

Establishing and fostering Process Safety Culture in a new business (Coal Gasification)

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New Business - Gasification & Purification Facility



Our Goal

Air Products will be the **safest, most diverse** and **most profitable** industrial gas company in the world, providing **excellent service to our customers.**

Process Safety Challenges

- Air Products - new player in the business
- Various **process hazards** with potentially high consequences in coal gasification and purification facilities
 - High pressure and high temperature syngas (mixture of CO, H₂, H₂S...)
 - High pressure oxygen and nitrogen
 - Large amount of flammable liquid, liquefied flammable gas at low temperature
 - Combustible coal powder - conveying, milling and storage system
 - High pressure steam
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Process Safety Challenges

- **Culture integration** challenges as new and large team with different experiences and culture of different companies
- **Mindset** of personnel
 - Reliance on experiences rather than on RAGAGEP
 - Respect/follow opinions of people in managerial positions instead of those with technical expertise
 - Complacency on safety records
 - Blame human error as root cause(s) of incidents
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What If Something went wrong in this Industry?

- Non Air Products Incidents



The Process Safety Culture “Journey”

10 Rules of Process Safety Culture

- Establish an Imperative for Process Safety
- Provide Strong Leadership
- Foster Mutual Trust
- Ensure Open and Frank Communications
- Maintain a Sense of Vulnerability
- Understand and Act Upon Hazards/Risks
- Empower individuals to successfully fulfill their Process Safety responsibilities
- Defer to Expertise
- Combat the Normalization of Deviance
- Learn to Assess and Advance the Culture



Establish an Imperative for Process Safety

- Process safety as critical part of Due Diligence review of acquired facility, separated from occupational safety/health topics
 - Hazard reviews and regulatory compliance
 - Onsite risk assessment and reduction
 - Public risk assessment
 - Define key requirements that need to be fulfilled before facility startup
 - Planning of resources for process safety activities
 - Process safety integration plan on work processes as well as installation of safeguards in design

Provide Strong Leadership

- Felt Leadership
 - Numerous site visits and on site meetings of management team, interaction between different levels/functions on process safety subjects
 - Leadership promote “safe to say” and avoid “check the box” attitude
 - Stop unsafe condition and define temporary immediate solutions once it is found
 - Steering team to provide support and guidance to baseline PHA. Periodic face-to-face meetings to review progress
 - Clarify criteria for plant shutdown

Foster Mutual Trust

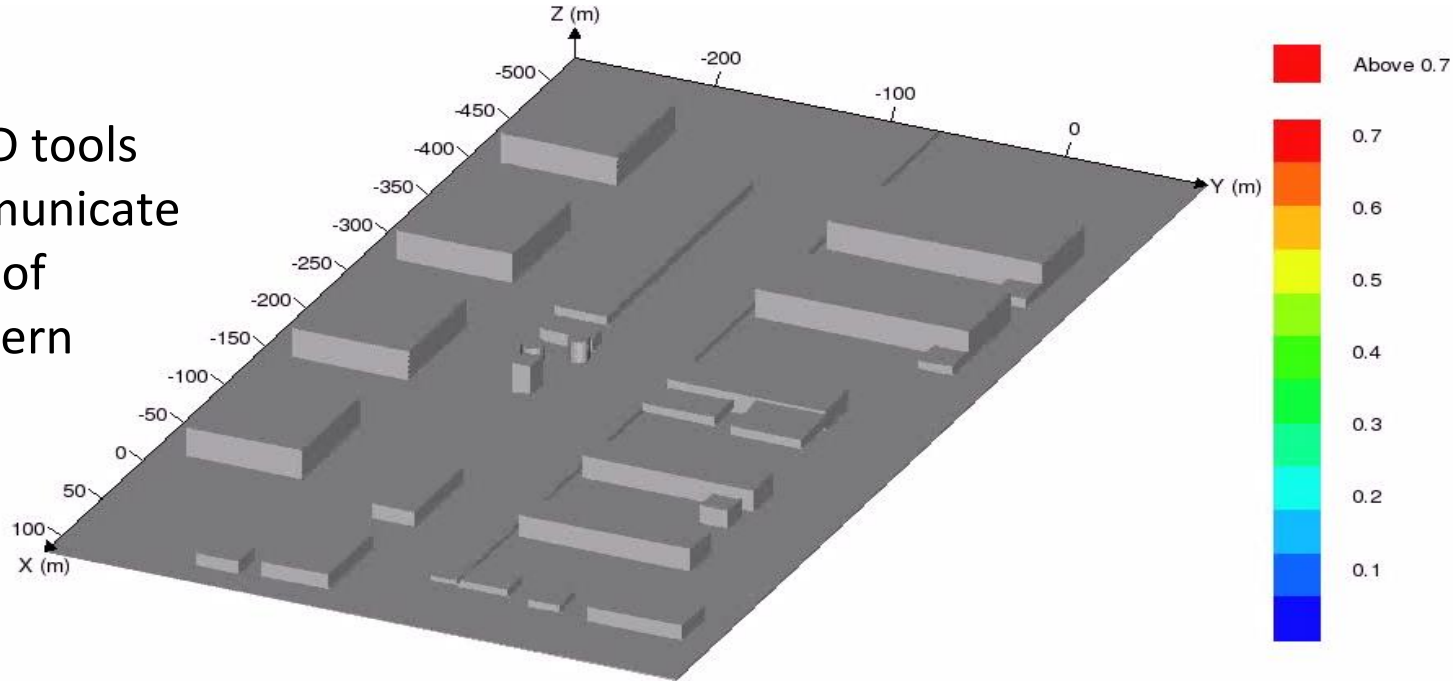
- Process safety training materials are tailored to ensure easy understanding by the participants
- MOC work process get modified from standard “e-MOC” system, make it easier and more convenient to use by site team. The offsite MOC approvals are kept essential, thus the review and approval process is more efficient
- Central “senior” people keep humble and support the plants with their expertise and knowledge and gain respect.

