



PNGRB Two-Day Mega Conference Pioneering Technical Innovations for a Safe Tomorrow

16th & 17th December 2024

"Accident Prevention and Learnings from Major Incidents / Accidents in Petroleum Industry"



S N Soman

CGM- Operations, HPCL Mumbai Refinery



Agenda



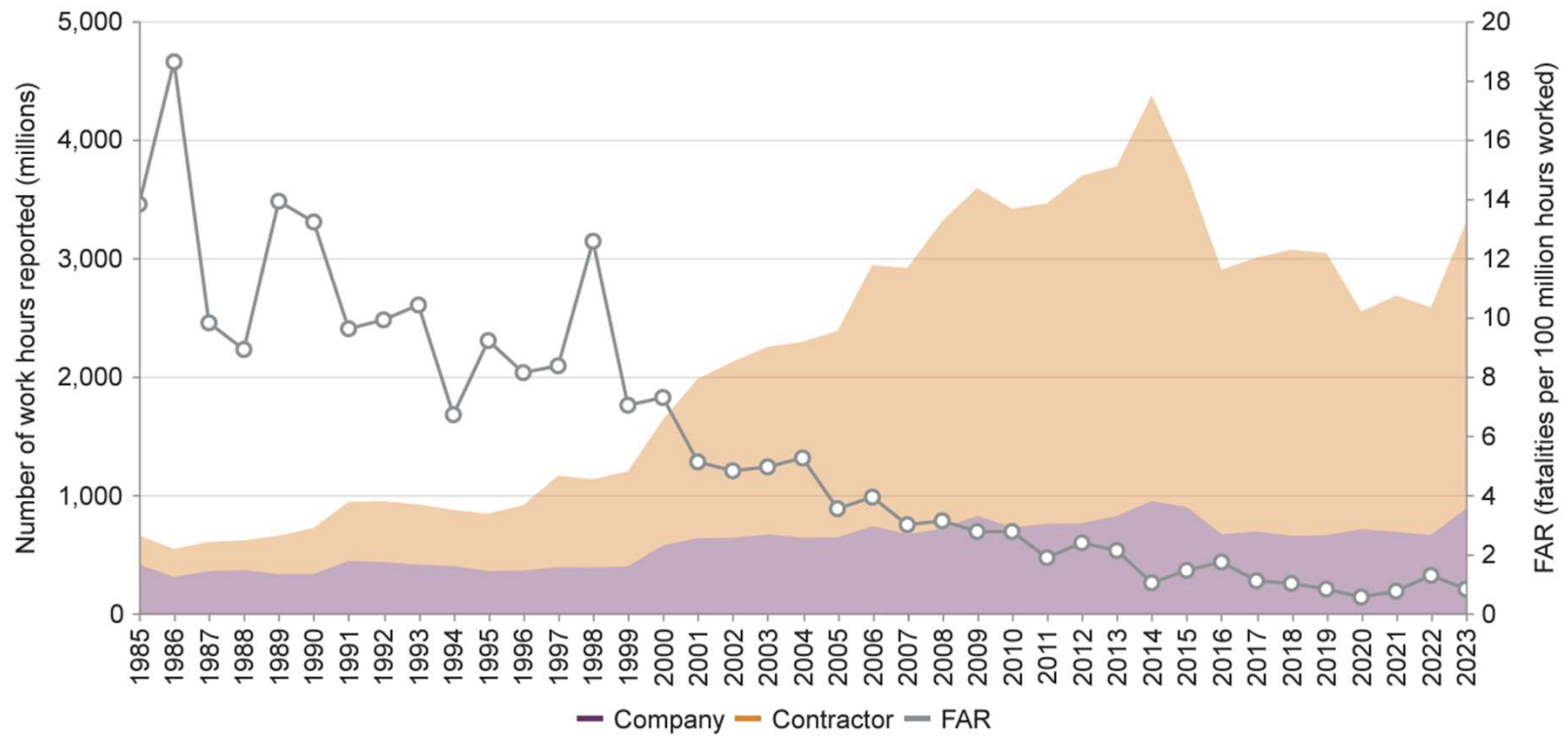
1. Industry Incident Data Overview
2. Common Root Causes of incidents
3. Major learning from Past incidents / accidents
4. HPCL Safety Initiatives
5. Way forward - Strengthening Safety



IOGP FAR



Reported work hours and fatal accident rate (1985–2023)

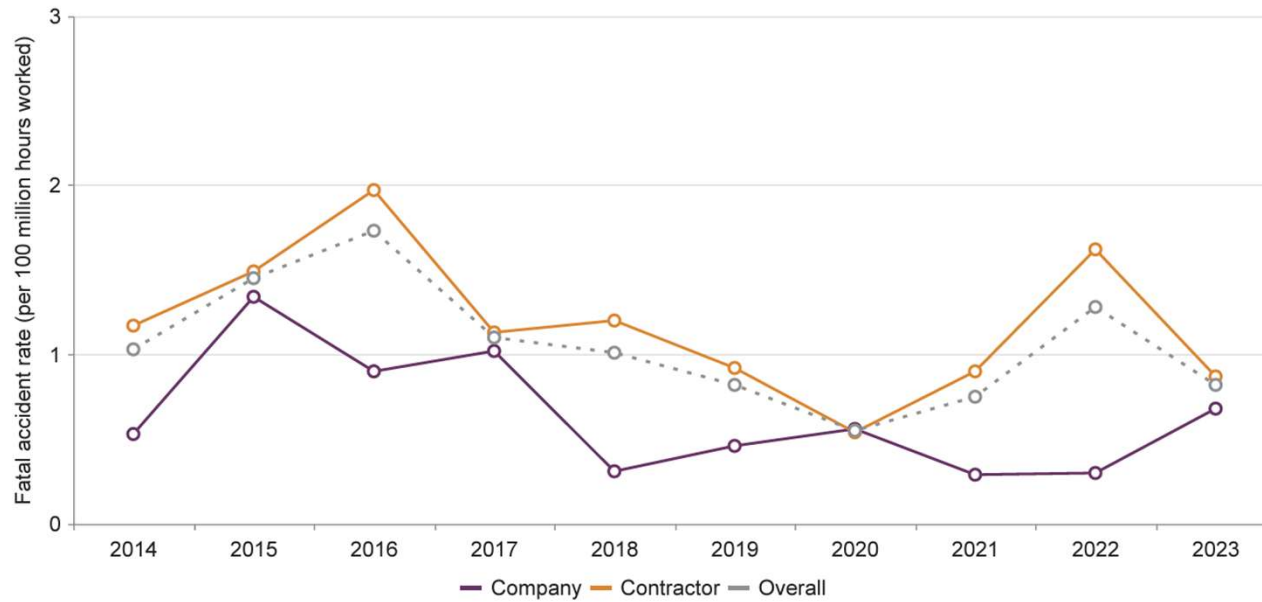




IOGP Fatal accident trend



Fatal accident rate by company & contractor
(2014–2023)

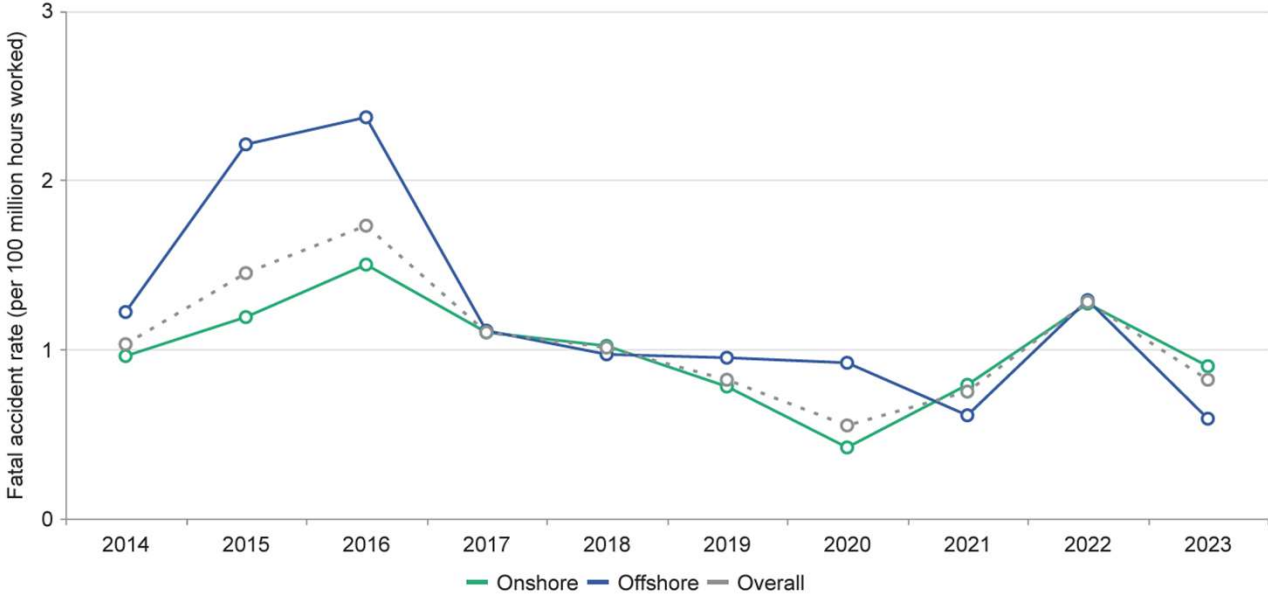




IOGP FAR onshore & Offshore



Fatal accident rate onshore & offshore
(2014–2023)

