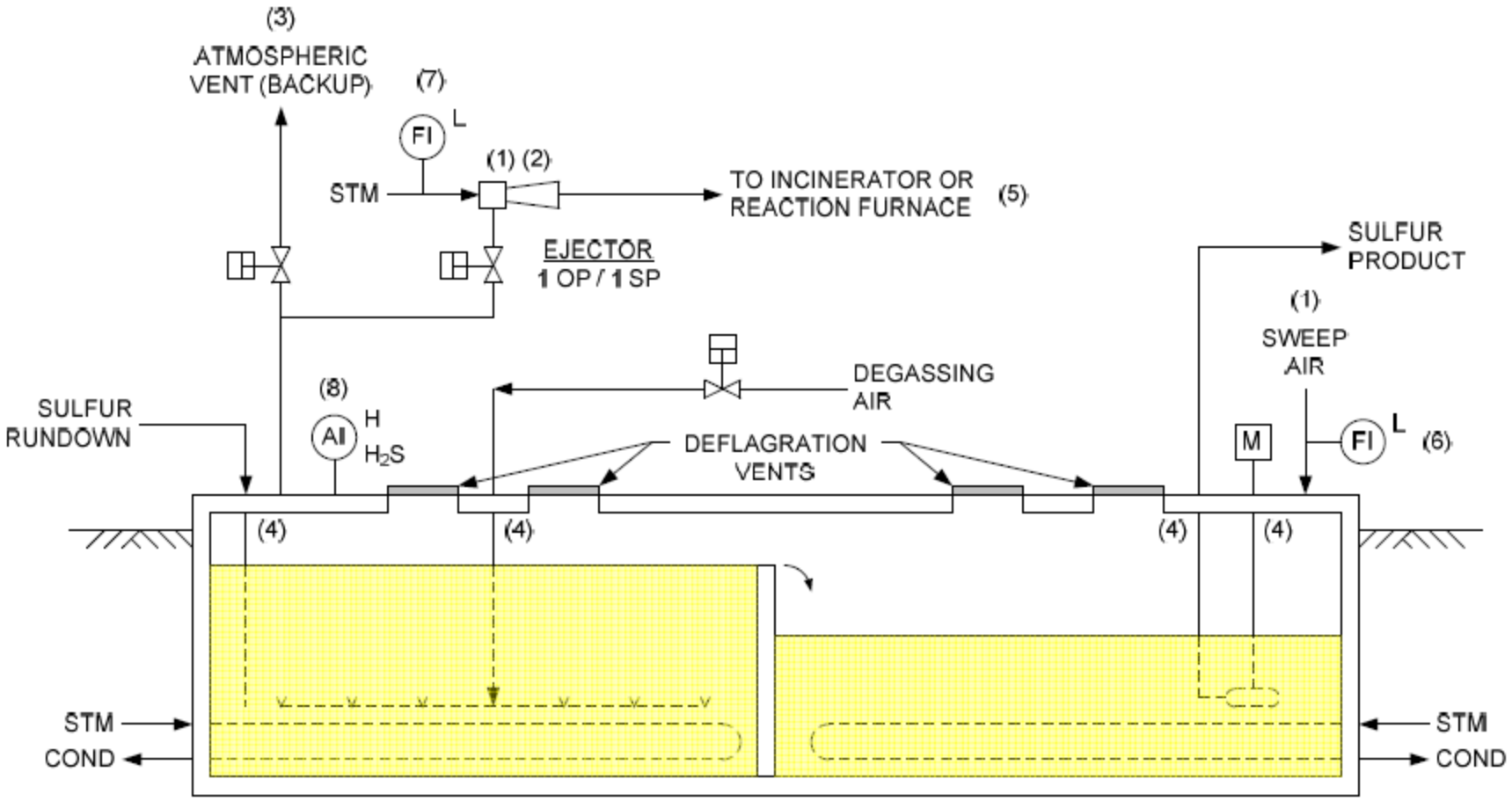
4. Process Safety



Typical Sulfur Pit

- H2S in Liquid Sulfur typically about 100-300 ppmw
- Liberated into the vapor space of its container can form a flammable mixture with air.
- Any inadequacy in air flow rate may cause formation of flammable mixture (%LFL) in vapor space of the vessel which has to be timely detected and acted upon.