Ensure Open and Frank Communications

- Take incident investigations as good opportunities to build trust in communication. Some actions to change the existing mindset
 - Keep all the relevant people in same meeting, any estimation and guess are proposed and verified instead of making judgement by assumption in separate team meetings
 - Root Cause Analysis (RCA) method is applied to ensure logical evaluation of all the potential causes and not jump to conclusion or thoughts of manager
 - Confrontation on putting blame on human error

Maintain a Sense of Vulnerability

- Use advanced CFD tools to evaluate/communicate the consequence of scenarios-of-concern



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Maintain a Sense of Vulnerability

Visualize the message to drive the point ... example: senior management includes this picture to remind team on the hazards we are dealing with

“The risk in the industry is like the beast in the cage; the beast will hurt nobody if it is kept inside the cage.”

— Mark D. Begg



Maintain a Sense of Vulnerability

- Spend a lot of time to have pilot baseline PHA to discuss with participants to identify unmitigated consequence without the safeguards as first step.
- Incidents and discussion on learnings are key part of the trainings.

Understand and Act Upon Hazards/Risks

- Identify baseline PHA priority based on risk assessment, as the whole PHA about 250 nodes take significant time to complete, ensure high risk process are addressed promptly.
- Document each near-miss/ incident happened in the format of hazard review worksheet.
- Put priority on high risk recommendations with temporary solutions and permanent solutions.

Baseline PHA Priority Matrix

High Consequence: <ul style="list-style-type: none">1. Hazardous properties of material handled2. Exothermic or runaway reactions3. High pressure operation (PV energy)4. High overpressure ratio scenarios.5. Mixing of incompatible materials	Phase 2	Phase 1
Low Consequence	Phase 3	Phase 2
	Low Frequency	High Frequency <ul style="list-style-type: none">1. Incident or near miss happened2. Changes had been made to process and control3. RBI findings

Leak Management - Risk Levels and Escalation

Risk Level	Potential Personnel impact	Potential Facility impact	Escalation if likelihood is low - medium	Escalation if likelihood is high
Level 1	Multiple Fatalities	Site level damage	Contact Regional leadership immediately	Shutdown
Level 2	Fatality	Unit operation damage	Contact Regional leadership within 8 hours	Contact Regional leadership immediately
Level 3	Injury	Local damage	Site Management decision	Contact Regional leadership within 8 hours

Empower Individuals to successfully fulfill their Process Safety Responsibilities

- Clearly define responsibility for each type, each class of MOC.

Change Type/Scope	Class 1 MOC	Class 2 MOC	Class 3 MOC
Valve and Piping Changes	Process, piping, instrument & control, maintenance, production manager	Process, piping, instrument & control, maintenance, production manager, EHS engineer, process safety engineer	Process, piping, instrument & control, maintenance, production manager, EHS engineer, process safety engineer, technical manager. Process safety engineer to define whether resources in central team is needed.
Replace piping/valves within specifications			
Replace (temporary or permanent) piping/valves outside of specifications			
Change Piping Specifications			
Install new piping system within piping specs (reroute, new, etc.)			
Addition/modification of piping support			
Installing temporary lines inside pipe specs			
Addition or change of a cross tie between process and utility			
...			

Defer to Expertise

- Collect/document information of incidents in the industry from people with extensive operations experiences.
- Invite functional engineers of process package owners to give series of presentations through conference calls.
- Invite renowned consulting company to conduct Dust Hazard Analysis (DHA), shelter-in-place leak test and building occupancy risk analysis
- PHA team members are defined by hazard review steering team. Peer reviews by senior PS resources also are arranged.

Combat the Normalization of Deviance

- One serious near-miss happened: running with “minor” leak; later found serious corrosion inside pipe.
 - RCA conducted with actions defined in PSM system and technical area.
 - Incident reviewed by company Serious Incident Review Board (SIRB) with top management involved
 - Numerous meetings in technical community held to understand causes, define solutions and apply learnings to similar locations.
- Housekeeping improvement, criteria defined for coal handling area and recommendations also shared with customer.

Combat the Normalization of Deviance

- Encourage reporting of incidents and near misses.
- Alarm management
 - Define alarm KPIs, get people aligned on target.
 - Focusing on main contributors - daily top 5 repeated alarms
- Operational Discipline Implementation
- Enforce using torch wrench for eliminating leak from flanges

FLANGE BASIC INFORMATION 法兰信息牌

Facility and Unit Number 装置和单元名称:	Equipment Number 设备位号:	PID 图纸号:
Flange Identification 法兰编号:	Flange Size and Rating 法兰尺寸和等级:	Flange Type (FF, RF, RTJ) 法兰种类:
Gasket Type 垫片种类:	Gasket Material 垫片材质:	Bolt Diameter 螺栓直径:
Final Torque (ft-lbs) 最终的力矩值:	Final Stress (ksi) 最终拉伸应力 (拉伸器):	Torque Wrench 扭矩扳手种类:
Contractors Company 承包商公司:	APLUAN Supervisor 合资公司人员签字:	Date 日期:

Learn to Assess and Advance the Culture

- External focus – Introduction and application of PSM practices in chemical industrial beyond company's strength in hazard review, quantitative risk analysis.
- Promote Root Cause Analysis (RCA) methodology in problem solving.
- Focus on leading Process Safety KPIs.
- Use self assessment tool of the CCPS book *"Recognizing Catastrophic Incident Warning Signs In The Process Industries"*
- Keep patience in culture change ... takes time.

Thank you
tell me more ...