TATA STEEL

TATA

“Centre of Excellence: Tata Steel way to Process Safety”

Moving the Culture from Compliance to Risk Management

8th August,2019

CII, 13th Safety Symposium & Exposition

Contents

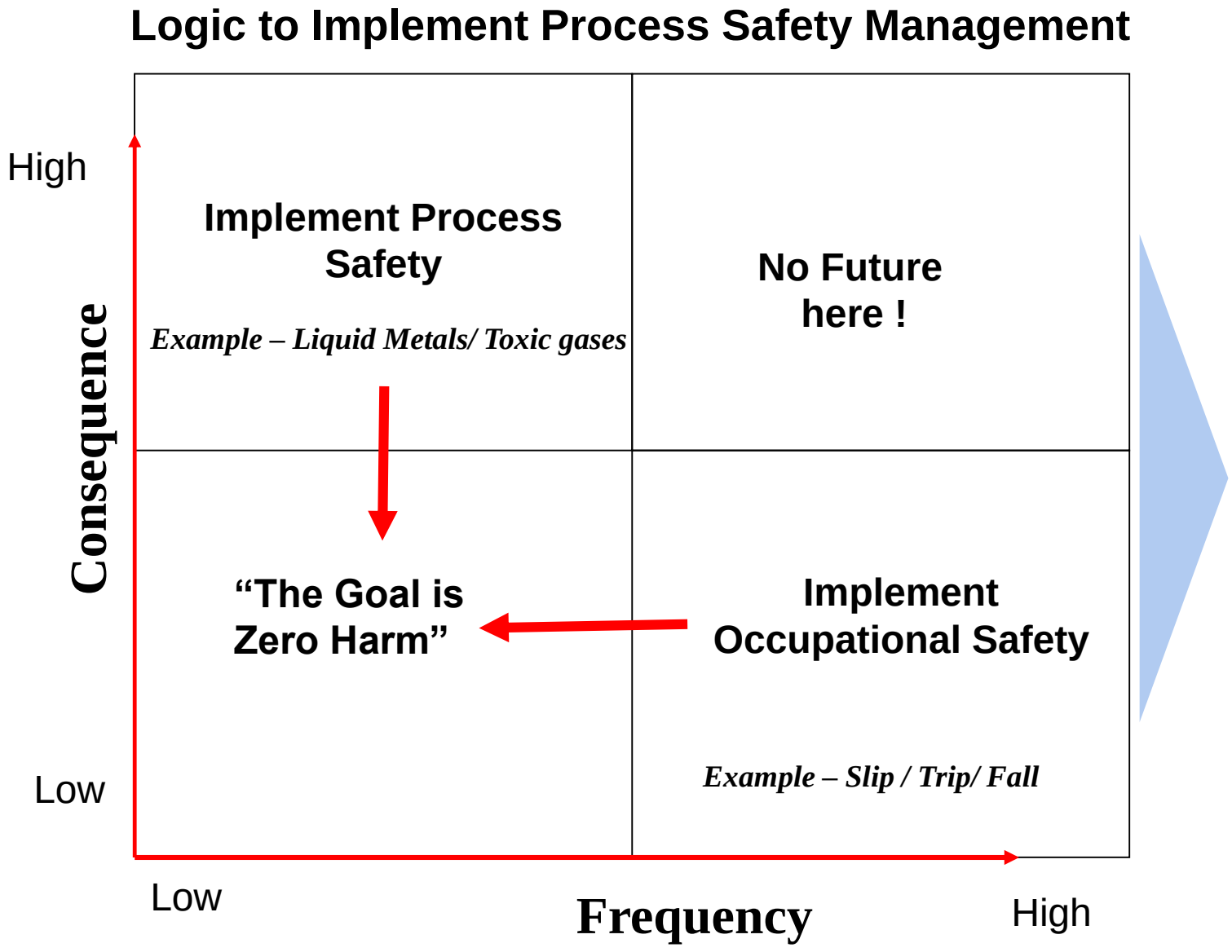
Contents

What is Process Safety?

*"Process safety is a blend of **engineering (Design & Maintenance)**, **operations** and **management skills** focused on **preventing catastrophic accidents**, particularly **structural collapse, explosions, fires and toxic releases** associated with loss of containment of energy or dangerous substances such as **toxic gases, molten metal, chemicals** and petroleum products.*

*These engineering (Design & Maintenance), operations and management skills **exceed** those required for managing workplace safety."*

How Process Safety is different from Occupational Safety



In a steel plant there is a need to implement both ***Occupational safety*** & ***Process safety***

Process Disasters at Indian Steel Industry

SAIL-Bhilai- Gas leakage GCP(6†)

Vizag Steel- O2 PRS explosion (18†)

Bhusan Steel- Dry pit explosion

CO Gas Line Fire Bhilai Steel (14+)

Process Safety Incidents can:

- ***Kill*** and injure many ***people***;
- Cause massive and long lasting pollution;
- Cause major ***economic disruption***;
- Severely ***damage*** a company's ***reputation***;
- Cause companies to become **"paralyzed"** in the aftermath;
- Lead to **companies and individuals** being ***prosecuted***.

Tata Steel LD Gas Holder Explosion : Failures of PSM Elements

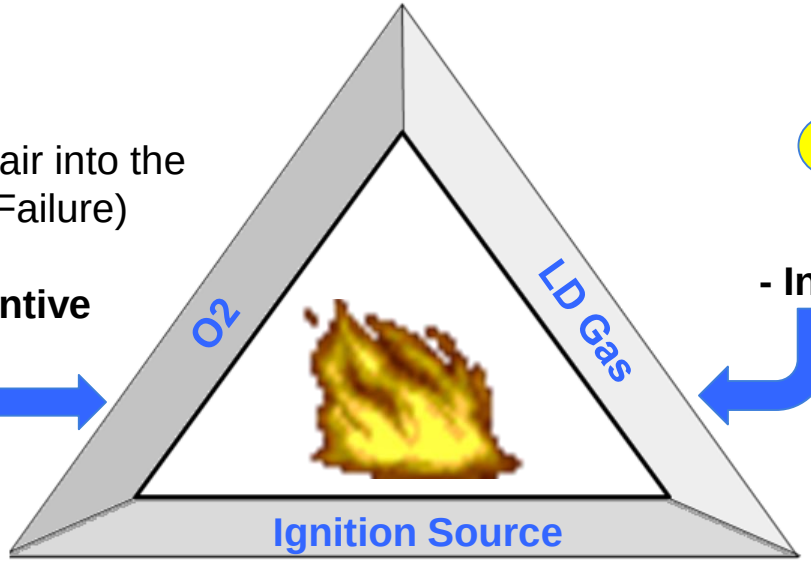
LD GH explosion Tata Steel (1†)

The incident investigation revealed failures at multiple levels

1 Oxygen

Pushing atmospheric air into the LD Gas Holder (PLC Failure)

- **Inadequate Preventive barriers**
- **Barriers not maintained**



2 Fuel

LD Gas

- Inherent hazard present

3 Ignition

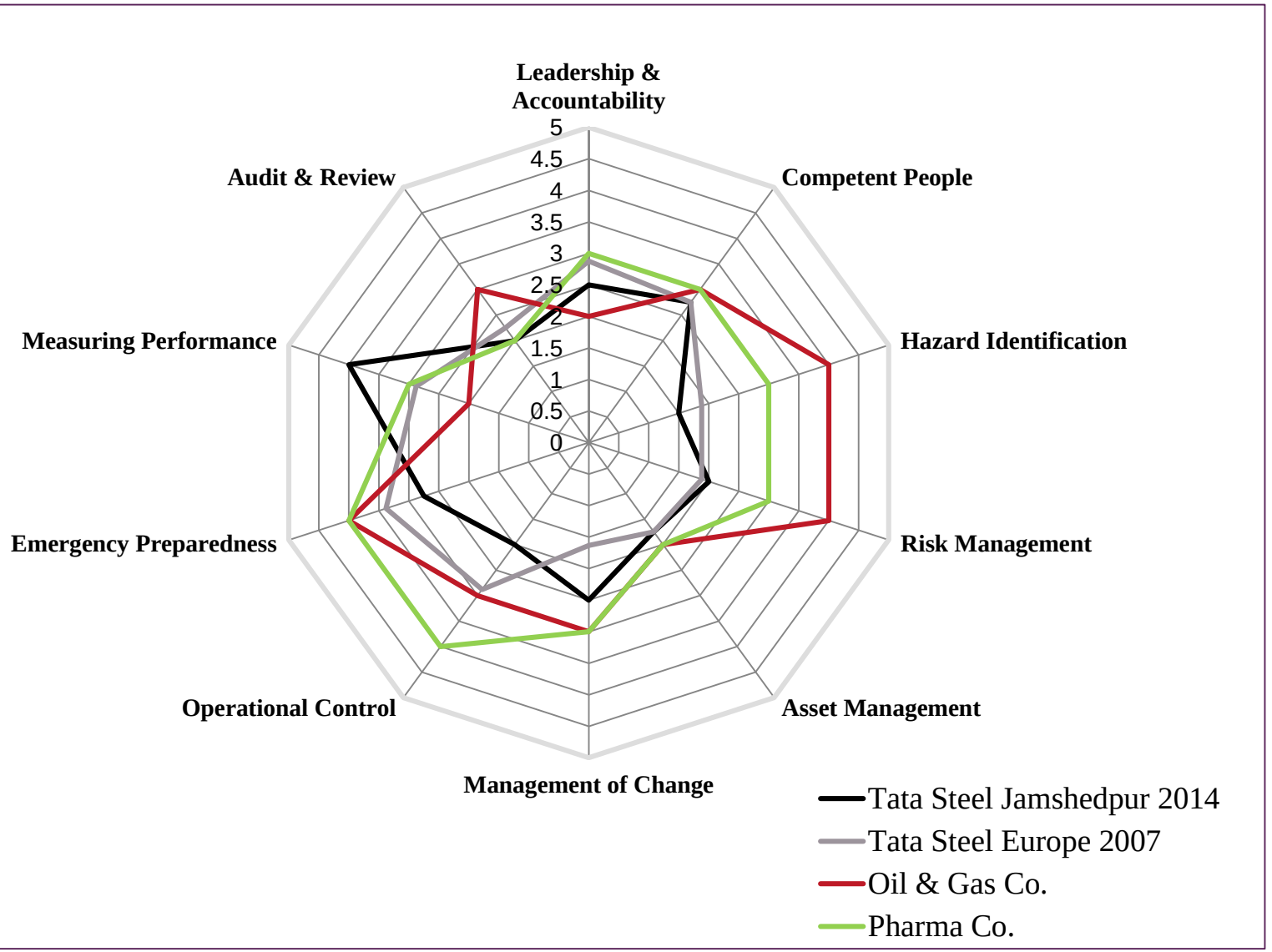
Spark from Electrostatic Precipitator

- Risk was not understood

PSM- Process Safety Management PLC- Programmable Logic Control

Contents

Tata Steel benchmarked its PSM System with best in class



Asset Management is a weak area across the organisation

- Barrier management can improve this

Hazard Identification is another weak area for Tata Steel

Audit & Review system needs improvement

Centre of Excellence (CoE) for Process Safety

Centre of Excellence (CoE) Approach for PSM : Key Objectives

Capability & Competency Building

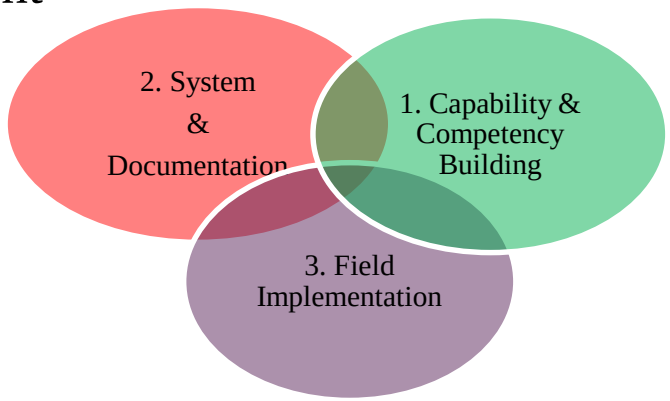
- Capability enhancement of operators following 70:20:10 approach on PSRM