Process Safety Example



Typical Sulfur Pit

Process Safety

CERTIFIED MAIL NO. 7002 2030 0000 1288 1217
RETURN RECEIPT REQUESTED

Mr. Harold Leggett
Louisiana Department of Environmental Quality
Office of Environmental Compliance
P. O. Box 4312
Baton Rouge, LA 70821-4312

Re: Written Notification Report
LDEQ Report Number T101694
LA State Police Incident Number 07-07568
Calumet Lubricants Co., L.P.
Calumet Princeton Refinery
Permit No. 0400-00004-V3
A.I. No. 1224

RECEIVED
DEC 2 0 2007
DEQ
Single Point of Contact

Dear Mr.

This notification is being submitted by Calumet Lubricants Co. L.P. (Calumet) for the Calumet Princeton Refinery as a follow-up written report for report number T101694 submitted at 7:38 AM on December 14, 2007, by Mr. Scott Jones, via the Louisiana State Police (LSP)Hotline. The incident involved a sulphur pit fire and the by-pass of the Sulphur Recovery Unit (SRU) to the flare during an emergency shutdown of the SRU.

- **Therefore, measurement of H2S in vapor space of sulfur pit vessel is safety critical parameter.**
- **Additional measurement of SO2 is also provided which serves as pre-warning for smoldering Fire in vapor space of the pits.**

The only possibility of a Non Performing component will be the Analyzer : Sulfur Pit H2S and SO2 Analyzer

5. Environment / Emissions

Tell Me which one is less polluting???

Black ??? **White????**

ARE YOU SURE

Environment / Emissions

Environmental Incident Penalties

Combustion Unit discharging more than 50 T/Y Pollutants (Monitored)

The only possibility of a Non Performing component will be the Analyzer : Continuous Emission Monitoring System

Environment / Emissions

The industry solutions are moving towards MACRO Monitoring in PANAROMA – CEMS will provide the RIGHT data. If FAULTY THEN ???

6. Personnel Safety

- OSHA Requirement for Airborne Toxic Substances like Benzene, VCM, EDC, H2S
- OSHA PEL (Personal Exposure Limit)
- STEL (Short Term Exposure Limits)
- TWA Time Weighted Average Limit

- The only possibility of a Non Performing component will be the Analyzer : **Plant Area Monitoring System, Fence Monitoring systems, Personal Protection Analyzer (Defender)**

7.Process Control Network (PCN) Security Risk

- A weak segment in PCN
- In Y2K age Analyzer upgrade was a dilemma

Whatcom Creek US gas pipeline rupture due to PCN security breach (Jun 1999)

- The only possibility of a Non Performing component will be the Analyzer : **Upgraded software, Secure Segment of PCN**

Incidents / Cases (known / Reported)

Typical LNG composition and calorific value

	Alaska	Brunei	Malaysia	Indonesia	Australia	Oman	LNG A	Qatar
Composition,mol%								
Methane	99.57	89.40	91.15	89.18	87.82	87.66	92.63	89.87
Ethane	0.16	6.30	4.28	8.58	8.30	9.71	6.89	6.50
Propane	0.09	2.80	2.87	1.67	2.98	2.04	0.35	2.25
Butane	0.04	1.30	1.36	0.51	0.87	0.58	0.06	1.04
Pentane	0.01	0.05	0.01	0.02	0.01		0.06	0.01
Nitrogen		0.05	0.32	0.03	0.01	0.24	0.01	0.34
HHV, MJ/scm	37.7	42.0	41.8	41.5	42.5	42.1	39.9	41.6
Wobbe Index	50.6	53.1	52.7	52.6	53.3	53.0	51.8	52.6

- **Interchangeability: (e.g. Natural Gas to LNG or different source)**
- **As per a study, Single Index Method to substitute one gas for another without materially changing safety, efficiency, performance or emissions is,**
- **Wobbe Index**
- **AGA Bulletin (Interchangeability Limits)**
- **As large change in Gas Composition would require modification of combustion units (boilers, furnaces etc).**

A Wobble Index **analyzer should have been part of the process to avoid dramatic change in processing conditions**

Incidents / Cases (known / Reported)

Wooden Pipeline 1862

Pipeline Incidents: (Corrosion due to High Moisture and Aging)

- As per PHMSA (The Pipeline and Hazardous Materials Safety Administration), a United States Department of Transportation agency: 3,200 Incidents since 1987.
- Many Reasons including Corrosion (high moisture & aging)

Pipeline Incidents: (corrosion, Fire)

Sept. 9, 2010: A fire caused by an natural gas pipeline accident rages through San Bruno, California.