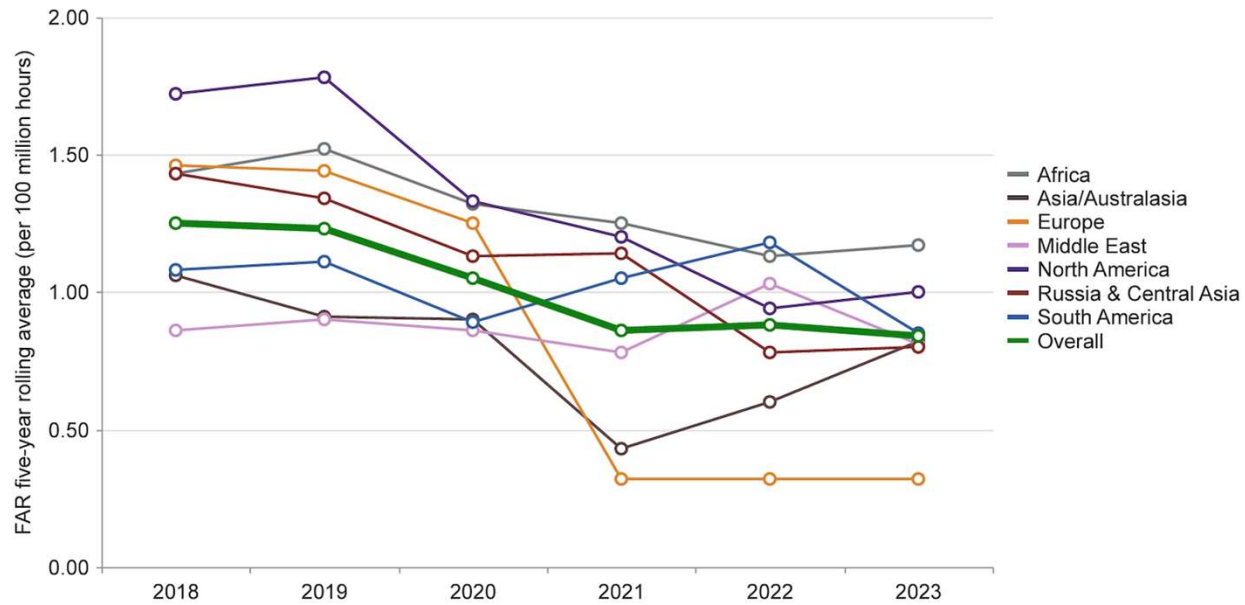




IOGP FA last 5 years



FAR five-year rolling average by region (2018–2023)

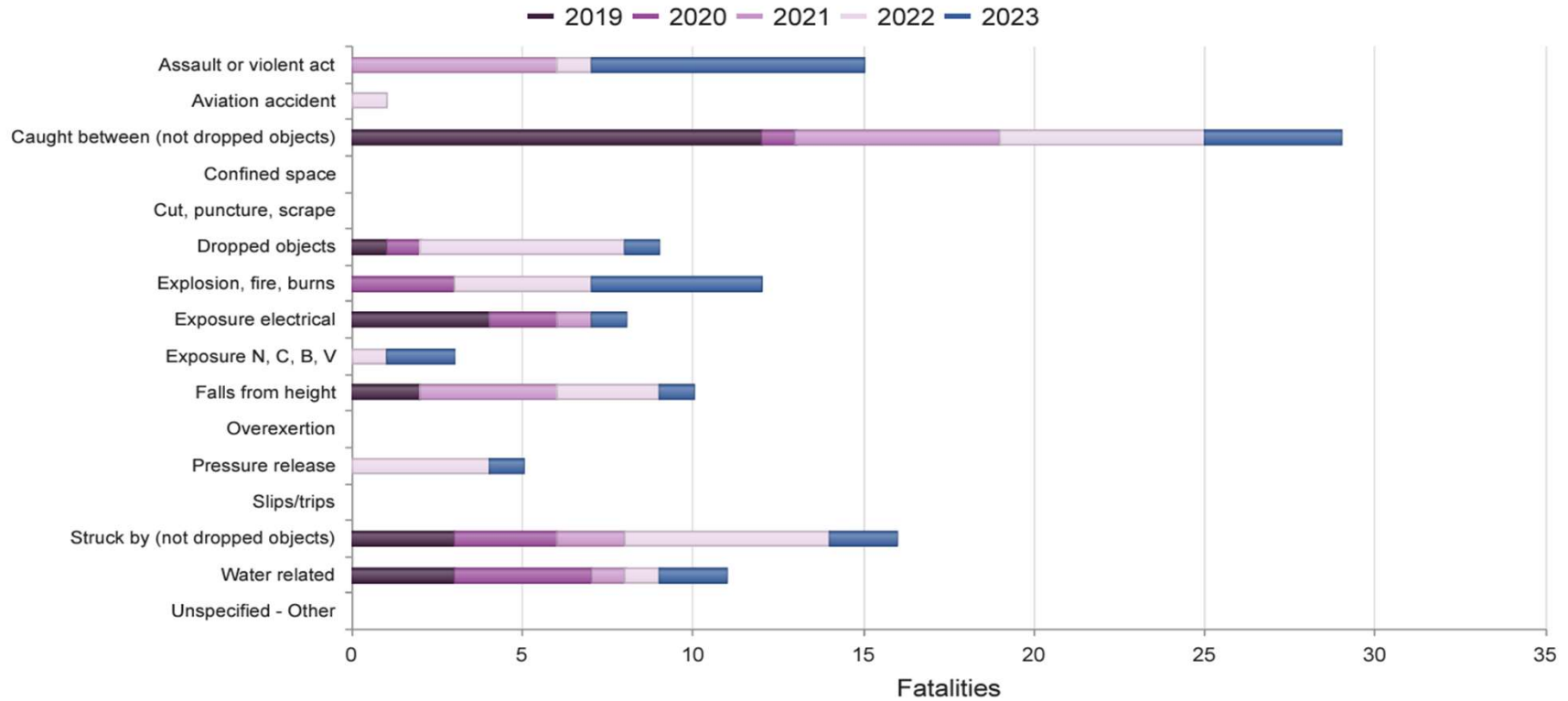




IOGP Fatality by Causes

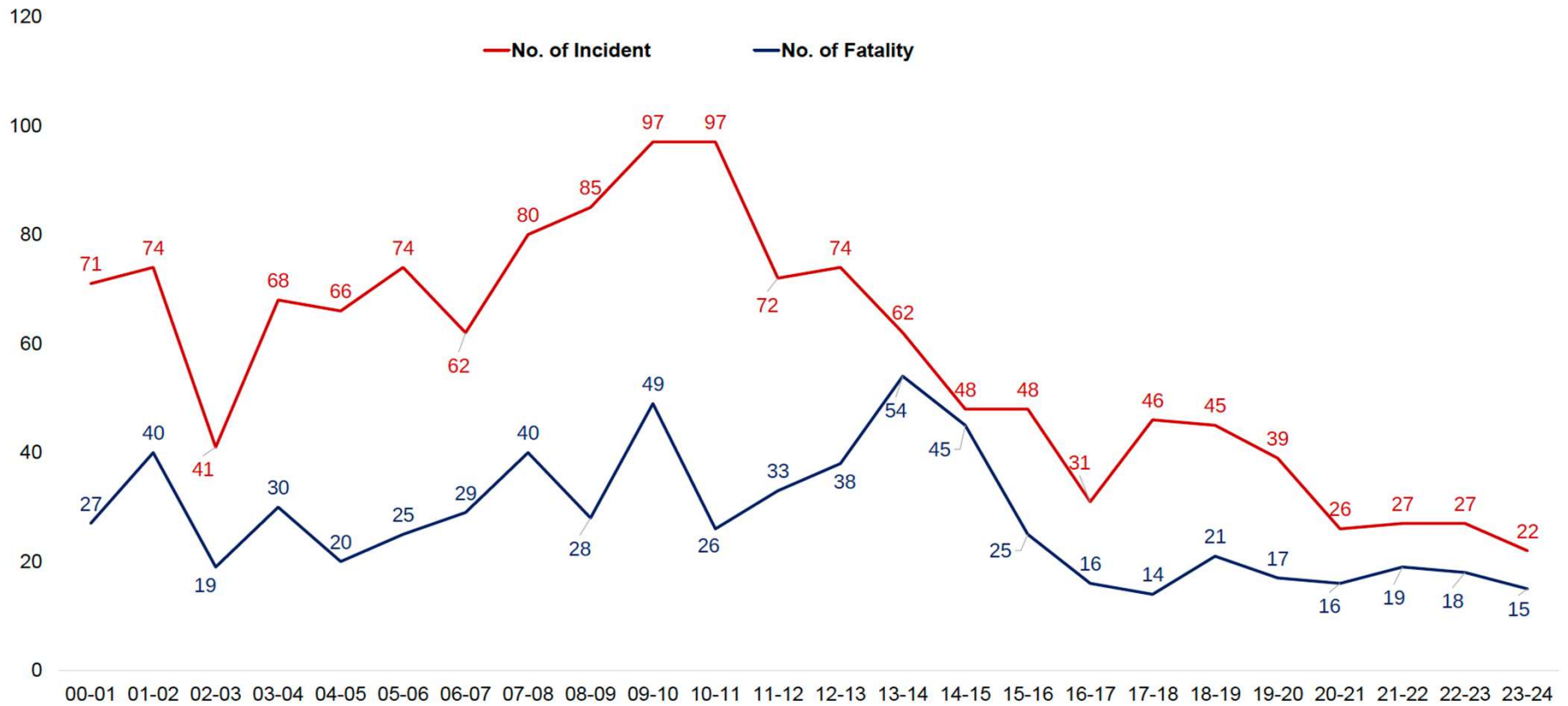


Fatalities by cause (2019-2023)