System & Documentation

- To review and upgrade existing procedures and tools for **PSI, PHA, MoC** and **PSSR.**
- To strengthen current PSI & PHA documents as per revised procedure

Field Implantation

- Strengthen the Inspection & Maintenance system of PSM critical equipment
- Upgrade the OP to manage Process Critical Parameters
- Implementation of Recommendations to reduce the Risk leve



Capability and Competency Building

Exemplar
3- IBF
3-LD#1
2 -SHE

Practitioner
48 at IBF
48 at LD#1

Beginner
All employeesat in both facilities

70
On the job learning by assigning task & guidance

20
Handholding , Coaching by Experts

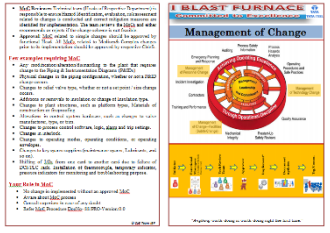
10
Class Room Training

- Developing PSI and PHA by TPM team

- PSI/PHA /MoC Training
- Shop floor Poster Campaign

- Kaizen, SGA , SIP/ Suggestion
- Daily Interruption
- Shutdown / Breakdown

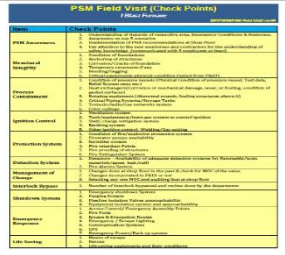
- Revised MoC Procedure
- 100% Shop floor Training



Safety Visit and Observation

PSM observation in Field Visit

PSM Field Visit Checklist Card



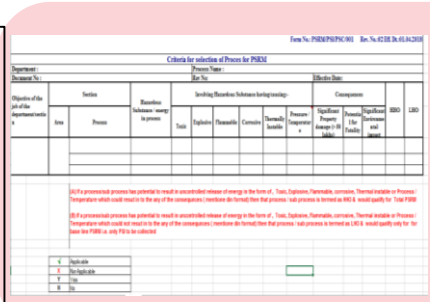
Felt Leadership : PSM Line Walk

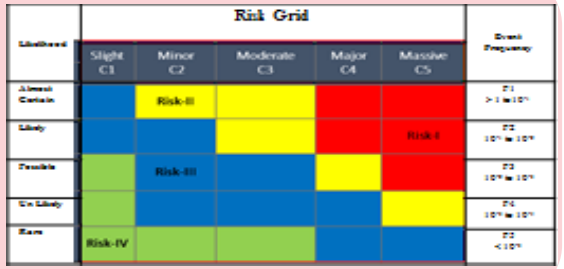
- Developed checklist & conducting PSM line walk
- Involving cross functional leaders & TPM/SGA team
- Weekly PSM Line Walk & review by chiefs IBF &LD1
- Horizontal deployment across JSR works by Apex PS&DM SC

Item	Check Points
PSM Awareness	1. Understanding of Hazards of respective area, Emergency Conditions & Response. 2. Awareness on top 5 scenarios 3. Implementation of PHA recommendations at Shop Floor 4. Pay attention to the new employees and contractors for the understanding of safety knowledge (communicated with 3 employees at least)
Structural Integrity	1. Condition of foundations 2. Anchoring of structu 3. Corrosion/Cra ion 4. Tempora 5. Ben 6. ts physical condition (Select from P&ID)
Process Containmen t	of pressure vessels (Physical Condition of pressure el, Test date, Relief System tests etc.) Heat exchangers(Corrosion or mechanical damage, wear, or fouling, condition of gasket surfaces) 3. Rotating equipment (Abnormal sounds, fouling structures above it) 4. Critical Piping System/Storage Tanks 5. Torpedo/ladle/Gas networks system 6. Colour codlings

PSM Deployment Framework

Steps 1- 5
1. Identify **High Hazard Facilities**
2. Categorize the processes as **High Hazard & Low Hazard operations**
3. Develop the **process safety information** (PSI)
4. Identify the hazards, evaluate the consequence and risk ranking **(Process Hazard Analysis)**
5. **Project Hazard** Study





Step 6
1.Model the consequence (Multiple Fatality) potential scenario

Barrier Management – Application to potential major accident hazard events (Fatality & Multiple Fatality Consequence)

Fire, explosion, toxic/energy release, environmental damage

Steps 7 & 8
7.Identify number and type of Barriers - **Safety critical equipment** and tasks
8.Assess **Barrier health**

Process Safety Critical Equipment (LTI & above consequence)

Safety Critical Tasks

Step 9
1.ALARP* demonstration through Layer of Protection Analysis (LOPA)

Step 10
1.Human factor analysis

ALARP Demonstration

Operational Control
Procedures, Training & Competence of Employees and Contractors

Asset Management
Design, Maintenance & Quality Assurance

Risk Reduction, Emergency Preparedness & Control

Monitor, Audit, Incident Investigation & Review

Management of Change

Management of Change

PSM CoE- Process Safety Management Centre of Excellence ALARP- As Low As Reasonably Practicable LTI – Lost Time Injury

Step 1: Identify High Hazard Facilities :

- Defined as per MSIHC rule / Steel industry specific hazards
- PHR-0 Procedure for the identification of High Hazard Facilities (HHF)

Step 2: Categorize the processes as High Hazard & Low Hazard Operations

- If any consequences is applicable, then High Hazard Operation (HHO).
- If any of the Hazardous Criterion without such Consequence ,then Low Hazard Operation (LHO)

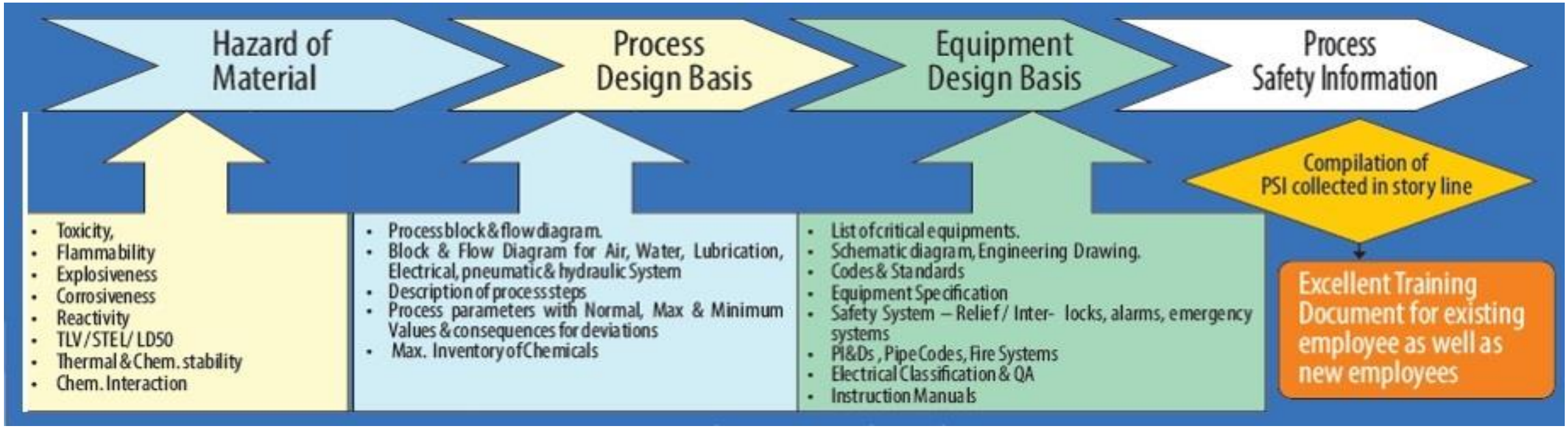
Criteria for selection of Proces for PSRM								Form No: PSRM/PSI/PSC/001 Rev.:01 Eff. Dt.:01.06.15				
Dept: I Blast Furnace								Doc. No.: PSRM/ IBF/GCP/PSI/PSC/001				
Process/ Sub Process: GAS CLEANING PLANT (WTP & Gas Network not Included)								Rev. No.: 01 Eff.Dt.15.01.16				
Section: IBF		Involving Hazardous Substance Having/Causing						Consequence			Process Category	
Process	Sub Process	Criteria#1 Toxicity	Criteria#2 Explosivity	Criteria#3 Flamability	Criteria#4 Corrosivity	Criteria#5 Thermal Instability	Criteria#6 Latent Heat or Compression	Significant Environmental Impact #7	Fatality Potential	Significant Property Damage	LHO	HHO
Gas Cleaning Plant	1. Dust Catcher (Heavy Dust Setled Down)	Y	Y	Y	Y	N	Y	Y	Y	Y		√
	2. Scrubber (Fine Dust Setled Down)	Y	Y	Y	Y	N	Y	Y	Y	Y		√
	3. Demister (De-Moisturing of clean BF gas)	Y	Y	Y	Y	N	N	Y	Y	Y		√
	4. AGE (Controlling of furnace top pressure)	Y	Y	Y	Y	N	Y	Y	N	N		√
	5. Launder (Water discharge to clarifier)	N	N	N	Y	N	Y	N	N	N	√	

Sample for identification of HHO & LHO

Step 3: Develop the Process Safety Information (PSI)

In PSI we collected information related to

- Hazards of Material(HOM) involved in the process
- Process design basis(PDB) and
- Equipment Design Basis(EDB)



Process Design Basis (PDB)