Incidents / Cases (known / Reported)

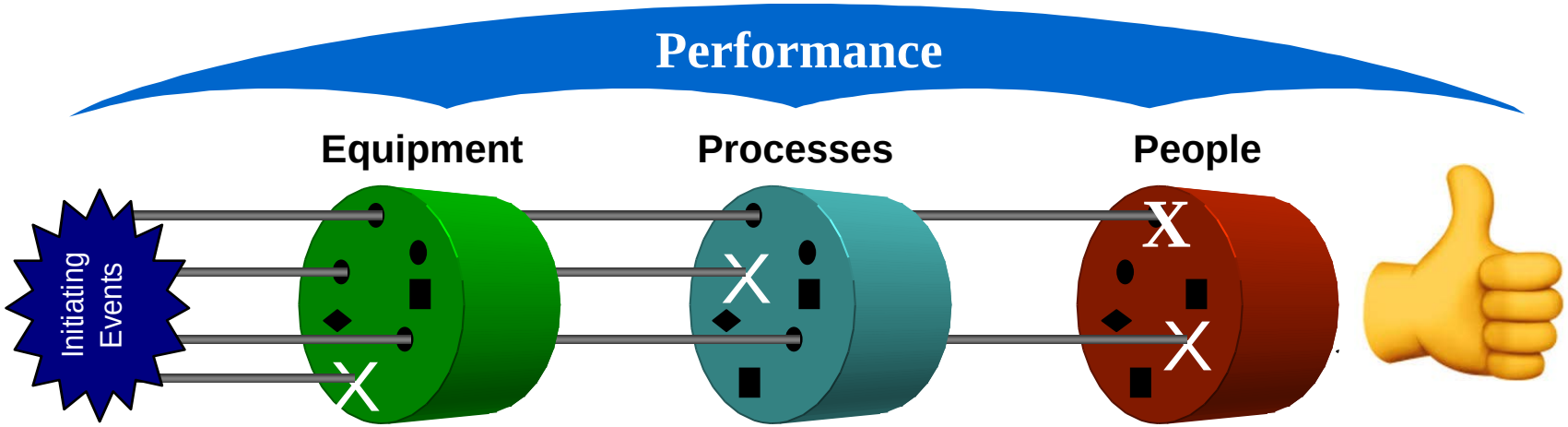
- Pipeline specs for CO2, H2S and Moisture contents
- Corrosion, Erosion and Personal Safety Risk
- Fatality or injury requiring in-patient hospitalization
- involving pipelines that carry a variety of products, including natural gas, oil, diesel fuel, gasoline, kerosene, jet fuel, carbon dioxide, and other substances.
- As per University of California, these accidents have resulted in 548 deaths, 2,576 injuries, and over $8.5 billion in financial damages.
- https://www.youtube.com/watch?v=EZ6YbUrnxVM

Incidents / Cases (known / Reported)

TVP / RVP Case

- **Tank Roof Blown up / Collapsing**
- **Poor Gasoline Blending and Transportation**

Thumb Rule



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- Barriers that fails

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

Recommendations

- Third Party Performance Evaluation on critical analyzers (RCA approach)
- Corrective maintenance to be performed by an Authorized Team.
- Upgrade / Replacement with suitable technology.
- Engineering / Design to address all the possible scenarios
- Reliability based Maintenance with proper approved Equipment Strategies to be followed.
- Cost optimization to be done rather than cost Cutting.
- Usage of ISO certified standard with Traceability for critical analyzer
- Selection of right technology for the application
- Handling capability / measurement range well above the process threshold.

Time to decide before it is too late..

Who has the first question ???


THANK
YOU
GRACIAS
BIYAN
DANKSCHEEN
SHUKRIA
TINGKI
YAQHANYELAY
TASHAKKUR ATU
SUKSAMA
EKHMET
ARIGATO
SHUKURIA
GOZAIMASHITA
EFCHARISTO
GRAZIE
MEHRBANI
MAAKE
KOMAPSUMNIDA
JUSPAXAR
PALDIES
BOLZÏN
MERCI
MINMONCHAR
SPASSIBO
SNACHALHUYA
NUHUN
CHALTU
WABEEJA
MAITEKA
YUSPAGARÀTAM
HUI
DHANYABAAD
ANHA
ATTO
SPASIBO
DENKUJA
NENACHALHYA
UNALCHÉESH
GUI
HÀTUR
EKOJU
SIKOMO
MERASTAWHY
GAEJTHO
TAVTAPUCH
MEDAWAGSE
AGUYJE
FAKAAUE
SANCO
LAH
BAINA
MANETAI

BACK UP SLIDES

Product Specifications

Importance of Product Purity Analyzer is the key for production.

The failure in the Product Specification analyzer not only involves reputation and cost – some times life threatening issues also arise.