Major onsite incidents and fatalities-India

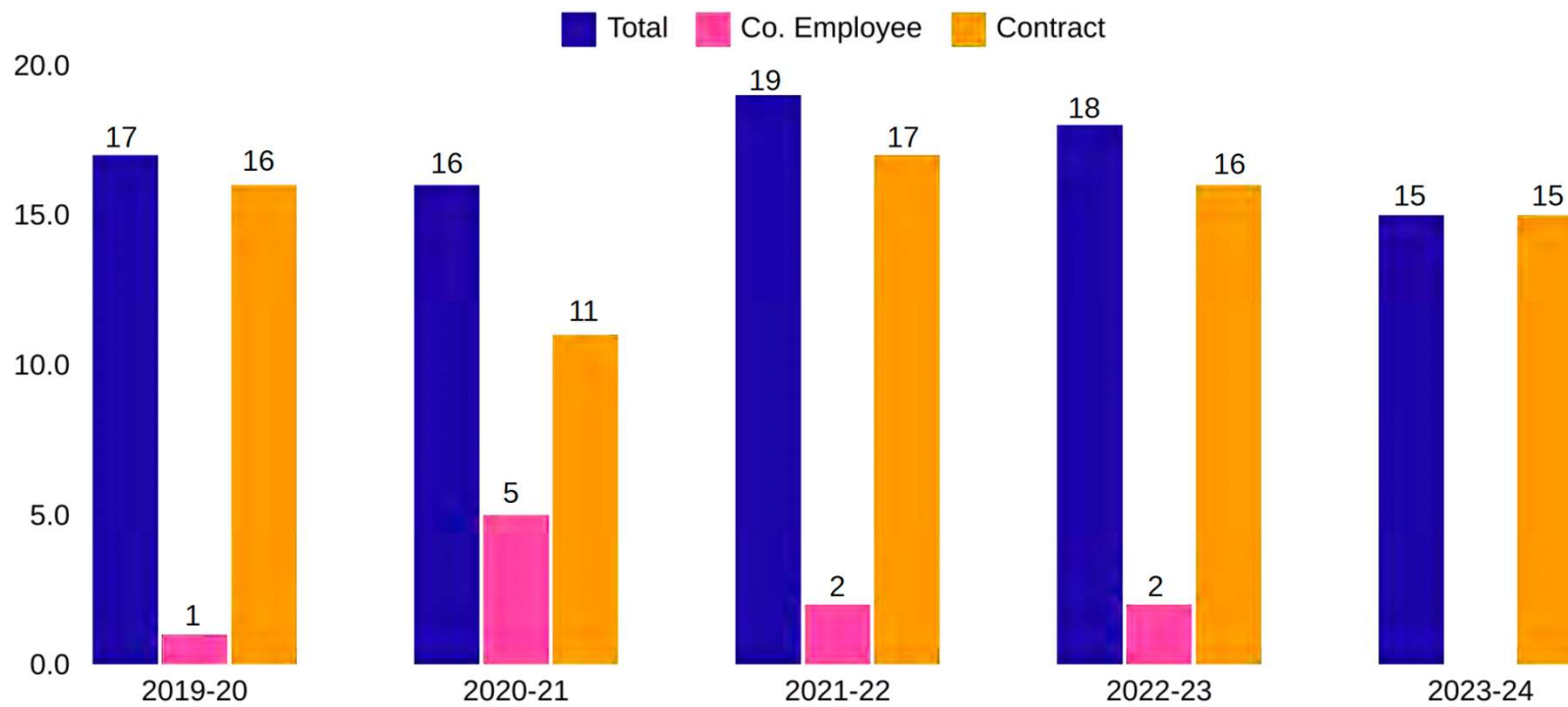


Does not include Retail Outlet, CGD, Offshore vessel, Helicopter, Road accident during transportation of petroleum products & Private marketing installations

Source: OISD SCM data



Fatality: Contract vs Company Employee-India



Source: OISD SCM data



Root Cause of major incidents worldwide

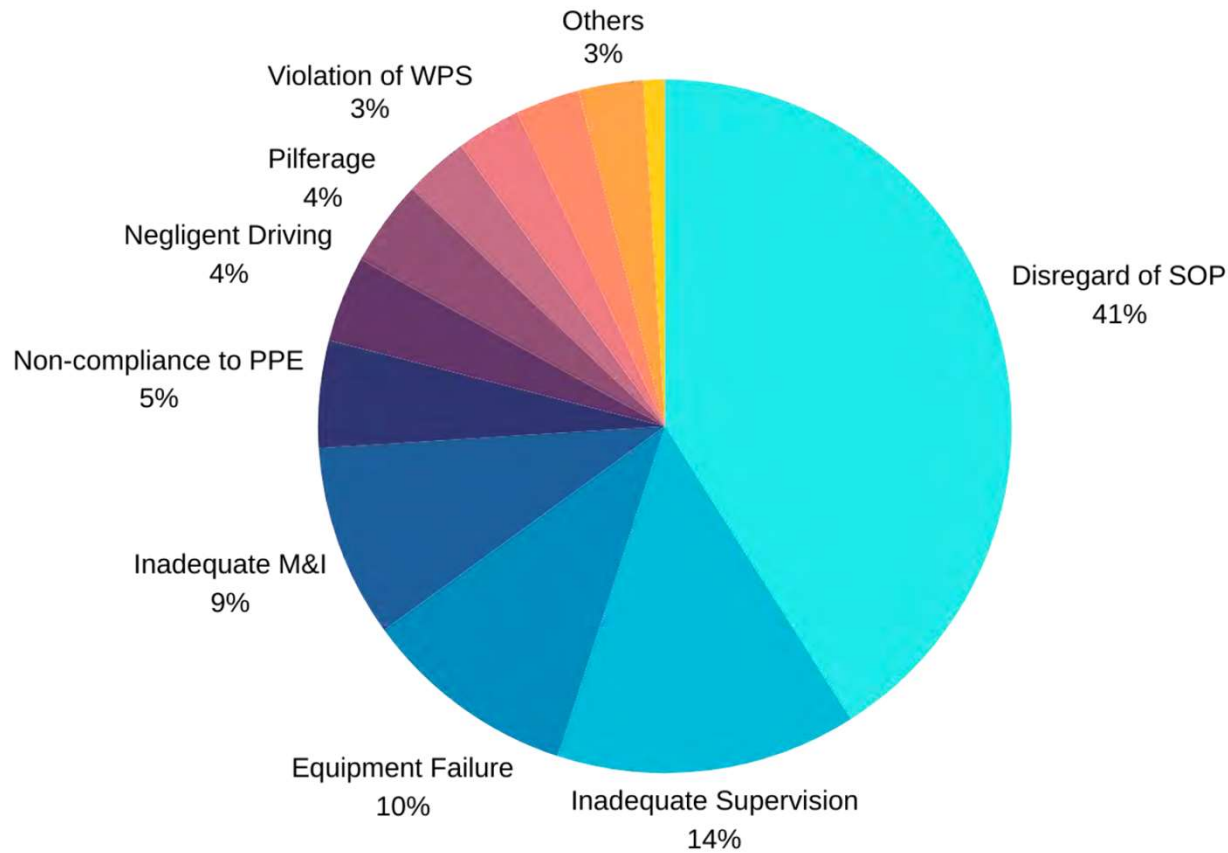


- ❑ Worldwide, there have been @ 32 major incidents in O&G sector in last 20 years leading to 900 fatalities and 4908 injuries.
- ❖ Major causes have been under following categories:
 - Design Factors
 - Operational Factors
 - Maintenance Factors
 - Personal
 - Competency
 - Culture
 - Regulator

Source: IChemE data



Root Cause of major incidents-India-Last 5 years



Source: OISD SCM data



Common Causes of Incidents



Human Factors

1

- Inadequate training
- Complacency
- Fatigue and poor communication
- Normalization of Deviance
- Increase in errors



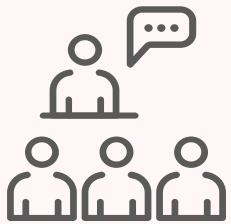
Behavioural and Cultural Issues

2

- Resistance to change
- High-risk tolerance
- Safety not a measurable matrix for business case



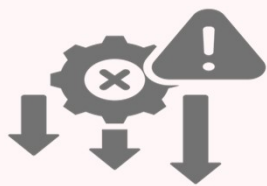
Common Causes of Incidents



Organizational Factors

3

- Minimal Leadership focus on Safety Culture
- Inadequate supervision
- Insufficient Resources
- Outsourced Services
- Inconsistent Policy enforcement



Procedural Failures

4

- Lack of clear SOPs
- Too many SOPs
- Strict Adherence to Procedures
- Inadequate Risk Assessment
- Down time of Mitigation & Preventive barriers.

Common Causes of Incidents



Environmental Conditions

5

- Increased Complexity
- Changing Operating conditions
- Poor hazard assessment
- Increased DCS
- Emergency preparedness



Incident Investigation Gaps

6

- Root Causes - Need to beyond Standard Reasons
- Systemic changes must
- Monitoring of implementation across the organization
- Periodic due-diligence
- Follow-up



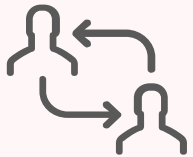
Common Causes of Incidents



Asset Integrity

7

- Ageing
- Shifting of Maintenance Schedules
- Delayed Upgradation / modernization



Corporate Amnesia

8

- Individuals learn from mistakes throughout their lives
- Organization's frequently repeat the same mistakes
- Institutionalizing learnings is a challenge



Key Learnings from Major incidents worldwide



As per Chat GPT, following are the Key Learnings from major incidents:

1. Importance of Safety culture
2. Risk Assessment and Management
3. Need for robust Emergency Response Plans
4. Continuous monitoring and maintenance
5. Regulatory compliance and auditing
6. Human factors and decision making
7. Importance of Incident Investigation and Root Cause Analysis
8. Technological advancements for safety
9. Contractor Management
10. Environmental Responsibility and Response
11. Transparency and Accountability
12. Global Collaboration

Source: IChemE data

Key Learnings from Major incidents



Human Factors

1

- Proper and time tested competency evaluation and trainings
- Job rotation to avoid complacency
- Impetus on effective (To Whom, When, What) communication
- Approval hierarchy for normalization of deviations
- Human factor Engineering
- Address cognitive biases



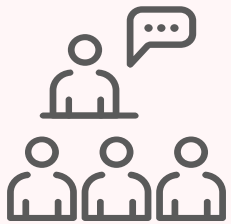
Behavioural and Cultural Issues

2

- Safety as Business case with POC
- Improve Safety Leadership
- Top driven but bottom implementation approach
- Create proactive safety culture
- Well defined Safety KPIs for each and every one
- Encourage open communication at all levels



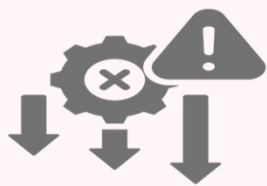
Key Learnings from Major Incidents



**Organizational
Factors**

3

- Focussed Safety Leadership
- Provide adequate Supervision
- Provide adequate resources
- Outsourced manpower to be as employees for safety
- Policy enforcement to be consistent



Procedural Failures

4

- Well documented, owned and published SOPs
- Non routine Jobs monitoring
- Strict Adherence to Procedures
- Proactive Risk Assessment for new /add on assets
- Down time of Mitigation & Preventive barriers.



Key Learnings from Major incidents



Environmental Conditions

5

- Commitment to Net Zero
- Better spill response technologies
- Improve waste management practices
- Quick and effective Emergency Response
- Mock drills on various scenarios



Incident Investigation Gaps

6

- Promote Open communication culture
- Systemic changes must
- Monitoring of implementation across the organization
- Periodic due-diligence
- Follow-up



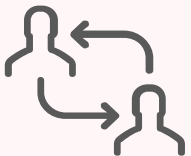
Key Learnings from Major incidents



Asset Integrity

7

- Asset Integrity Management Program
- RLA schedule and Mitigations measures
- Obsolescence Management Program
- Usage of modern Technology for Predictive analysis
- Robust MOC process covering Asset integrity



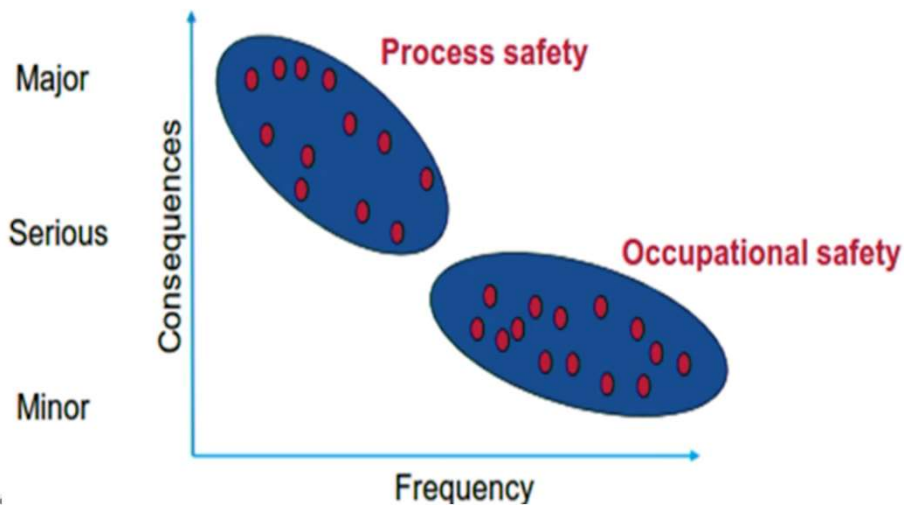
Corporate Amnesia

8

- Common platform for sharing of learnings
- Horizontal compliance across organization
- One Organization-One Safety Culture
- Risk Identification /Assessment /Mitigation



Personal Safety & Process Safety



Personal Safety

- Focuses on protecting individuals from harm
- Skill based jobs
- Human Behavior
- Injury Prevention

Process Safety

- Risk Management
- System Integrity and Reliability
- Technology, Processes, and Equipment,
- Applied at the engineering and management level



Initiatives in HPCL for enhancing Safety



How do we improve Safety Culture?? (What is Culture???)