PROCESS DESIGN BASIS										Form No: PSRM/PSI/PDB/002 Rev.:01 01.07.15			
Dept: I Blast Furnace										Doc. No.: PSRM/I BF/GCP/PSI/HOM/			
Process/ Sub Process: GAS CLEANING PLANT										Rev. No.: 01 Eff.Dt.01.07.15			
Sub Processes	Sl. No	Parameter	UoM	PSM Critical (Y/N)	Safe Operating Limit		Safe Operating Conditions (SOCs)		Control measure to avoid deviations (SOC)		Consequence of deviation (SOL)		Control/Measures to avoid deviation (Existing Safeguard)	
					Min	Max	Min	Max	Min	Max	Min.	Max.	Min	Max
Dust Catcher	3	BF gas inlet temp	°C	Y	80	500	80	250	Fuel & burden distribution adjustment (Increase in fuel/more central gas flow by burden adjustment)	1. Automatically open top spray water. 2. Fuel & burden distribution adjustment (Reduce fuel/less central gas flow by burden adjustment)	Dust not coming out with the BF gas	BLT equipments damage (LSV seal may burn and uptakes may get damage)	NA	Emergency Preparedness

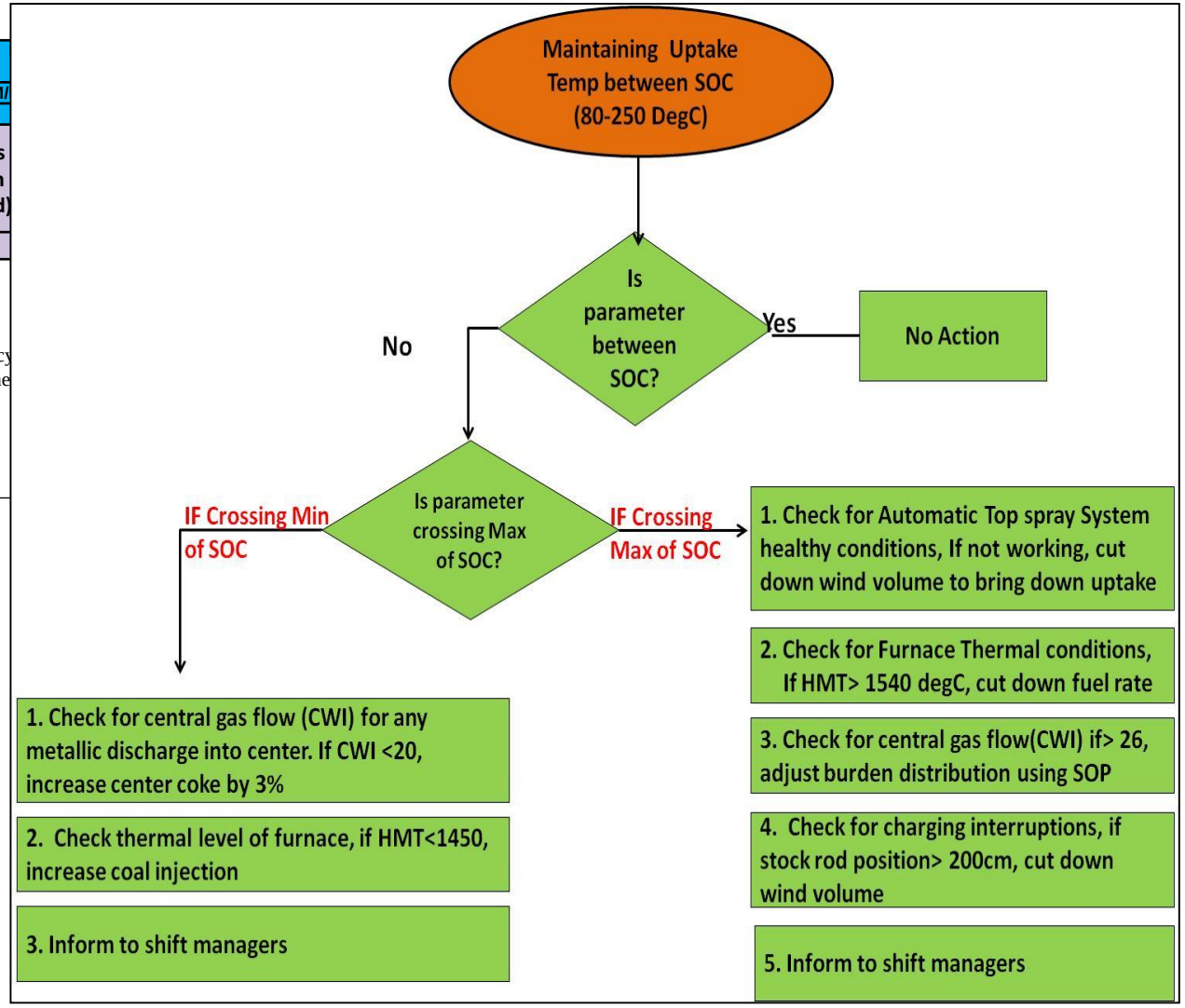
Tagging PSM critical process parameters in DCS system

Detailing control measures

AREA/SUB PROCESS :- GCP						
PROCESS	UNIT	SOC		SOL		RUNNING VALUE
		MIN	MAX	MIN	MAX	
TGP PIT 4901	Bar	NA	2.5	NA	2.6	2.22
BF GAS INLET TEMP.	'C	80	250	80	500	137.68
LEVEL OF DUST CATCHER	'C	2	3	1	5	
DISPENSER PRESSURE	Bar	0	2	NA	3.6	0.00
DISPENSER WEIGHT	Tons	0.7	8	NA	10	0.06
PR. UPTP SCRB. INLET	Bar	NA	2.5	NA	2.6	2.18
PR. AFTER SCRB.(TRT RUN)	Bar	NA	2.2	NA	2.45	1.71
PR. AFTER SCRB.(TRT NOT RUN)	Bar	0.01	0.15	0.01	0.2	1.71
WATER FLOW TO SCRB.	NM3/Hr	950	1020	800	1050	1039.84
PRE. SCRB LIT 8020	%	40%	80%	30%	90%	61.26
PRE SCRB WATER FLOW	NM3/Hr	475	510	400	525	486.41
RECIRCULATION WATER FLOW	NM3/Hr	510	525	400	560	446.64
HYD PRESSURE	Bar	185	195	100	195	191.46

LEGENDS : WITHIN SOC | BEYOND SOL-SOC | BEYOND SOL

Controlling PSM critical Process Parameters within the range thereby & avoiding loss of containment



Increasing visibility of PSM critical Process Parameters for control room operators

Clearly defined action standard for operators to avoid a process parameter crossing its maximum limits (SOL)

Equipment Design Basis (EDB)

Purpose: Identify & Manage PSM Critical Equipments

↓

New approach to identify PSM Critical Eqpts. (Consequence Based, Preventive/Mitigation & Prescriptive)

↓

• ~750 PSM **critical equipments identified** at IBF & LD#1

↓

Verification of existing list in SAP;

↓

•**Tagged equipments separately in SAP** system (S category) for identification and tracking of maintenance compliance

↓

•Developing Standard Maintenance Practices (**SMP) for PSM critical equipment**

↓

•**Daily management**

EQUIPMENT DESIGN BASIS (EDB)					Form No: PSRM/PSI/EDB/002 Rev.:01 Eff.Dt.: 01.07.15	
Dept: I BLAST FURNACE					Doc. No.: PSRM/I BF/GCP/PSI/EDB/001	
Process/ Sub Process: Gas Cleaning Plant					Rev. No.: 01 Eff.Dt.01.07.15	
Sl No	Hazardous Substance (Equipment is related with)	Sub Process / Sub System	Equipment	Basis of Selection Note#1	Associated Alarms / Interlocks / logics / loop Diagrams	Remark
3	BF GAS	Dust Catcher	SRV at dispenser hopper.	Prescriptive/Preventive/Mitigative		Failure of SRV may lead to vessel rupture
4		Scrubber	Scrubber Vessel	Consequence based	High Pressure Alarm	leak of valve will lead to uncontrolled gas release.
5			Pre Scrubber Level Transmitter LIT 8020.1/2/3	Consequence based	Closing of shutoff valve (SOV 8021) if level is lower than threshold.	Wrong reading with Low water level situation will allow BF gas to come out from scrubber.
6			SC			ure of closing of will lead BF gas.

Improving reliability of PSM critical equipments & to avoid loss of containment

Field Implantation

Field Tagging and PSM Dashboard Review

PSRM in Daily management

Dashboard for monitoring Maint. compliance of PSM critical equipment

Tagging in field for easy identification

Step 4: Process Hazard Analysis(PHA)

Steps Involved :

A. **Hazard Identification** (Chemical, Process Potential Energy Source, Mechanical, Electrical , Others)

B. **PHE- Process Hazard Evaluation** (Qualitative method- HAZOP/ What-if / HIRA)

C. **Facility siting Analysis** (Occupancy at Work place , Storage of Material)

D. **Field Tour for Members (**P&ID, Corrosion , Structural , Fire detection , Pipe line Marking , Emergency Planning Etc..)

E. **PSM Line walk for Leadership (**PSM Awareness to shop Floor Employees, Asset Integrity , Interlock By Pass Register, Protection Systems, Emergency Response , Lifesaving equipment**)**

Step 4: Process Hazard Analysis(PHA) Contd….

HAZOP :

The purpose of a Hazard & Operability(HAZOP) study is to carefully review a process or operation in a systematic fashion to determine whether deviations from the design or operational intent can lead to undesirable consequences. This technique are mostly used for continuous processes.