Reality:

Largest Helium Manufacturer, shipped the ISO container with a detailed Load Sheet certification mentioning CO content of 0.5 PPM where the CGA G-9.1-1992 Commodity Specification for Helium, Grade P sates CO+CO2 shall be < 0.5 PPM – based on the Sale Purchase Agreement - The container ended up in the Health Care City – Now you can Guess!!!

RCFA Outcome – The CO was actually less than 0.05 PPM and still the analyzer (High End GC) reported high concentrations (it was apparent that there could be no possibilities of high CO in the middle east crude in first instance), however Rapport is GONE is GONE.

Off Spec Products (False Cases)

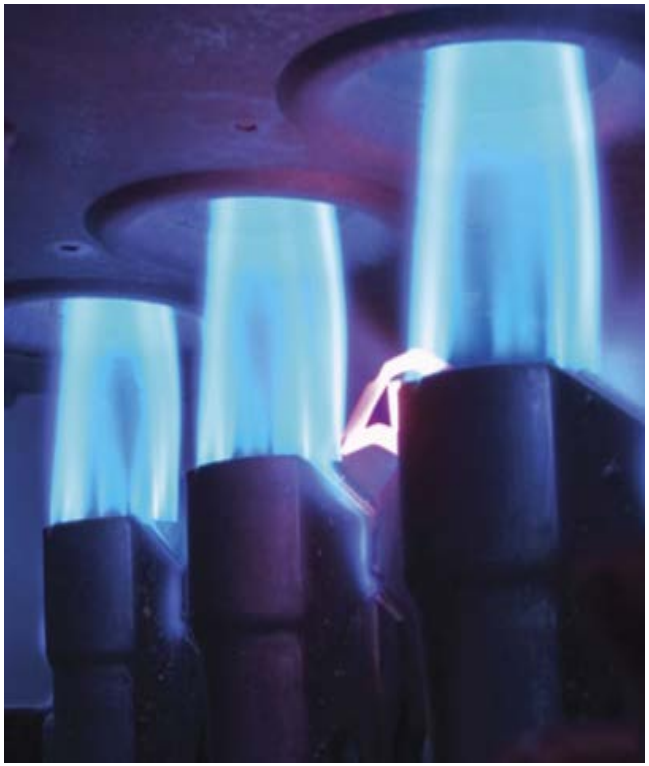
Helium- 1 & 2 Measurements & Certification comparison

CGA G-9.1-1992 Commodity Specification for Helium, Grade P		Measurement Status	
Limiting Characteristic	**Value**	**Helium -1**	**Helium-2**
(ppm(mole/mole) unless otherwise **indicated)**			
- Helium Minimum **% (mole/mole) (100- Total impurities)**	> =99.999	Yes	Yes
- Water **ppm** v/v (**vapor**)	< = 1.5	No	No
- Dew Point °F	< = -100	No	No
- Total **Hydrocarbon** Content (as **Methane**)	< = 0.5	Yes	No
- Hydrogen	< =1	Yes	Yes
- Oxygen	< =1	No	Yes
- Nitrogen	< =5	Yes	Yes
- Argon		No	Yes
- Neon	< =2	Yes	Yes
- Carbon Dioxide	< = 0.5	No	No
- Carbon Monoxide		No	Yes
- Temperature (below Hydrogen triple point)	13.86K	No	No
GC Tag Number		314-AT730	325AT-127
Detector Type		TCD (Thermal)	PID (Plasma)
Read out from GC & Load Sheet Entry		Manual/ Operator	Manual/ Operator
EC Entry & Load Ticket Certification		Operator	Sales
Verification of Product quality		None	None
Lab Measurements (daily), limited only to		Crude He	Crude He

Manufacturing & Sales teams biased that ** Company's Helium Quality is impeccable***

Incident Cases:

- **Combustion Unit Efficiency:**
- **Because energy costs are a major factor for many industrial processes, it makes sense to carefully analyze how the natural gas is being used and whether the system is running at peak efficiency.**
- Natural gas seeps were first discovered in China as early as 900 B.C.
- Surprisingly, natural gas was not discovered in the United States until around 1815 during the digging of a salt brine well in Charleston, W.V., and it was not until 1886 when natural gas was first discovered in the northeastern states.



Incident Cases:

- **Sour Gas Processing:**
- Sour gas is 50% H_2S and 50% CO_2
- Removing CO_2 is also important because high concentrations decrease the amount of energy yielded when burning the gas
- The process for liquefying natural gas in order to be transported requires extremely low concentrations of CO_2 – less than 50 parts per million (ppm).
- This is because when the gas is cooled for liquefaction (down to -160 degrees Celsius), CO_2 will freeze, causing blockage of flow lines and other operational problems.

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