1. **Scheduled Safety tours by GMs and above**
2. Do not walk past safety deviations initiative
3. Safety Volunteer program (50 volunteers)
4. EHS, RSC and PLSC meetings
5. Unit Area Team Concept for day to day working
6. Spot the Hazard initiative
7. Safety Pause concept implementation
8. Safety Challan concept by permit receivers themselves
9. **“Error Café “concept implementation in Operations for critical jobs**
10. Flare monitoring in mobile phone of Head Operations (Plant irregularity tracking off the shift)
11. Safe Operating Envelop Kiosk in offices of GMs and above
12. **Safety Task Observations of operational activities by other UAT Section Heads**
13. **Innovation day (UAT) and innovation Council (Refinery) concept implementation**



Initiatives in HPCL for enhancing Safety



Other measures to improve Safety:

1. What Can Go Wrong (WCGW) analysis for each critical activity
2. Implementation of Job Vulnerability Index concept for all planned jobs (Plant, Process, People)
3. AI/ML based emergency handling scenario simulation training
4. Specific Process Safety Cardinal Rules for operations based on previous incidents
5. Driving Habit monitoring outside Refinery
6. Safe driving Dangler cards in all vehicles
7. First Air and CPR certification training to 100% employees of operations and F&S dept
8. Lone Worker protection thru Gas detector connected platform
9. Unit Trespassing monitoring thru digital tools
10. Positive Metal Identification for all the critical circuits in 3 stages
11. Process LOTO implementation and digitalization
12. Process Safety Leading indicators monitoring in EHS meeting
13. Visitor Pass Management system (Plant and non plant visitors and safety induction)
14. Life Saving rules experience center
15. STFO concept for all the tanks post T&I



Initiatives in HPCL for enhancing Safety



Other measures to improve Safety:

1. PSM (total 19 elements) implementation
2. **Animated incident display on all monitors including Canteen, Cafeteria**
3. Metaverse training platform
4. **Auto detection of PPE non compliance using CCTV camera monitoring system**
5. Every meeting to start with Safety moment
6. Mega Insurance survey and action item implementation based on Global practices
7. Alarm Rationalization, Management and trip Management Authorization Digitalization



Way forward



Leadership and Commitment

- Lead by example
- Encourage dialogue
- Fostering behavioural safety
- Bringing in Safety focus of Middle and Senior Management
- Promote open reviews
- Stop Work Authority – A Responsibility
- Celebration +ve safety outcomes
- Encourage innovation

Assurance

- Enhancing Safety Competency
- Dashboards – for KPI
- Monitor Operating excursions
- SOP monitoring through Video Analytics
- Mechanical integrity assurance
- Contractor rating system

Sense of Vulnerability

- Vulnerability Index to prioritize critical tasks
- What can go wrong sessions
- Safety Pause
- Knowledge of process safety events
- Near-misses
- Unsafe Conditions and Acts
- Critical review of Start-up jobs

Continuous Improvement

- Daily Safety Moment
- Institutionalizing Learnings from incidents
- Use Digital tools
- Remote Safety monitoring tools
- Advanced trainings
- Benchmarking Safety performance
- Networking and sharing












Thank You !!!



Personal Safety - Life saving rules



IOGP – Lifesaving Rules

Bypassing Safety Controls  Obtain authorisation before overriding or disabling safety controls <ul style="list-style-type: none"> I understand and use safety-critical equipment and procedures which apply to my task I obtain authorisation before: <ul style="list-style-type: none"> disabling or overriding safety equipment deviating from procedures crossing a barrier 	Confined Space  Obtain authorisation before entering a confined space <ul style="list-style-type: none"> I confirm energy sources are isolated I confirm the atmosphere has been tested and is monitored I check and use my breathing apparatus when required I confirm there is an attendant standing by I confirm a rescue plan is in place I obtain authorisation to enter 	Driving  Follow safe driving rules <ul style="list-style-type: none"> I always wear a seatbelt I do not exceed the speed limit, and reduce my speed for road conditions I do not use phones or operate devices while driving I am fit, rested and fully alert while driving I follow journey management requirements
Energy Isolation  Verify isolation and zero energy before work begins <ul style="list-style-type: none"> I have identified all energy sources I confirm that hazardous energy sources have been isolated, locked, and tagged I have checked there is zero energy and tested for residual or stored energy 	Hot Work  Control flammables and ignition sources <ul style="list-style-type: none"> I identify and control ignition sources Before starting any hot work: <ul style="list-style-type: none"> I confirm flammable material has been removed or isolated I obtain authorisation Before starting hot work in a hazardous area I confirm: <ul style="list-style-type: none"> a gas test has been completed gas will be monitored continually 	Line of Fire  Keep yourself and others out of the line of fire <ul style="list-style-type: none"> I position myself to avoid: <ul style="list-style-type: none"> moving objects vehicles pressure releases dropped objects I establish and obey barriers and exclusion zones I take action to secure loose objects and report potential dropped objects
Safe Mechanical Lifting  Plan lifting operations and control the area <ul style="list-style-type: none"> I confirm that the equipment and load have been inspected and are fit for purpose I only operate equipment that I am qualified to use I establish and obey barriers and exclusion zones I never walk under a suspended load 	Work Authorisation  Work with a valid permit when required <ul style="list-style-type: none"> I have confirmed if a permit is required I am authorised to perform the work I understand the permit I have confirmed that hazards are controlled and it is safe to start I stop and reassess if conditions change 	Working at Height  Protect yourself against a fall when working at height <ul style="list-style-type: none"> I inspect my fall protection equipment before use I secure tools and work materials to prevent dropped objects I tie off 100% to approved anchor points while outside a protected area

HPCL – MR Lifesaving Rules

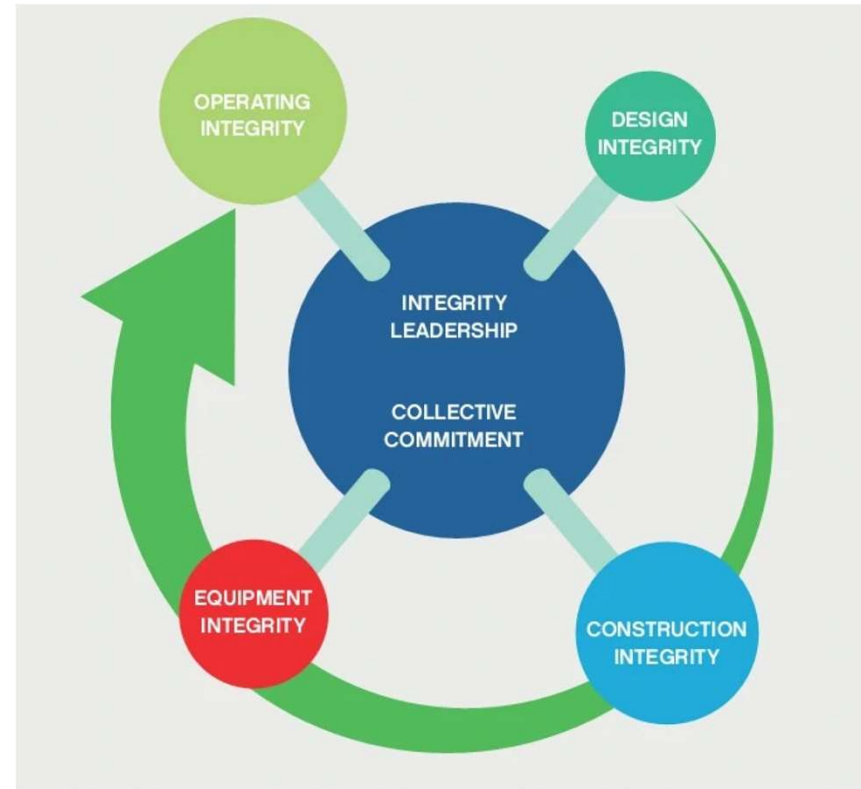
LIFE - SAVING RULES

Follow the Life-Saving Rules so that everyone gets home safely

 Work Authorization	 Energy Isolation	 Hot Work	 Confined Space Entry
 Working at Height	 Safe Mechanical Lifting	 Line of Fire	 Bypass Safety Control
 SOP	 Safe Driving		



Process Safety Management














Process Safety Rules



HPCL – MR Process safety Cardinal Rules

PROCESS SAFETY - CARDINAL RULES

Dont's	Do's
 Do Not leave any HC system draining unattended	 Use personal H2S detector before entering concerned Unit area
 Do Not Light Furnace without confirming purge completion	 When in doubt, Ask, before proceeding
 Do Not keep Alarms in silent mode	 Issue permit to Rotary only after De-energization tag
 Do Not operate any reciprocating pump/compressor with PSV isolated	 Inform DCS before carrying out any activities in field
 Do Not take up critical activities during shift change time	 Remove air /condensate pocket before commissioning any HC/Utility line
 Never consider valve holding unless confirmed physically	 Treat entire underground system as live HC system and prepare area accordingly
 Never assume Utilities Line Hydrocarbon free	 Carry out any commissioning / operations only after understanding and checking entire line up