HAZOP of Gas Cleaning Plant – R-I risk Identified in HAZOP study

Guideword	Parameter	Deviation	Causes	Consequences	Impact S-Safety A- Asset E- Environment	Safeguards	Protected Risk			Recommendations	RESIDUAL RISK		
							Severity	Frequency	Risk		Severity	Frequency	Risk
No	Flow	No Flow	Pipe line rupture	BF Gas backflow (possible exposure to high BF gas concentration to the people in the surrounding)	S	1.Pressure Transmitter, alarm & operator action 2. Flow Transmitter alarm (When Flow<900 m3/hr), alarm & operator action 3. Non return valve (Not suitable for complete gas stoppage- not counted as safeguard)	C4	F2	I	1.Isolation valve is provided in CP 30 discharge line which will close when DP (Water pressure minus BF pressure) is low (xxx) 2. Three pressure transmitters (modified design of impulse line) to be provided to bring the logic of closing the shutoff valve	C4	F5	III

Sample of a HAZOP Sheet

Heat Map for Process Safety Related Risks

Risk Heat Map for **Unmitigated Risks

Impact→ / Likelihood ↓	Slight C1	Minor C2	Moderate C3	Major C4	Massive C5
Almost certain - F1		10	30	7	3
Likely - F2			32	16	1
Possible - F3				26	1
Unlikely - F4					7
Rare - F5					

Total R-I Risk (Red) : 28
Total R-II Risk (Yellow) : 105

***Residual Risk Heat Map as on June'19

Impact→ / Likelihood ↓	Slight C1	Minor C2	Moderate C3	Major C4	Massive C5
Almost certain - F1		1	1	1	0
Likely - F2	2	7	0	0	0
Possible - F3	5	14	40	0	0
Unlikely - F4	2	3	4	34	0
Rare - F5		4	4	3	8

Total R-I Risk (Red) : 1
Total R-II Risk(Yellow) : 2

Unmitigated Risk : As is Risks (without any new safeguards)

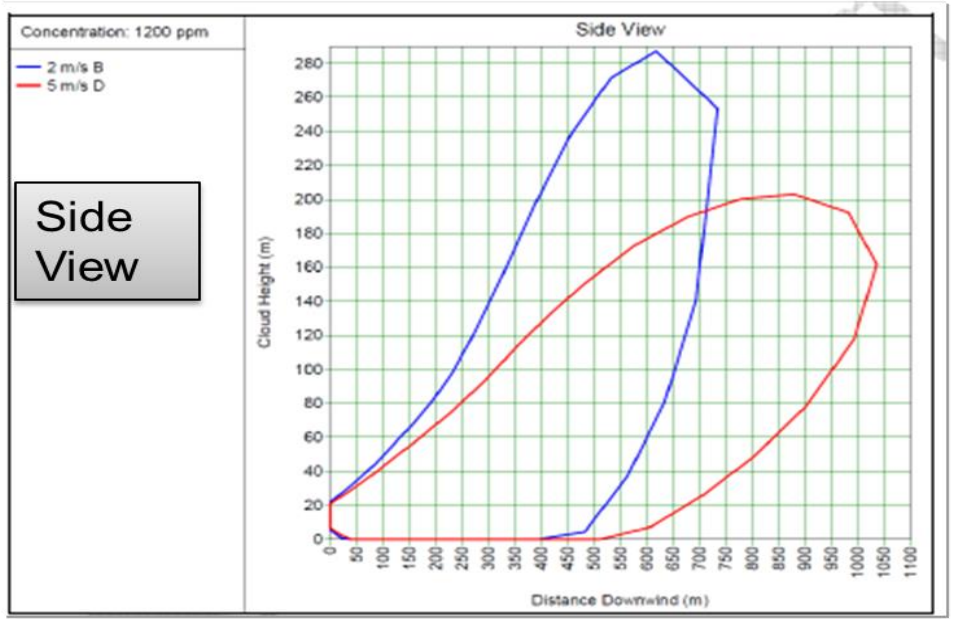
****Residual Risk : Risks after implementation of new safeguards***

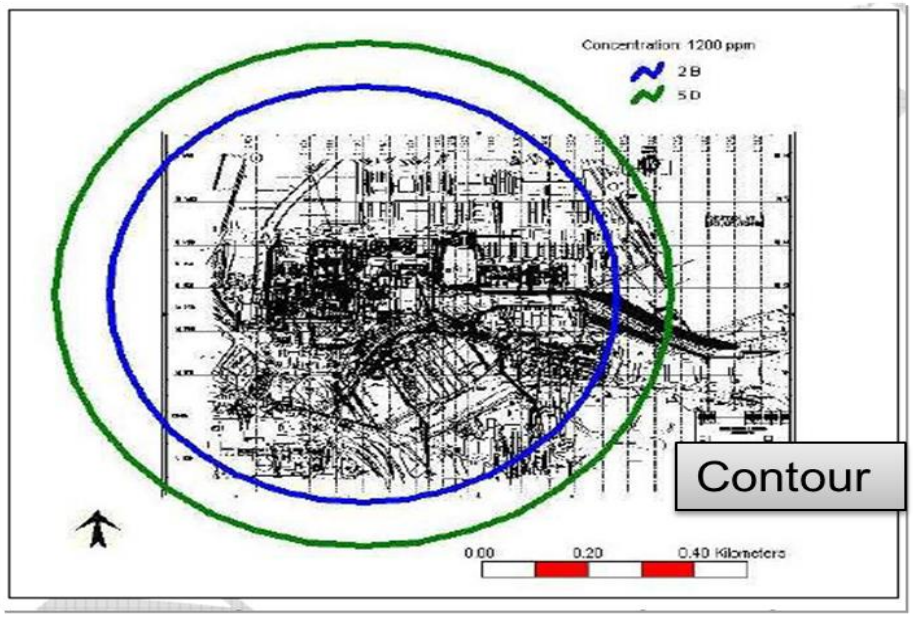
Step 5: Project Hazard Study

Project Stage		Activity / Input	Output
HS1 – Concept identification / Study	Conceptualising stage and before finalizing the basic engineering.	• **Learning from Past Incidences** and previous PHA Studies • **Inherent SHE** Considerations • Effect of **Loss of Containment** of Hazardous chemicals and **related health and safety issues** • Environmental Considerations • Transport & siting • **Emergency facilities** for proposed project	**Past leanings & Key applicable** aspects of **safety, health and environmental** for the project should be identified prior to the submission for approval at BU PRG level
HS2 – Design / Execution	End of the project design stage, using developed P&IDs	**Detail identification** of process **safety hazards (like HAZOP)** , particularly Major Accident Hazards, which could arise because of deviations of process parameters from the design intent.	Verify & ensure whether **adequate safeguards have been provided** to reduce all the risks to acceptable level **as per TSL risk matrix**
HS3 – Startup & Ramp-up	Before starting up and a follow up review after 3 months of commissioning	**PSSR-Checklist based audit** to ensure implementation of • Appropriate elements of process safety • New facility meet the original design • Access control / Safe access to equipment • Energy Isolation system • Implementation of generated recommendations	**Safe startup** of facility and **monitoring of Open Points** (post startup)

Step 6: Model the consequence (Multiple Fatality) potential scenario

Consequence Analysis (QRA- Quantitative Risk Analysis)





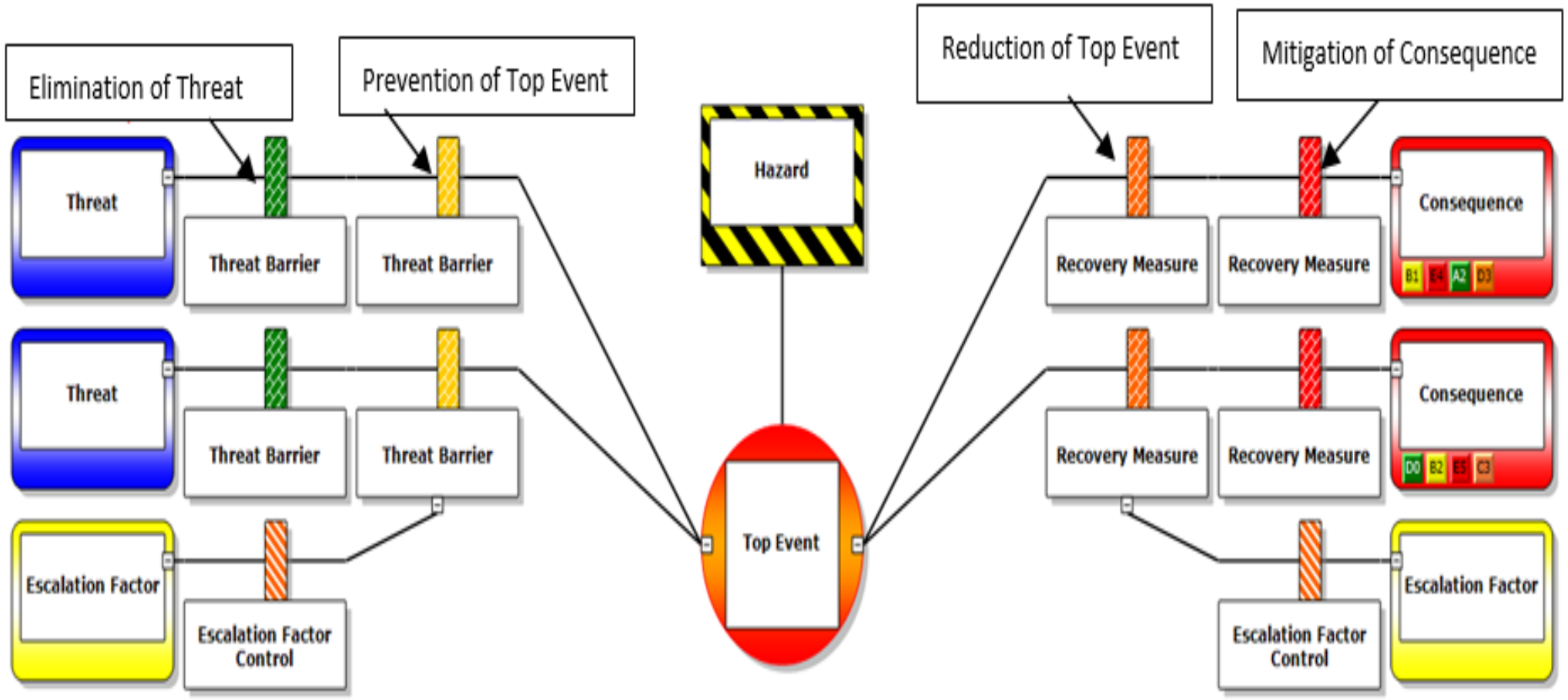
Mathematical Modeling to portrait the geographical spread of impact like Gas Release.