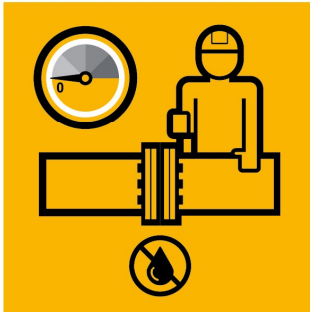




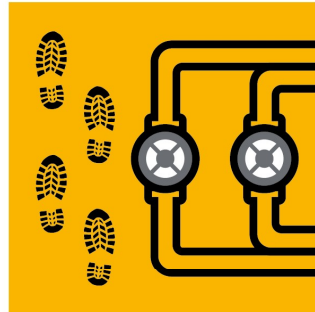
Process Safety Fundamental



IOGP – PSF



Maintain safe isolation



Walk the line



Apply procedures



Sustain barriers



Control ignition sources



Recognize change



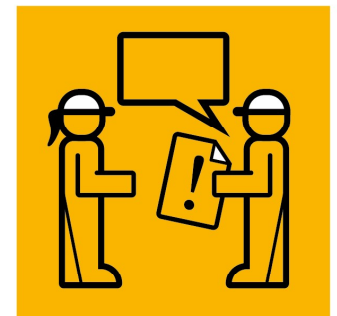
Respect hazards



Stay within operating limits



Stop if the unexpected occurs



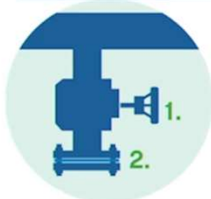
Watch for weak signals



EPSC Process Safety Fundamentals



EPSC Process Safety Fundamentals



Double Isolation



First Line Break



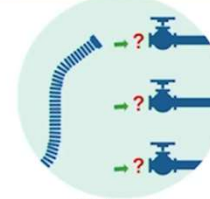
Flexible Hoses



Furnace Burners



Leak Tightness



Unloading



Open Drain



Operating Limits



Overrides



Plugged Equipment



Critical Equipment



Reporting



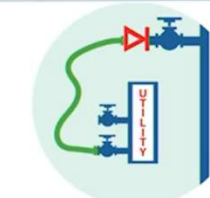
Run Away Reaction



Splash Loading



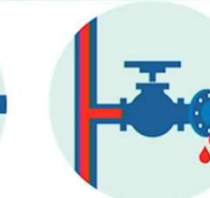
Line of Fire



Utility Connections



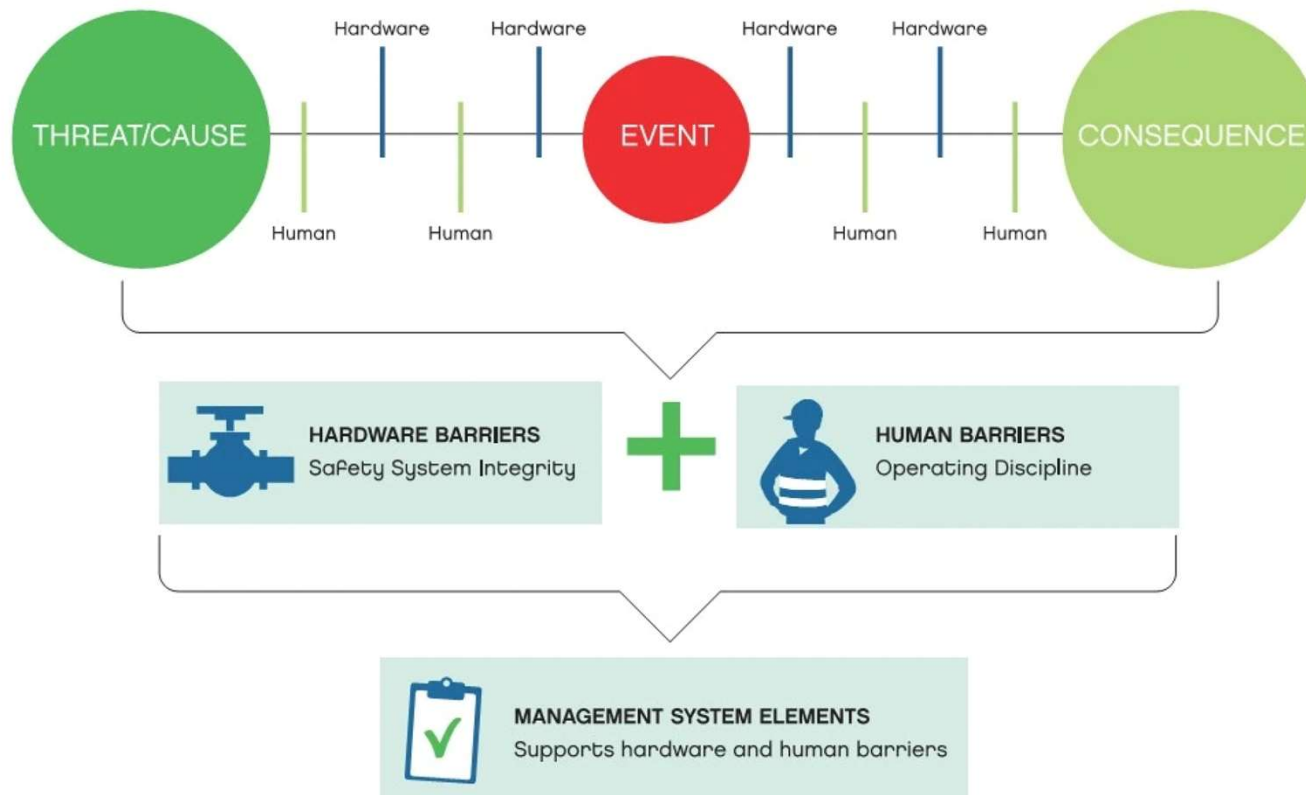
Walk the Line



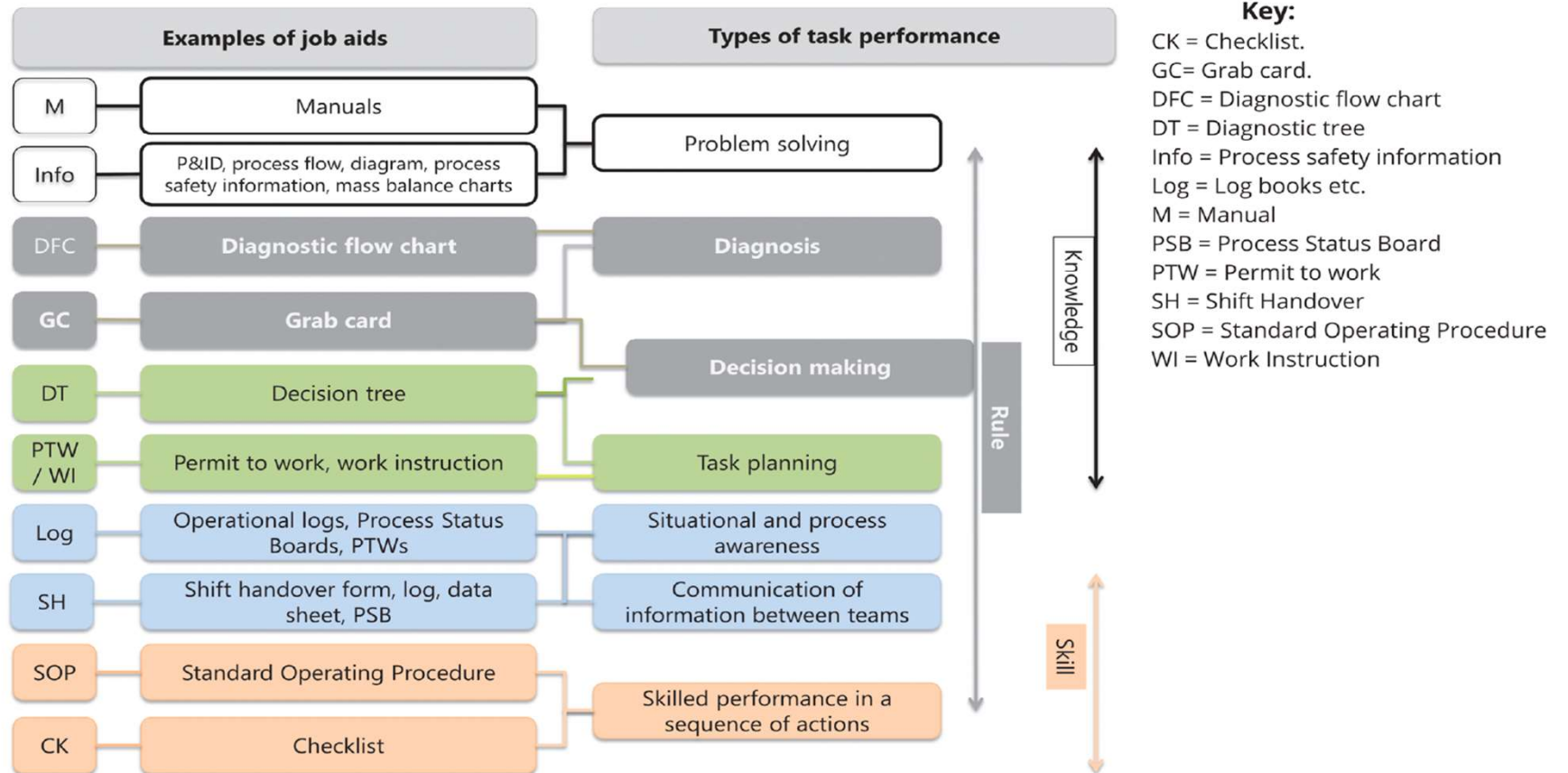
Single valve



Focus on Human barriers



Tools for safety





Safety Awareness Communication

Delivering Happiness

1. HPCL introduced "**Safety Cues**" as a communication tool. Visual reminders of key safety practices.
2. Safety Cues are one-page documents with safety messages and images.
3. HPCL also shares weekly **safety videos**. Engaging multimedia safety content
4. **Safety moment**: A safety message popup appears on the screen, and the PC cannot be accessed until it is read and acknowledged.



DID YOU KNOW

Pressure Testing

Do not enter pressure testing areas

Fatality Prevention Behaviors

You must:

- Conduct pressure testing in designated pressure testing areas
- Inspect all critical components prior to test.

If you are the supervisor or person in charge of the work, you must:

- Ensure that barriers are in place
- Ensure that nobody walks into a designated pressure testing area until equipment is fully depressurized

I acknowledge that I have read the safety message and am committed to adhering to the safety rules.

Acknowledge



SAFETY CUE

Safety Culture: Handling of Unsafe Acts, Unsafe Conditions and Near-misses

How an Organisation monitors and responds to the Unsafe Acts, Unsafe Conditions and Near-misses that occur in its day-to-day Operations determines it's Safety Culture.

Unsafe Acts:
An unsafe act occurs when an individual knowingly and willingly engages in or ignores an unsafe condition.

- Proper work permits.
- Non-adherence to Standard Operating Procedure (SOP)
- Un-authorized operation of machinery
- Non-adherence to Personal Protective Equipment.
- Not following Lock Out Tag Out (LOTO).
- Unauthorized persons entering restricted area.
- Over speeding of vehicles beyond specified speed
- Any act that can contribute to an incident remotely

Handling of Unsafe Acts

- i. Discuss unsafe acts with the employee and record in register.
- ii. Repeated Unsafe Acts should be followed by counselling

Heinrich's Triangle Theory

Unsafe Conditions:
A condition in the work place that is likely to cause property damage or injury.

- Integrity loss in systems
- Wet or oily slippery surfaces
- Presence of flammable materials in open areas
- Open manholes
- Improper lighting in workplaces
- Defective Scaffolding
- Loose electrical panels & electrical connections

Handling of Unsafe Conditions

- i. Record all unsafe conditions everyday
- ii. The location management should take immediate actions for mitigation till unsafe conditions removed

Near-misses: HIPO near-miss Incident is an incident that had "High Potential" of causing a major accident leading to loss of lives and property, but timely action / intervention prevented the accident.

Handling of Near-miss incidents:

- i. Near-miss incidents should be reviewed.
- ii) Carry out Root Cause Analysis.
- iii) File a detailed near-miss report,
- iv) Preventive measures / corrective actions need to be taken in time.
- v) Complete Root Cause Analysis,
- vi) Review and ensure effective implementation

All Near-miss incident, Unsafe Conditions and Unsafe Acts shall be reported with SAP Incident Reporting System.

CORPORATE HSE SC-035



DO NOT WALK PAST SAFETY DEVIATION



What is a Safety Deviation?

- ✓ **Unsafe Practices:** Improper use of tools or equipment, bypassing safety guards, or neglecting personal protective equipment (PPE).
- ✓ **Hazardous Conditions:** Spills, leaks, damaged equipment, or obstructed pathways.
- ✓ **Incomplete Safety Protocols:** Missing signage, unmarked hazards, or incomplete documentation.

Why It Matters:

- ✓ Prevent Accidents
- ✓ Promote a Safety Culture
- ✓ Ensure Compliance



"Spot Safety Deviations, Shape a Safer Workplace!"





LIFE-SAVING RULES

Delivering
Happiness

- ✓ **Set clear expectations** for responsibilities.
- ✓ **Lead by example**, modeling appropriate behavior and timely intervention.
- ✓ Introduce **Life-Saving Rules** during new joiner inductions.
- ✓ Facilitate **discussions on the rules** in toolbox talks and safety meetings.
- ✓ **Emphasize the Life-Saving Rules'** purpose of saving lives.
- ✓ Encourage **peer-to-peer intervention** and reporting without fear.
- ✓ Approach **Life-Saving Rules observations** with a learning mindset.
- ✓ Implement Fair Event Handling and a systems approach to **promote reporting** and self-reporting.
- ✓ **Investigate high-risk or learning opportunities**, focusing on improvements and compliance. Analyze trends to enhance controls.

LIFE - SAVING RULES

**Follow the Life-Saving Rules
so that everyone gets home safely**



Work
Authorization



Energy
Isolation



Hot Work



Confined
Space
Entry



Working
at Height



Safe Mechanical
Lifting



Line of
Fire



Bypass
Safety
Control



SOP



Safe
Driving



CONTRACTOR SAFETY CONNECT



Volunteer Safety - Contractor Safety Connect

Personalized Engagement: taking the time to learn about their family background, life experiences, and the challenges he have faced.

- ✓ *Building Trust Through Connection*
- ✓ *Family-Inclusive Safety Culture*
- ✓ *Future-Oriented Growth*
- ✓ *Continuous Support and Development*



"Building Trust, Connecting Lives: A Family-Inclusive Safety Culture for a Stronger, Safer Future"



SAFETY PAUSE



SAFETY PAUSE

Observing a brief 5-minute safety pause upon arrival at the worksite is a critical practice to ensure the safety and well-being of all workers. Here's a brief overview in 6 Easy Steps

- ✓ *Safety Compliances*
- ✓ *Unsafe Conditions*
- ✓ *Equipment Inspection*
- ✓ *Establish a Communication*
- ✓ *Documentation*
- ✓ *Worker Connect*



"Pause. Inspect. Connect. Ensure Safety "



Safety Awareness Trainings



- Induction Trainings
 - 5 Days F&S Induction for Employees
 - Safety Induction for workmen (Gate pass interlock with safety training)
 - F&S Induction for Transferred employees
- Refresher Trainings
 - Fire Fighting Refresher for Employees
- Work Permit Training
- Traffic Safety Training (RDP)
- Contractor Supervisor Safety Training and competency certification with yearly validation
- Fire Training to CISF Employees
- Training to Apprentice and Summer Trainees

Driving Permit No. 160
Authorized To Drive (Type Of Vehicle) LTV + HMV
Date of Issue 27.05.2020
Validity 21.02.2025
The Driving Permit Is Valid Till The Validity of RTO Licence.
Signature [Signature] Card Holder [Signature]
Issued By F&S Dept.

HINDUSTAN PETROLEUM CORPORATION LIMITED
अविश्राम एवं सुरक्षा विभाग | Fire & Safety Dept.
नाम / Holder: _____
पदनाम / Desg.: DRIVER
केन्द्र / Contractor: _____
ने प्राथमिक सुरक्षा प्रशिक्षण परिपूर्ण किया।
Has successfully completed Basic Safety Training held on _____
Valid upto _____
General Manager Fire & Safety



Safety Awareness Trainings



SN	ACTIVITY	DAYS
1	General Department Overview	1 Day
2.	Individual Unit Assignment and Overview	1 Day
3.	Training on Process Flow Diagram	2 Days
4.	Line Tracing of Individual Unit Assigned	7 Days
5.	Process Equipment Start Up, Shutdown, Emergency Handling	7 Days
6.	Written test and personal interview with Section Head	1 Day
7.	Standby Charge in Day Shift	7 Days
8.	Standby Charge in Evening Shift	7 Days
9.	Residual Training Requirement Basis Assessment	7 days
10	Routine Independent Charge in Shifts	7 days



Contractor safety



- Safety Induction Training
- Scaffolding Certification by Competent Person
- Certification & Tagging of Equipment
- Tool Box Talks
- Site Safety Briefings
- Training/Certification for Contractor Supervisors
- Pre-shutdown Meeting for major works
- HSE Requirement In Tenders

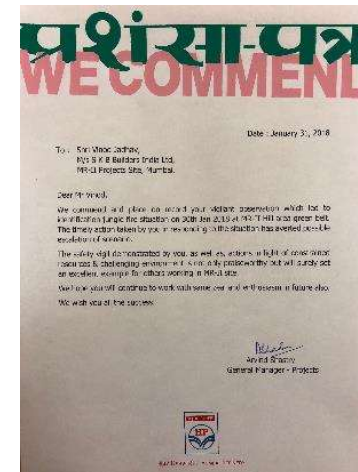




Employee Engagement

Delivering Happiness

- Safety Register System
- Participation in ISA, JSA, RSC and PLSC.
- Loss Control Meetings/ Safety Talks
- On the Job Trainings
- Monthly Incident sharing
- Appreciation/Commendation





PROCESS SAFETY - INCIDENT TRIANGLE



- Knowledge
- Communication
- Experience
- Training

Lack of understanding
Wrong Safety focus

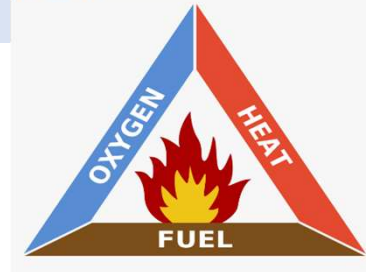
- Work load
- Stress
- Age factor

Comfort & Convenience
Saving Time / Short cuts

- Behavioral

Complacency
Achievement Orientation

P E O P L E

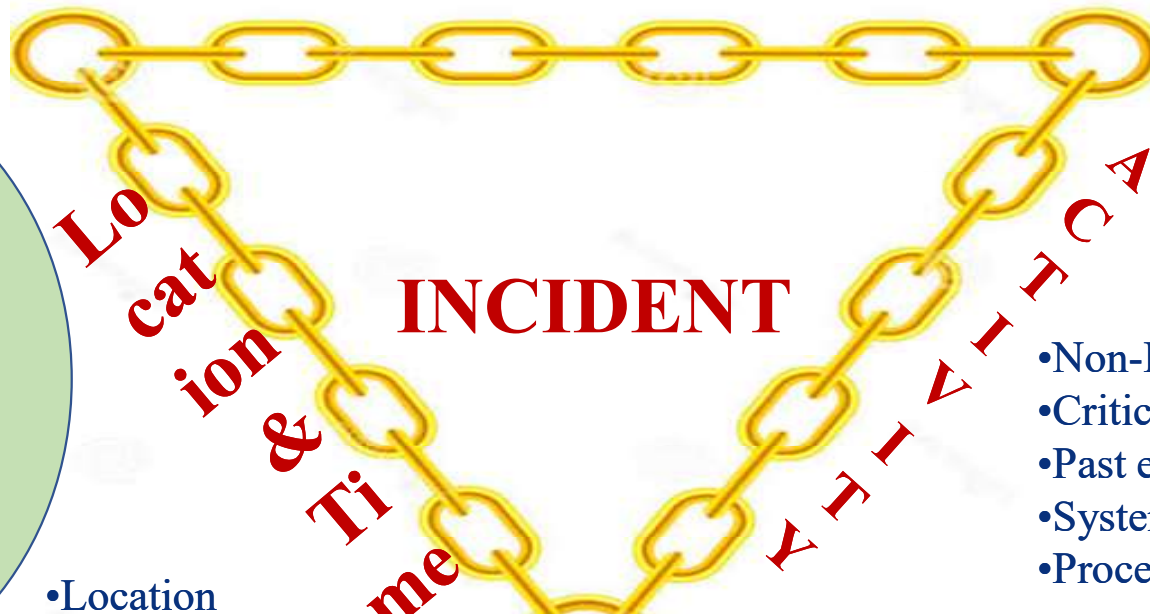


THE 3 A'S OF SAFETY

AWARENESS

ANTICIPATION

ACTION



• Location

- Non-Routine
- Critical Routine
- Past events
- Systems
- Procedures



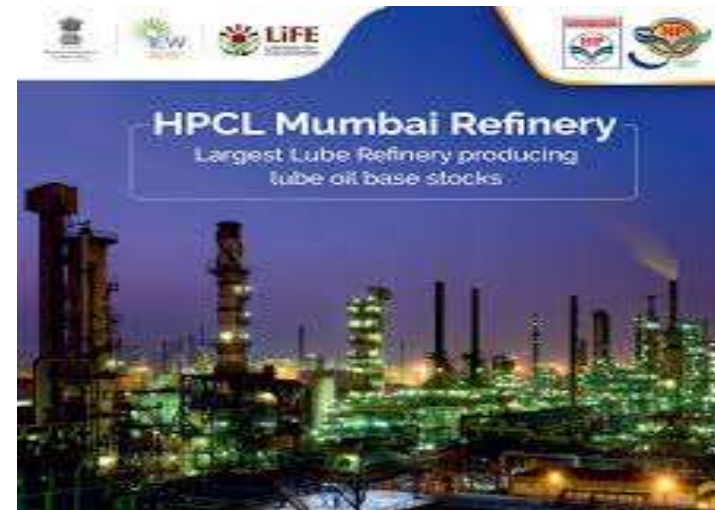
Vulnerability Index



1. Vulnerability Index (VI) is a tool to understand and predict complexity of High hazard activities
2. **VI Score Assignment** - Risk level assessment for each work area
3. **Targeted Monitoring** - Focused oversight based on VI severity
4. **Continuous Improvement** - Ongoing efforts to reduce risks and enhance safety