Ex : Full bore rupture of the pipeline from BF to TRT – Toxic Release

New Recommendations generated based on such modelling

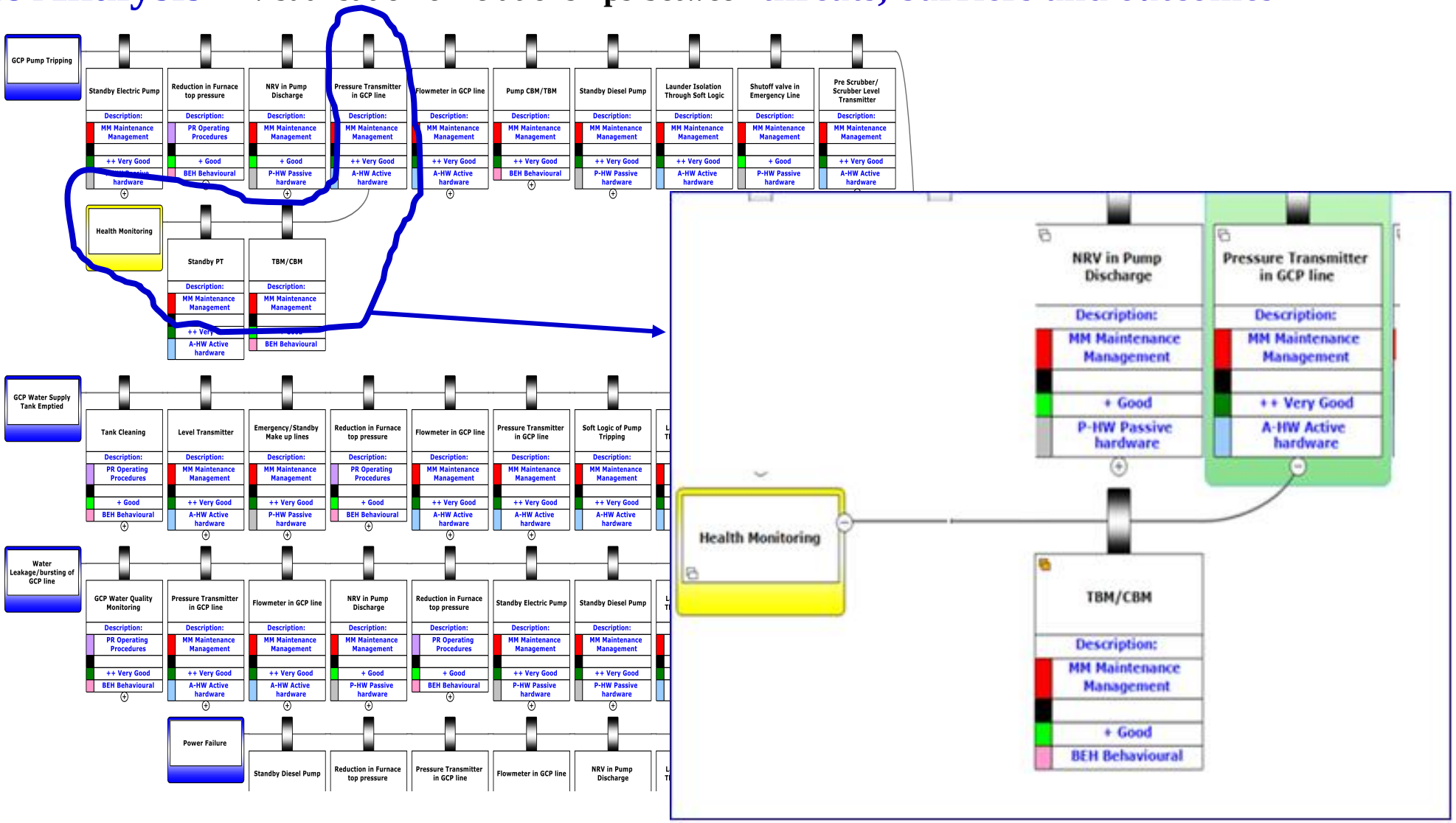
Step 7: Identify number and type of Barriers Using Bow-Tie Software

Bow Tie is diagram which provides visual explanation of risk



Bow Tie Helps to Identify Process Safety critical equipment and tasks

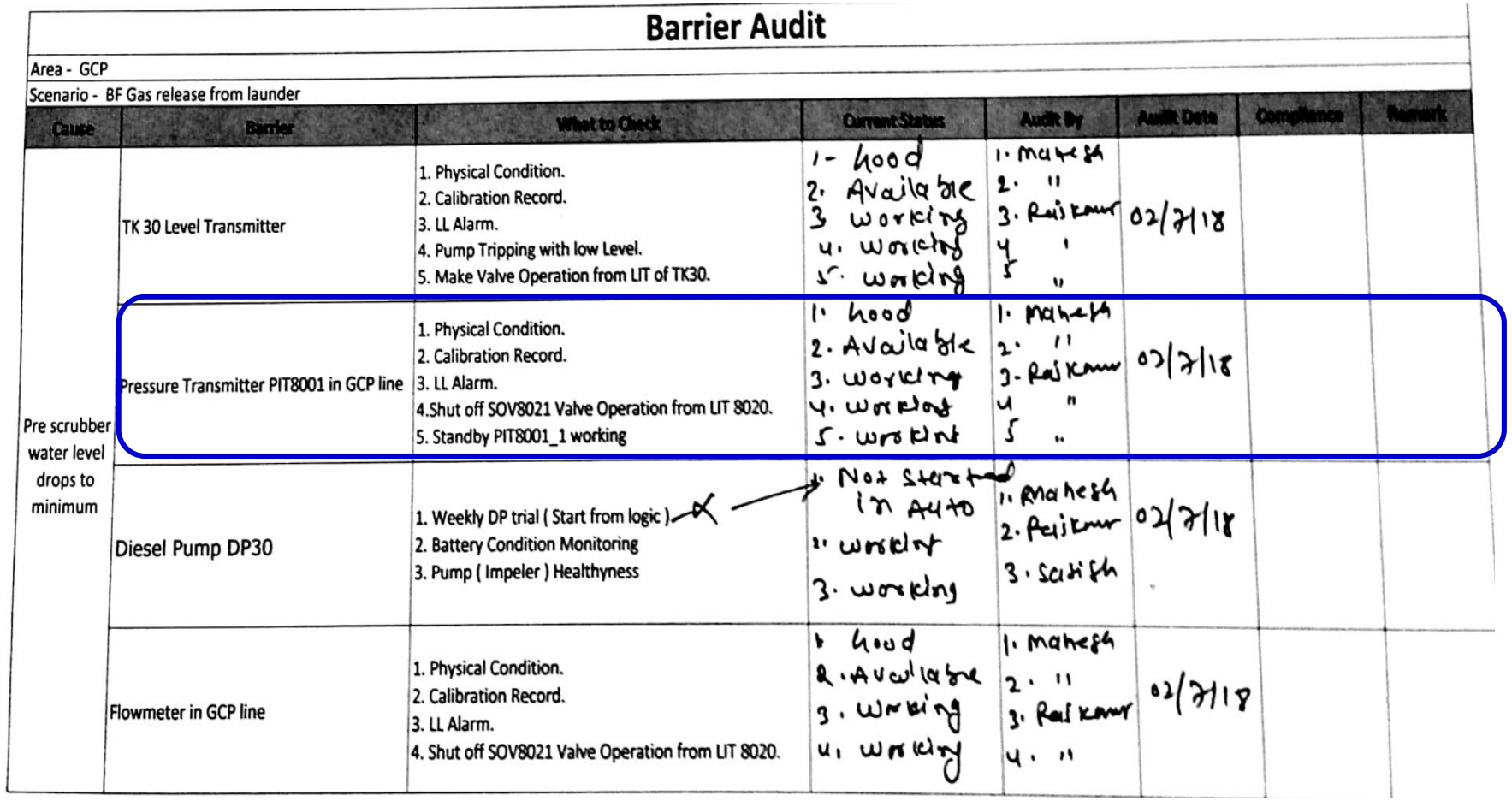
BowTie Analysis - visualisation of relationships between threats, barriers and outcomes



Bow tie also helps us in Validation of identified Process Safety **Critical Equipment and** Process Safety **Critical task**

Step 8: Assess Barrier health

Barrier Audit for all C4 & C5 scenarios identified in PHA for validating the effectiveness of barriers with the help of Bow Tie diagrams.



Barrier Audit

Area - GCP

Scenario - BF Gas release from launder

Cause	Barrier	What to Check	Current Status	Audit By	Audit Date	Compliance	Remark
Pre scrubber water level drops to minimum	TK 30 Level Transmitter	1. Physical Condition. 2. Calibration Record. 3. LL Alarm. 4. Pump Tripping with low Level. 5. Make Valve Operation from LIT of TK30.	1- Good 2. Available 3 working 4. working 5. working	1. Mahesh 2. " 3. Ravikumar 4 " 5 "	02/7/18		
	Pressure Transmitter PIT8001 in GCP line	1. Physical Condition. 2. Calibration Record. 3. LL Alarm. 4.Shut off SOV8021 Valve Operation from LIT 8020. 5. Standby PIT8001_1 working	1. Good 2. Available 3. working 4. working 5. working	1. Mahesh 2. " 3. Ravikumar 4 " 5 "	02/7/18		
	Diesel Pump DP30	1. Weekly DP trial (Start from logic) 2. Battery Condition Monitoring 3. Pump (Impeler) Healthyness	1. Not started in Auto 2. working 3. working	1. Mahesh 2. Ravikumar 3. Satish	02/7/18		
	Flowmeter in GCP line	1. Physical Condition. 2. Calibration Record. 3. LL Alarm. 4. Shut off SOV8021 Valve Operation from LIT 8020.	1. Good 2. Available 3. working 4. working	1. Mahesh 2. " 3. Ravikumar 4. "	02/7/18		

It will **ensure the healthiness** of the Safeguards and will **perform as required as intended**

Step 9: Layer of Protection Analysis (LOPA)

To evaluate **effectiveness and sufficiency** of safeguards for a Risk Event (LOPA- Semi Quantitative Method)

LOPA is to be done for all C4 & C5 scenarios identified in PHA.

Layer of Protection Analysis (Tata Steel Limited)										
Form No: TSL\SAFETY\PS\LOPA Rev:00							**Doc. No. :IBF/PHA/LOPA/Gas Exposure(GCP)/01**			
Execution Date:							**Done By:**			
Consequence Description : BF Gas back travel into CP30 Pump House. People working near WTP may get exposed to toxic gas.										
References : HAZOP of GCP , Bow Tie										
Consequence Risk Category : C4							**Applicable Risk Tolerance Criteria: 3.5 X 10^{-5}**			
Initiating Event		**Enabling Event**		**Conditional Modifier**		**Frequency of Unmitigated Consequence $f_{umc} = f_i \times P_e \times P_c$**	**Safeguards**			**Frequency of Mitigated Consequence $f_{mc} = f_{umc} \times \prod$ PFD**
Description	**Frequency (Per Year) f_i**	**Description**	**Probability P_e**	**Description**	**Probability P_c**		**Description**	**IPL Credit**	**PFD**	
Rupture of CP30 to GCP water Line	1.00E-02	None	1	People Presence Near Launder	1	1.00E-02	Flow meter and Pressure in GCP line with SOV	Yes	1.00E-01	1.00E-04
							NRV in Pump Discharge	No Credit		
							Reduction Furnace top pressure after low water level alarm	Yes	1.00E-01	

Above study reveal that **present safeguards is not adequate and we need a additional safeguards to reduce the risk in ALARP range.** It justify the requirement of new recommendations

Step 10: Human factor analysis

Human failure (if not completed or completed incorrectly or untimely) has the potential to:

- Initiate a process incident scenario
- Fail to prevent a process incident scenario occurring
- Cause a process incident scenario to escalate

The primary purpose of conducting a HFA is to assess qualitatively the likelihood of human failure and to put in place relevant measures to reduce that likelihood or the effects of the failure.