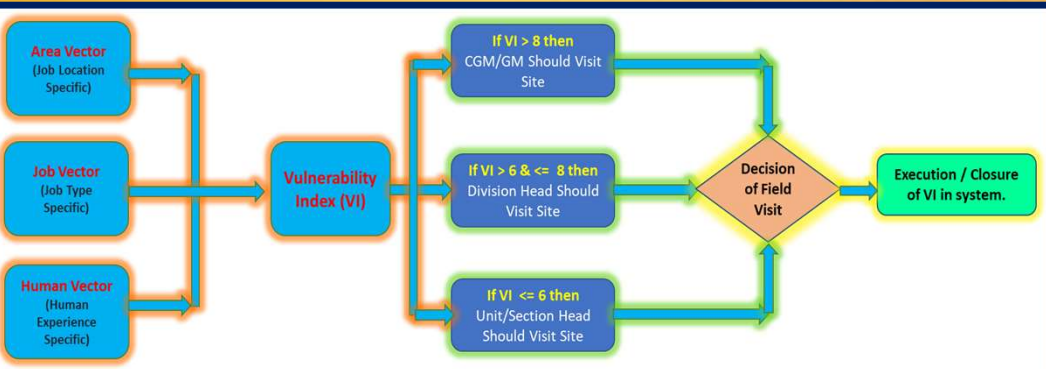
VI is based on three factors for identification of Hazards:

1. Location of the job (based on Assets, lines, instruments etc.)
 2. Nature of job (Type of permit)
 3. Human factor (Experience of supervisor, Maintenance, and Contractors etc.)
- High-risk areas are given prioritized attention to reduce incidents and improve workplace safety.
 - A proactive approach helps allocate resources effectively.
 - Potential safety concerns are addressed before they escalate, ensuring continuous safety improvement.

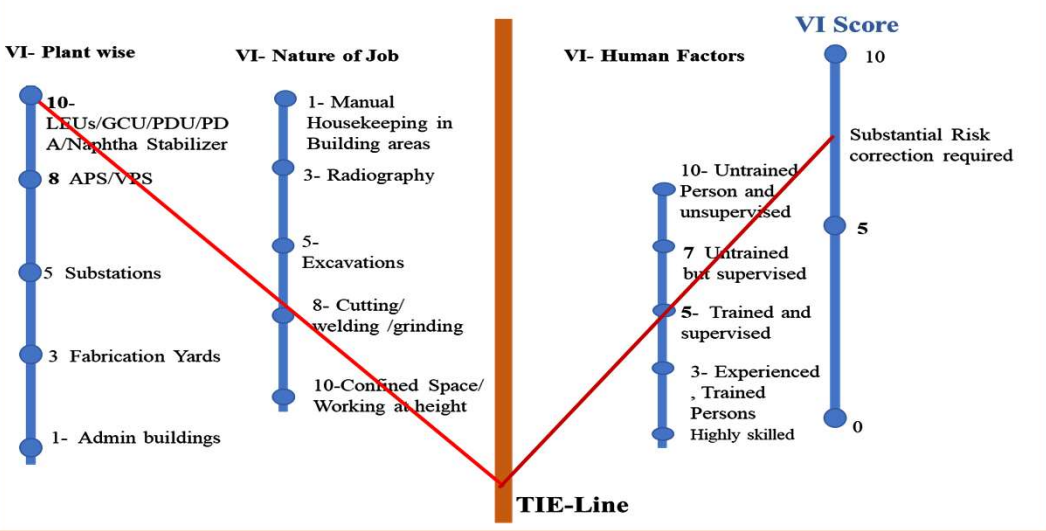




Vulnerability Index



Tie-Chart: Hot work in light end units



Hindustan Petroleum Corporation Limited 6000 - Mumbai Refinery Hot Work Permit		Permit No. 100000303040
		Work Order 130000264726
		Start Date 23:10:2024 15:50:07
		End Date 29:10:2024 23:59:59
Description of work	To do vehicle entry at LPG unit for scaf 23.10.2024 15:49:44 INDIA (31999520) To do vehicle entry at LPG unit area for scaffolding material shifting.	
Functional Location	LPG STORAGE AREA OMCC FR	Work Center STATIC
Equipment		
Exact Location of work	LPG UNIT ISBL	Vulnerability Index 06
Issued to Contractor	MAGS ANTI CORROSIVE COATINGS PVT. L	No. of Workmen 0010
Issued on	24.10.2024 - 10:42:13	Shift 08:00-16:00 Start Time 10:42:13
JSA Ref No.	Electrical Isolation No.	Mechanical Isolation No.
Permit Sub Type	Crane / Forklift / Vehicle Entry	

VI Score	Risk Level	Action
Low	Min	Regular monitoring
Medium	Moderate	Enhanced supervision
High	Significant	Prioritised mitigation

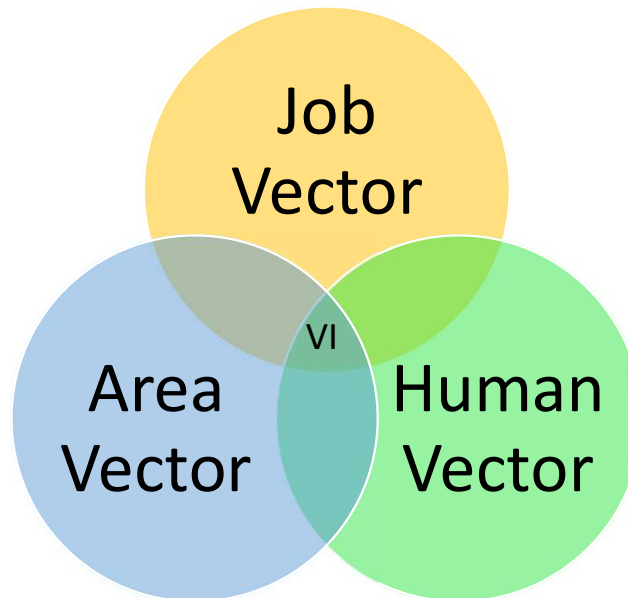


Job Vulnerability Index



Final Job Vulnerability Index is average of Job VI, Area VI and Human VI

$$\frac{\text{Area VI} + \text{Job VI} + \text{Human VI}}{3}$$

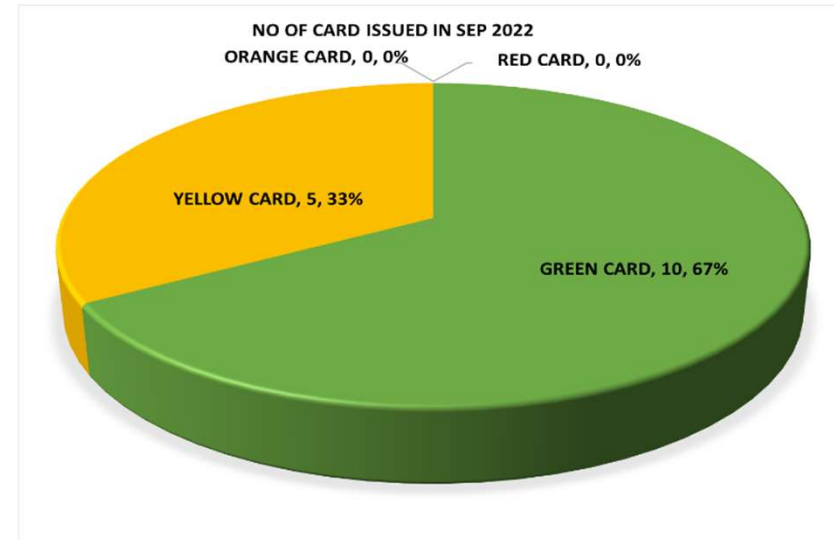




Safety Chalan System



Sr No	Green Card	Yellow Card	Orange Card	Red Card
No of Cards Issued	10	05	00	02



Card Type	Green Card			Yellow Card			Orange Card			Red Card		
	Till Aug 22	During Sep 22	Total	Till Aug 22	During Sep 22	Total	Till Aug 22	During Sep 22	Total	Till Aug 22	During Sep 22	Total
No of Cards	183	10	193	150	05	155	10	00	10	03	02	05





SAFE OPERATING ENVELOPES(SOEs)



At HPCL, Mumbai Refinery have made SOEs Dashboard showing real-time values and range of critical process parameters.

The critical Operating parameters limits are called “Safe Operating Limits (SOLs)” or “Safe Operating Envelope (SOEs)” Technical Department reviews SOEs parameters on daily basis and provide guidelines to operation as and when required.

As per API RP 754 Process Safety Performance Indicators for the Refining and Petrochemical Industries one of the Tier 3 Process Safety Events (PSE) of Plant critical operating parameters should have Safe Operating Limit / Envelop (SOL/SOE) and its excursions are need to be monitored in a specified time period.

Operating Envelope Monitoring System
Information Technology, HPCL, Refineries

Introduction
Process safety is of utmost importance to any process industry, including Oil and Gas. An operating envelope is a standard method of defining safe operating limits and ensuring process safety by adhering to the limits.