Contents

Deliverables of the PSM Deployment

With the help of 10 steps we have tried to answer the 3 Key Questions

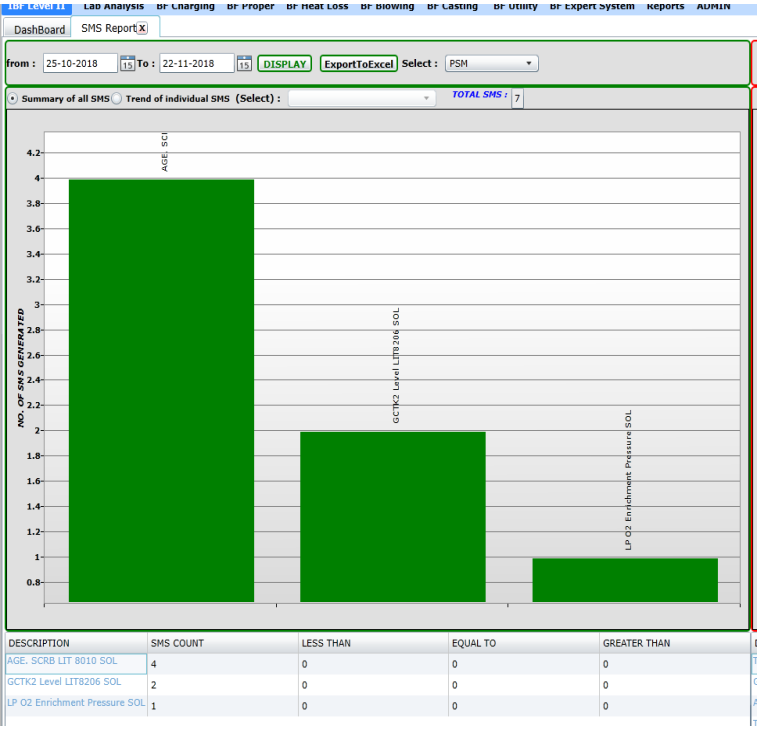
- **1) Do we know what can go wrong?**
  - Hazard Identification, Risk Management

- **2) Do we know what barriers we have to ensure that it doesn't go wrong?**
  - Asset Management, Management of Change, Operational Control, Human factor Analysis, Emergency Preparedness.

- **3) Do we know that our barriers are effective and working properly?**
  - Barrier Audits, Learning from Events, Measuring Performance, Audit and Review

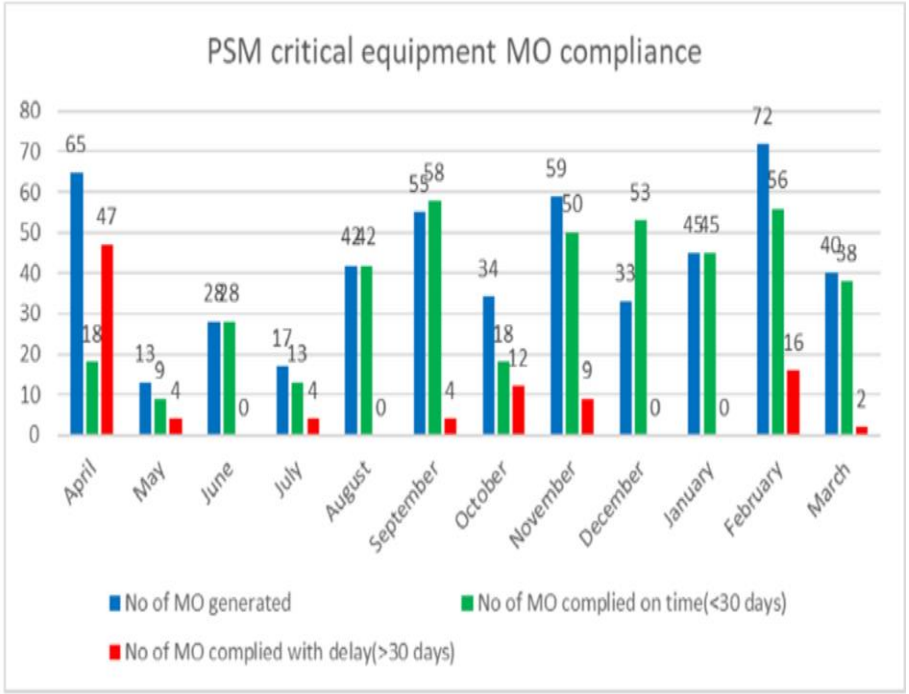
Deliverables of PSM Deployment

SOC & SOL Alerts Status

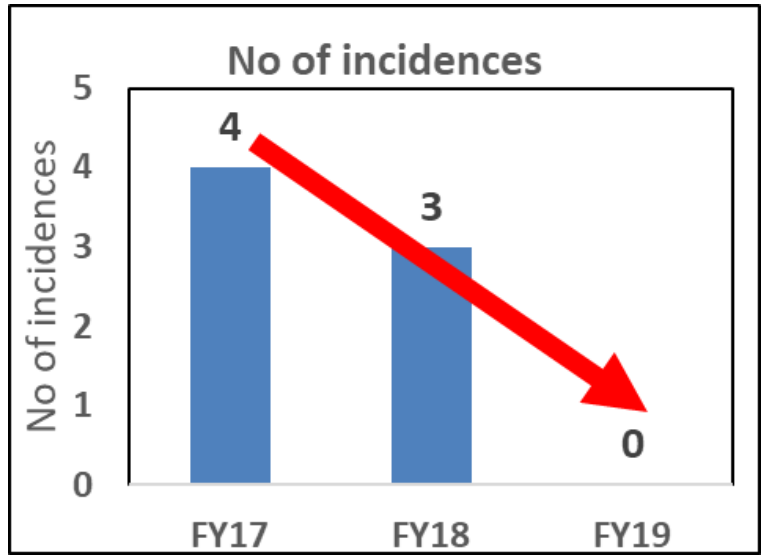


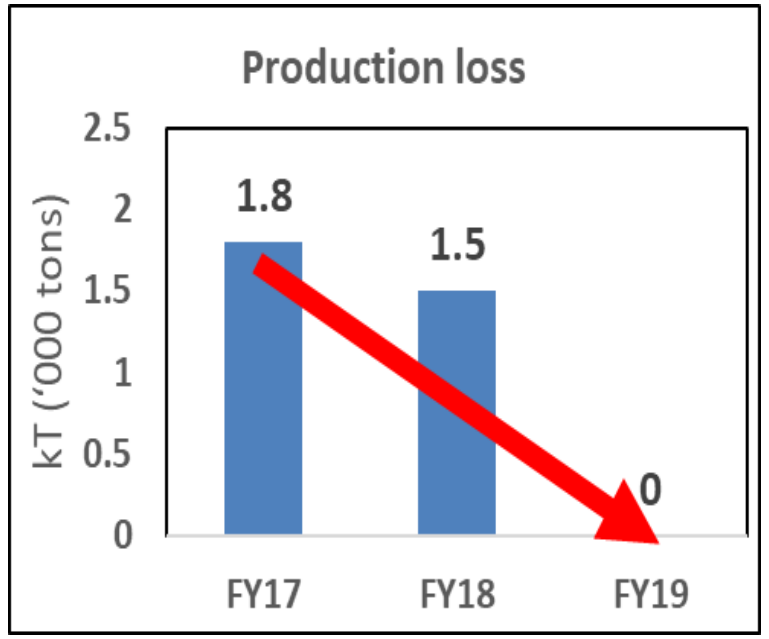
DESCRIPTION	SMS COUNT	LESS THAN	EQUAL TO	GREATER THAN
AGE. SCRB LIT 8010 SOL	4	0	0	0
GCTK2 Level LIT8206 SOL	2	0	0	0
LP O2 Enrichment Pressure SOL	1	0	0	0

Management of PS Critical Equipment



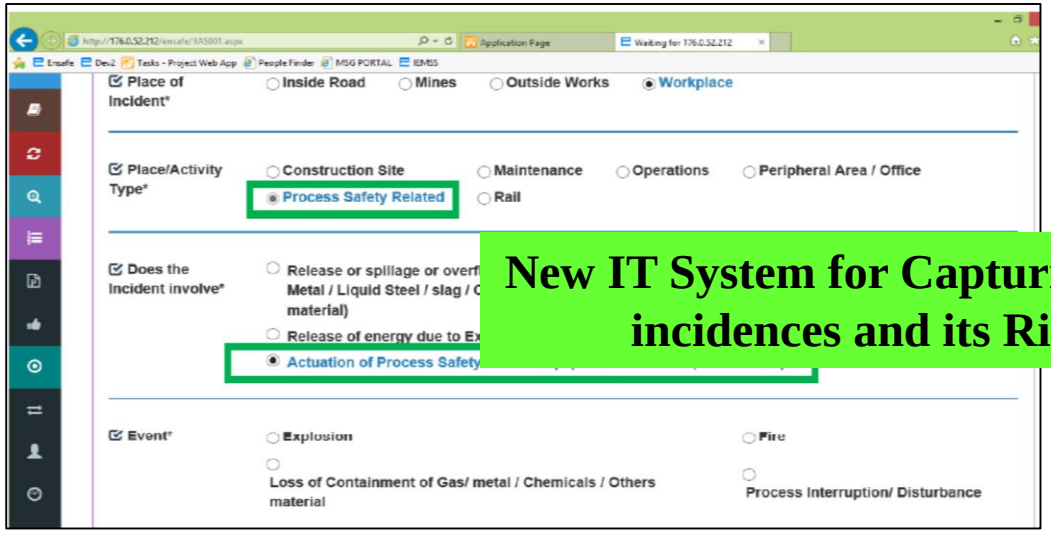
Result – Business Impact

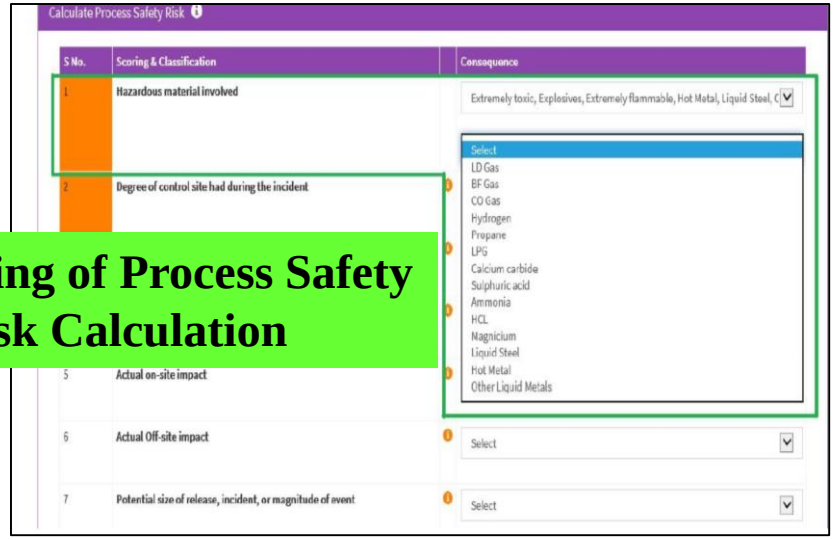




Contents

Sustenance : Strengthening Incident investigation system





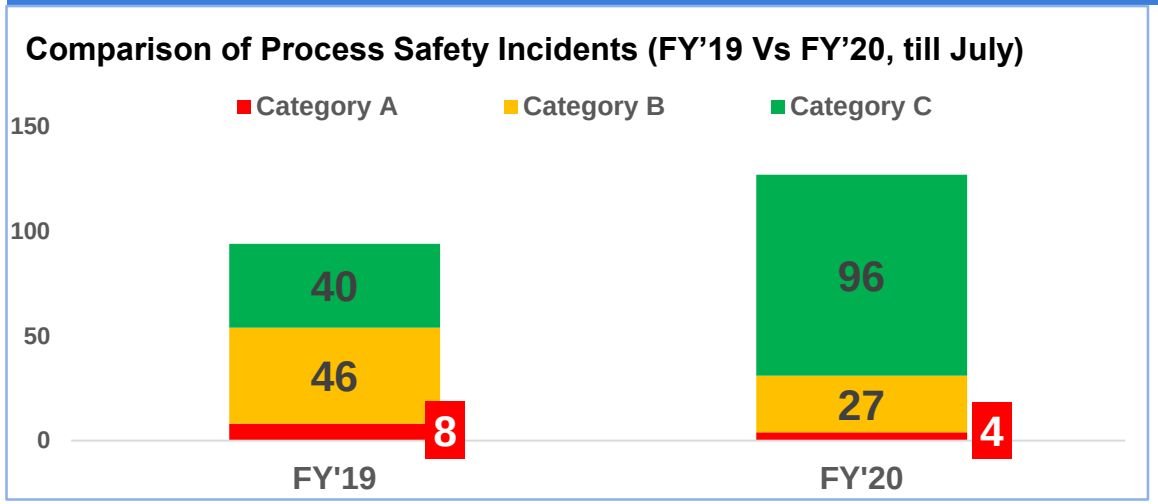
New IT System for Capturing of Process Safety incidences and its Risk Calculation

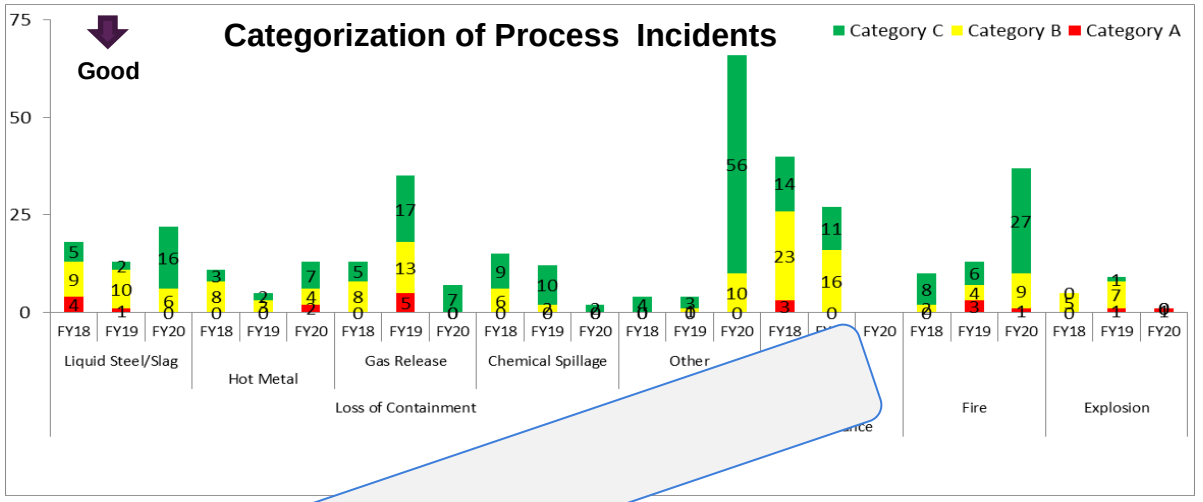
Certified Process Safety Exemplars : PSM Competency Network

Competency	Experience		Process Safety Information	Process Hazard Analysis	Management of Change	Pre Start Up Safety Review	
Exemplar	at least 7 years of working experience & Knowledge of plant systems for operation, maintenance and resources. Understanding of operation / plant functions / design & engineering / technical design standards	Training & certified on	PSI Procedure including Various Formats & related information Clear concept on EDB, PDB, HOM & CIM	PHA procedure, PHA Various Formats & related information Advanced PHA Tools -HAZOP, LOPA, Consequnce Analysis, Bow- Tie , SIL(Optional)			
		Practical Experience	Completed at least 5 PSI of any process			Conducted Independent Audit (at least 5 PSSR audit)	3. Educate teams on PSI , PHA, MOC, PSSR & other PSRM requirments by imparting training & reviewing 4. Participate in PSM Audit as lead auditor 5. Provide a single point of coordination and contact for process safety requirements at their site 6. Lead the PHA team
		Coaching Experience	Coach other team for PSI at least 5 processes	Coach other team for PHA at least 5 processes			

Criteria for certifying as Process Safety Exemplars

Process Safety Incidences and investigations





Use of Process Safety elements in Investigation

Sample

Process Safety Information (PSI) – Available & But Not Adequate

Process Design Basis (PDB)

- Furnace top pressure (2.2 to 2.5 bar) identified as critical Process Parameters
- Safeguards in case of high pressure (Bleeder valves get open automatically with higher pressure)
- Indirect Value of K Value (DP Value) is also identified as critical Process Parameters [illegible] defined
- Hydraulic pressure was not identified as Process Safety Critical Parameter

Equipment Design Basis (EDB)

- All Four Bleeders are identified as Process Safety Critical
- Furnace Pressure measuring system (PIT 4901.1 T[illegible] rocess Safety Critical equipment
- Accumulator was not identified as Proc[illegible]

Process Hazard Analysis (PHA) –

- Five Different causes were ident[illegible] ssurization & high BF gas pressure
- This High Top gas Pressure scena[illegible] ell defined in the PHA (PSM/HBF/HAZOP/BF Proper/01) as risk category III by considering Semi clean & three crude bleeder as safeguards. But "Bleeder failed to closing" was not considered

Operating Procedure & Compliance – Not Complied

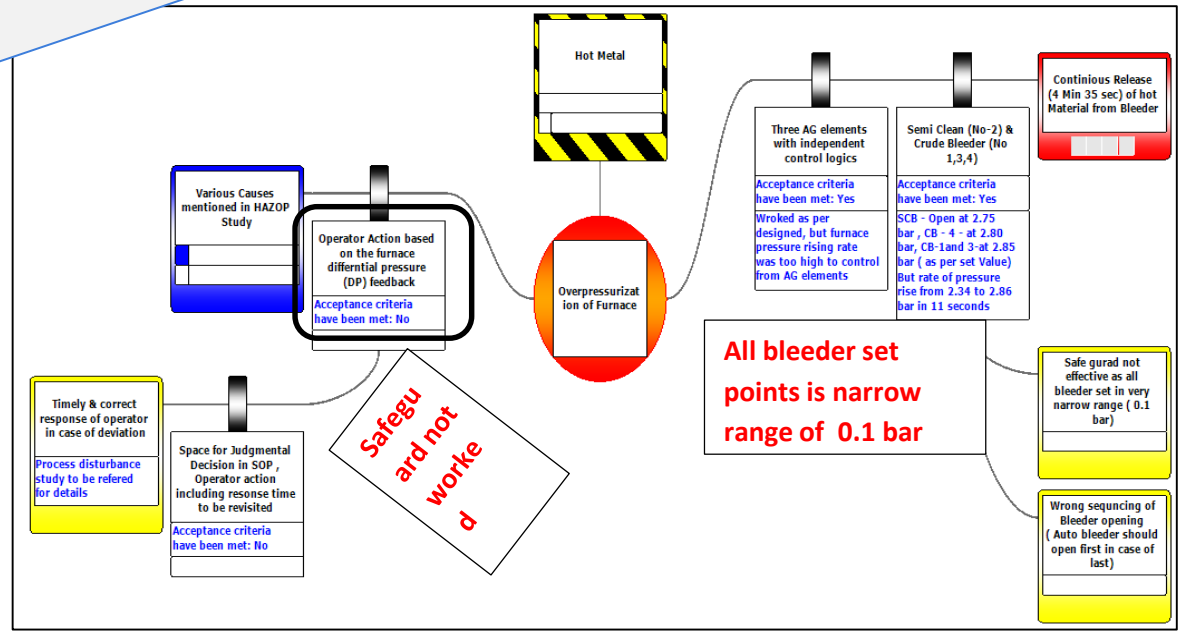
- Operator Action not as per the deviation guidelines (i.e, SOP)

Asset Management – Applicable but not Equipment not performed as intended

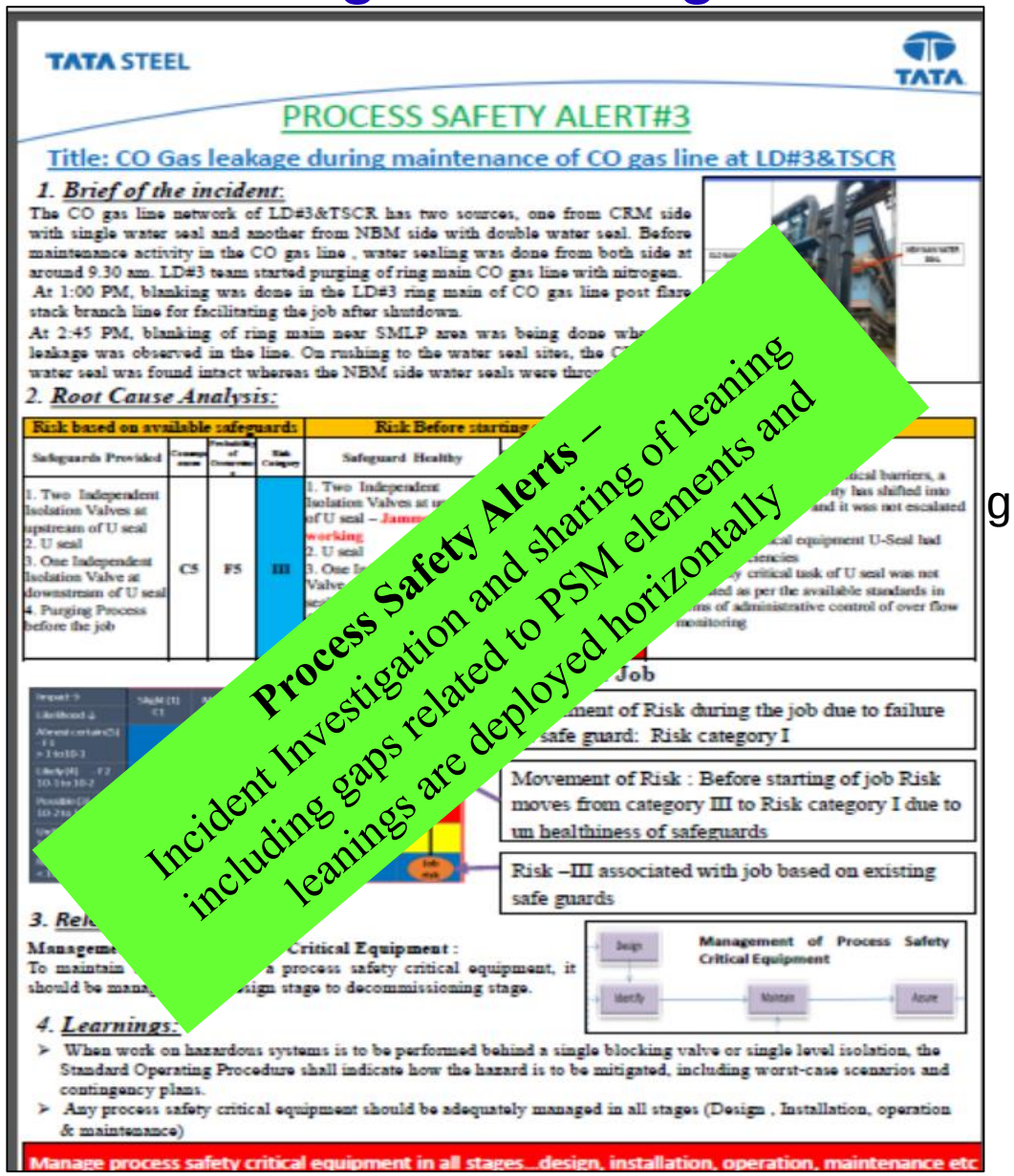
- Bleeder #3 stuck up in between & feedback not coming to operator / DCS
- Hydraulic pressure drop & accumulator effectiveness

Incident Investigation –

- Learning from I BF incident was not implemented (Bleeder opening setting , Change in Pump logic,).



Sustenance : Sharing the leanings



TATA STEEL

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PROCESS SAFETY ALERT#3

Title: CO Gas leakage during maintenance of CO gas line at LD#3&TSCR

1. *Brief of the incident:*

The CO gas line network of LD#3&TSCR has two sources, one from CRM side with single water seal and another from NBM side with double water seal. Before maintenance activity in the CO gas line , water sealing was done from both side at around 9.30 am. LD#3 team started purging of ring main CO gas line with nitrogen.

At 1:00 PM, blanking was done in the LD#3 ring main of CO gas line post flare stack branch line for facilitating the job after shutdown.

At 2:45 PM, blanking of ring main near SMLP area was being done wh... leakage was observed in the line. On rushing to the water seal sites, the C... water seal was found intact whereas the NBM side water seals were thro...

2. *Root Cause Analysis:*

Risk based on available safeguards				Risk Before starting ...
Safeguards Provided	Consequence	Probability of Occurrence	Risk Category	Safeguard Healthy
1. Two Independent Isolation Valves at upstream of U seal 2. U seal 3. One Independent Isolation Valve at downstream of U seal 4. Purging Process before the job	C5	F5	III	1. Two Independent Isolation Valves at u... of U seal – Jamm... working 2. U seal 3. One I... Valve...

...Job

...ment of Risk during the job due to failure ...safe guard: Risk category I

Movement of Risk : Before starting of job Risk moves from category III to Risk category I due to un healthiness of safeguards

Risk –III associated with job based on existing safe guards

3. *Rel...*

Manageme... Critical Equipment :

To maintain ... a process safety critical equipment, it should be mana... sign stage to decommissioning stage.

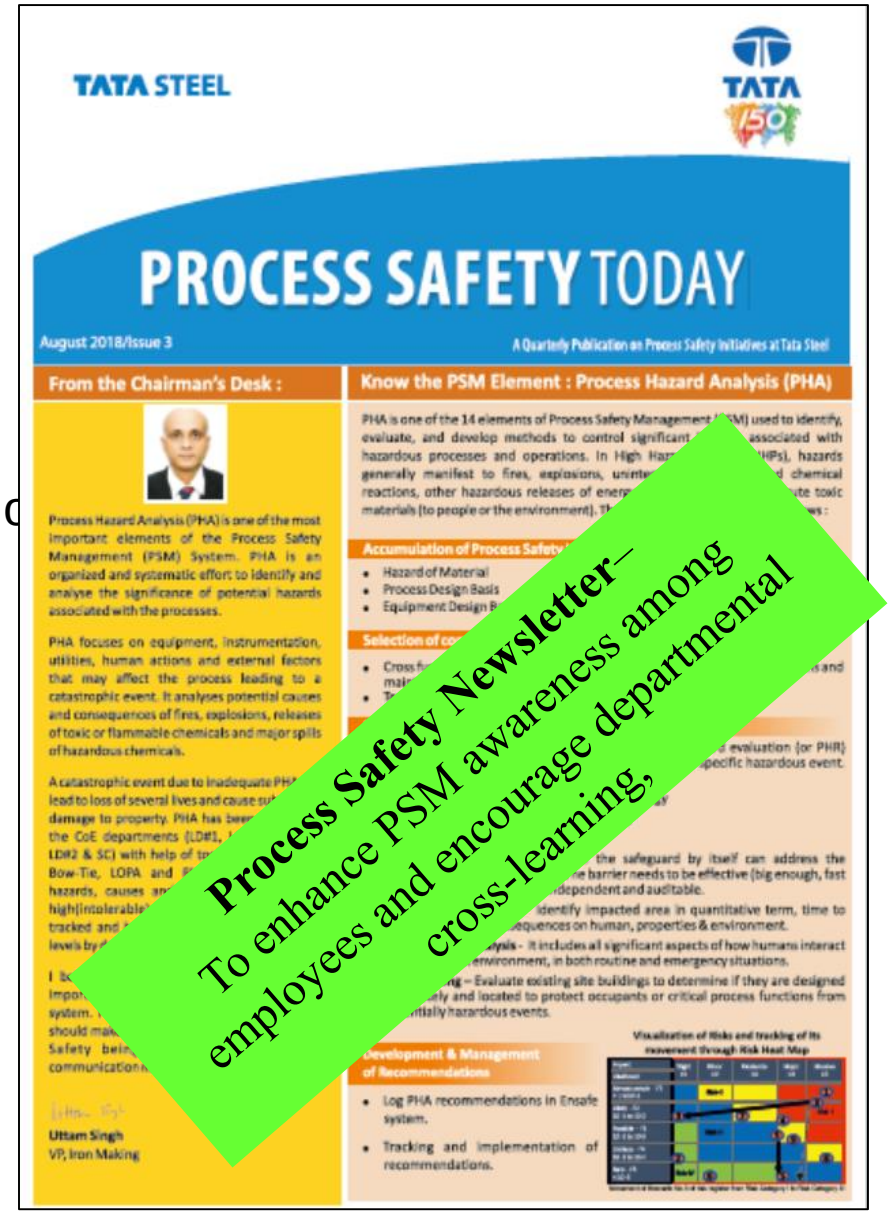
4. *Learnings:*

- When work on hazardous systems is to be performed behind a single blocking valve or single level isolation, the Standard Operating Procedure shall indicate how the hazard is to be mitigated, including worst-case scenarios and contingency plans.
- Any process safety critical equipment should be adequately managed in all stages (Design , Installation, operation & maintenance)

Manage process safety critical equipment in all stages...design, installation, operation, maintenance etc

Process Safety Alerts – Incident Investigation and sharing of leaning including gaps related to PSM elements and leanings are deployed horizontally

g c



TATA STEEL

TATA 150

PROCESS SAFETY TODAY

August 2018/Issue 3

A Quarterly Publication on Process Safety Initiatives at Tata Steel

From the Chairman's Desk :

Process Hazard Analysis (PHA) is one of the most important elements of the Process Safety Management (PSM) System. PHA is an organized and systematic effort to identify and analyse the significance of potential hazards associated with the processes.

PHA focuses on equipment, instrumentation, utilities, human actions and external factors that may affect the process leading to a catastrophic event. It analyses potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals and major spills of hazardous chemicals.

A catastrophic event due to inadequate PH... lead to loss of several lives and cause su... damage to property. PHA has bee... the CoE departments (LD#1, ... LD#2 & SC) with help of to... Bow-Tie, LOPA and ... hazards, causes an... high(intolerable... tracked and ... levels by ...

Uttam Singh
VP, Iron Making

Know the PSM Element : Process Hazard Analysis (PHA)

PHA is one of the 14 elements of Process Safety Management (PSM) used to identify, evaluate, and develop methods to control significant ... associated with hazardous processes and operations. In High Har... (HIPs), hazards generally manifest to fires, explosions, uninte... chemical reactions, other hazardous releases of energ... toxic materials (to people or the environment). Th... :

Accumulation of Process Safety...

- Hazard of Material
- Process Design Basis
- Equipment Design B...

Selection of co...

- Cross f... and mai...

...evaluation (or PHR) ...specific hazardous event.

...the safeguard by itself can address the ...e barrier needs to be effective (big enough, fast ...dependent and auditable.

...identify impacted area in quantitative term, time to ...equences on human, properties & environment.

...ysis - It includes all significant aspects of how humans interact ...environment, in both routine and emergency situations.

...g – Evaluate existing site buildings to determine if they are designed ...ly and located to protect occupants or critical process functions from ...ntially hazardous events.

...development & Management of Recommendations

- Log PHA recommendations in Ensafe system.
- Tracking and implementation of recommendations.

Visualisation of Risks and tracking of its movement through Risk Heat Map

Process Safety Newsletter– To enhance PSM awareness among employees and encourage departmental cross-learning,

Way Forward

Action Plan	Responsibility	Target
CoE Concepts to **all the high hazards** installation by end of FY'20	Central Safety Team	March'20
Development of **Asset management Standard** & its **Pilot implementation**	COMM/COEM	FY'20
Standard to identify **PSM critical Tasks** and application of **human factor**	Head PSM	FY'20
Quarterly second party **audit by exemplars** team	Apex PS&DM	March'19
Half yearly **Assessment by TSE** team	Head PSM	As per plan
Roll out of **CoE concept in TSK, Bhushan Steel** & other associated companies	Central safety team	FY'21

Conclusion

The manufacture of Steel and downstream production involves complex processes with in-built **intrinsic hazards** that need **careful management**.

The **measures needed to contain these hazards** in a controlled way are equally complex and **not always readily understood.**

Effective Process Safety and Risk Management is not a choice but a must for survival of our industry.

Thanks

worldsteel
ASSOCIATION

SAFETY AND HEALTH EXCELLENCE RECOGNITION 2018

"Nothing is more important than the safety and health of people who work in the steel industry"

For its process safety journey through its Centre of Excellence (CoE)

TATA STEEL LIMITED

is recognised for excellence in its commitment and innovation in the pursuit of Zero – an injury-free, illness-free and healthy workplace

Kosei Shindo	Edwin Basson	Andrew Purvis
worldsteel Chairman	Director General	Director, Safety, Health and Environment

Reward and Recognitions