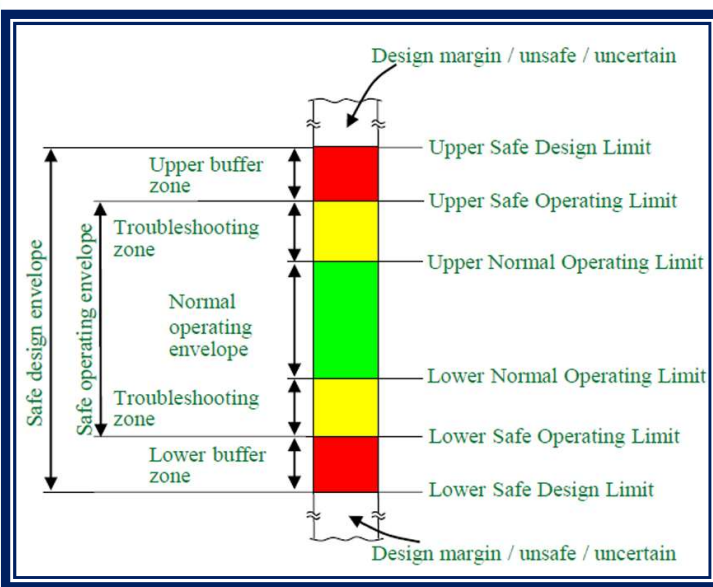
Operating Envelope Monitoring System (OEMS) is an initiative to enable Operations team with a system of continuous monitoring, measuring and enhancing process safety.

How it works
OEMS takes live information of selected set of critical parameters, that define Operating Envelope, creates a dashboard consisting of real-time and advisory scores. It highlights excursions that facilitate identification of hot spots.

Reports and MES
Current OI Dashboard: One click report of all deviations.
Alarming Dashboard: Helps in identifying and controlling the frequently occurring deviations.
Performance Dashboard: The long running or sustained deviations, are reported and presented to the Operations team using this report.

OEMS - Objective
Operating Envelope Monitoring System (OEMS) is designed with the objective of improving process safety in refineries by continuously measuring compliance to Operating Envelope. It provides detailed compliance scores for each unit and aggregated score for the refinery. This helps Operations team to know the live process safety status and take appropriate actions to enhance it.

The Scorecard
OEMS uses a unique scoring mechanism to identify the compliance level of the process units. A weighted scoring method using process parameters that define Operating Envelope, calculates compliance score for each unit based on the severity. The dashboard provides information about current state of process safety. The system also helps operators and management to identify hot spots for corrective actions.



DIU SOEs Report							
Description	Tag No	SOE Limit		Actual		Remarks	Action to be taken
		Low	High	Low	High		
ass flow to Tr-1	71FC9001.PV	1535	4000	2233.7	2555.0	OK	
ube oil pressure fro 71-C-02-B, kg/cm2g.	71PI9709B.PV	2.2	5	2.4	2.8	OK	
ripper level, %	71LC9901.PV	20	90	63.9	66.2	OK	
ripper O/H pressure, kg/cm2g	71PC0001.PV	4	10	5.9	5.9	OK	
evel in 71-D-01 %	71LC8401.PV	70	90	79.7	96.0	Exceed High Limit	
Vash water flow, MT/Day	71FC0603.PV	85	250	251.4	257.6	Exceed High Limit	
ilet temperature of R-01, deg. C.	71TC8702.PV	250	380	364.8	374.4	OK	
ressure drop in 71-R-01, kg/cm2	71PD18704.PV	0	6.5	3.0	3.5	OK	
ressure drop in 71-R-02, kg/cm2	71PDY1407.PV	0	8	4.8	5.1	OK	
ripper (T-02) Inlet Temperature, deg. C.	71TI9901.PV	210	240	223.0	228.5	OK	
urrent for 71-P-20, Amps	71TI1601.PV	0	670	369.9	420.3	OK	
eed rate, MT/Day	71FI8301.PV	2000	7500	4743.7	5413.8	OK	
re-filter pressure drop, kg/cm2g	71PD18301.PV	0	1	0.4	0.8	OK	
emperature at 71-P-01-A/B/C S/C	71TC8402.PV	30	120	103.6	104.3	OK	
ressure of 71-D-01, kg/cm2g	71PC8401.PV	2	4.5	1.9	2.4	Exceed Low Limit	
ass flow to Tr-2	71FC9002.PV	1535	4000	2249.6	2557.0	OK	
os pressure in 71-F-01, MMWC	71PI1120.PV	-20	10	-14.2	-4.6	OK	
lush diesel flow to 71-P-20 m3/hr.	71FT1611.PV	0.2	1	0.4	0.4	OK	
Vinding temperature of 71-P-20, deg. C.	71TI1601.PV	40	90	47.8	51.2	OK	
op bed level in 71-R-01, %	71LT8731.PV	20	85	62.3	77.1	OK	
ottom bed level in 71-R-01, %	71LT8732.PV	20	85	39.1	98.2	Exceed High Limit	



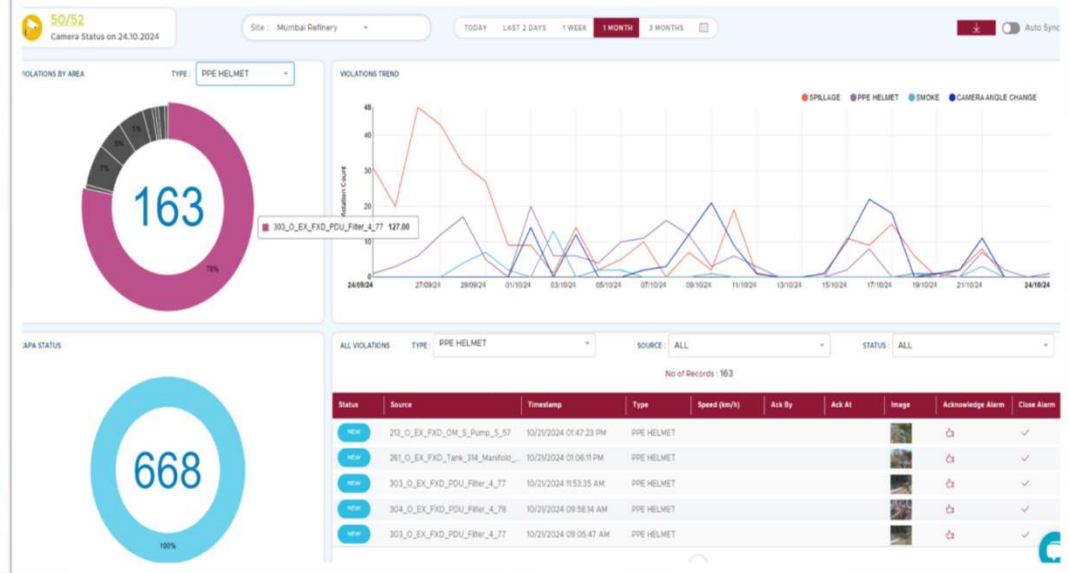
Artificial Intelligence-Visual Analytics



Artificial Intelligence – Visual Analytics (AI-VA) of PPE violation implemented HPCL Mumbai Refinery as part of Digitalisation, has collaborated with HPCL marketing team and implemented

This system make use of existing CCTV and using AI, helps in identifying safety violations.

Current model includes PPEs violation, trespassing, smoke detection, spillage etc.





Why all behave differently?

Bhagavad Gita: Chapter 18, Verse 14

अधिष्ठानं तथा कर्ता करणं च पृथग्विधम् ।
विविधाश्च पृथक्चेष्टा दैवं चैवात्र पञ्चमम् ॥ 14॥

*adhishṭhānaṁ tathā kartā karaṇaṁ cha pṛithag-vidham
vividhāśh cha pṛithak cheṣṭā daivaṁ chaivātra pañchamam*

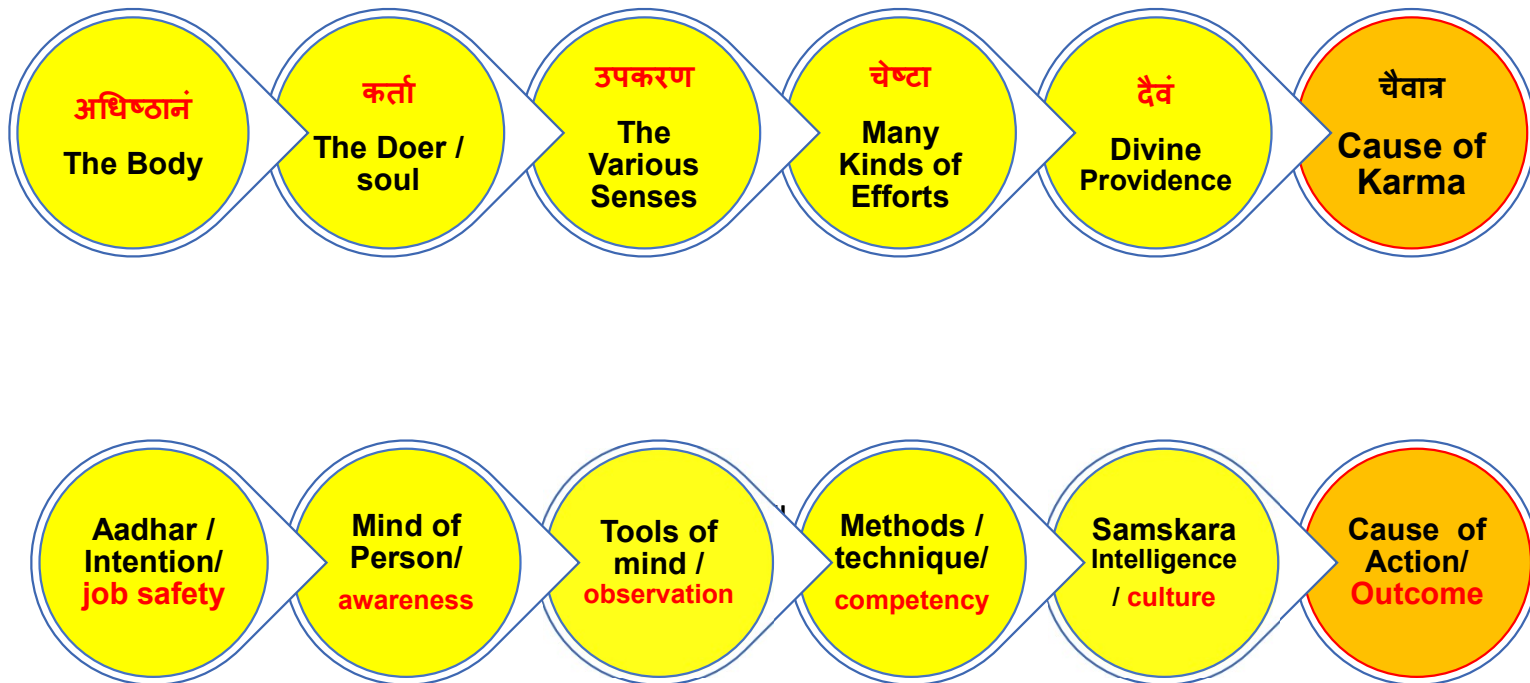
*The body, the doer (soul), the various senses, the many
kinds of efforts, and Divine Providence,
these are the five factors of action.*



Five Factors of Action

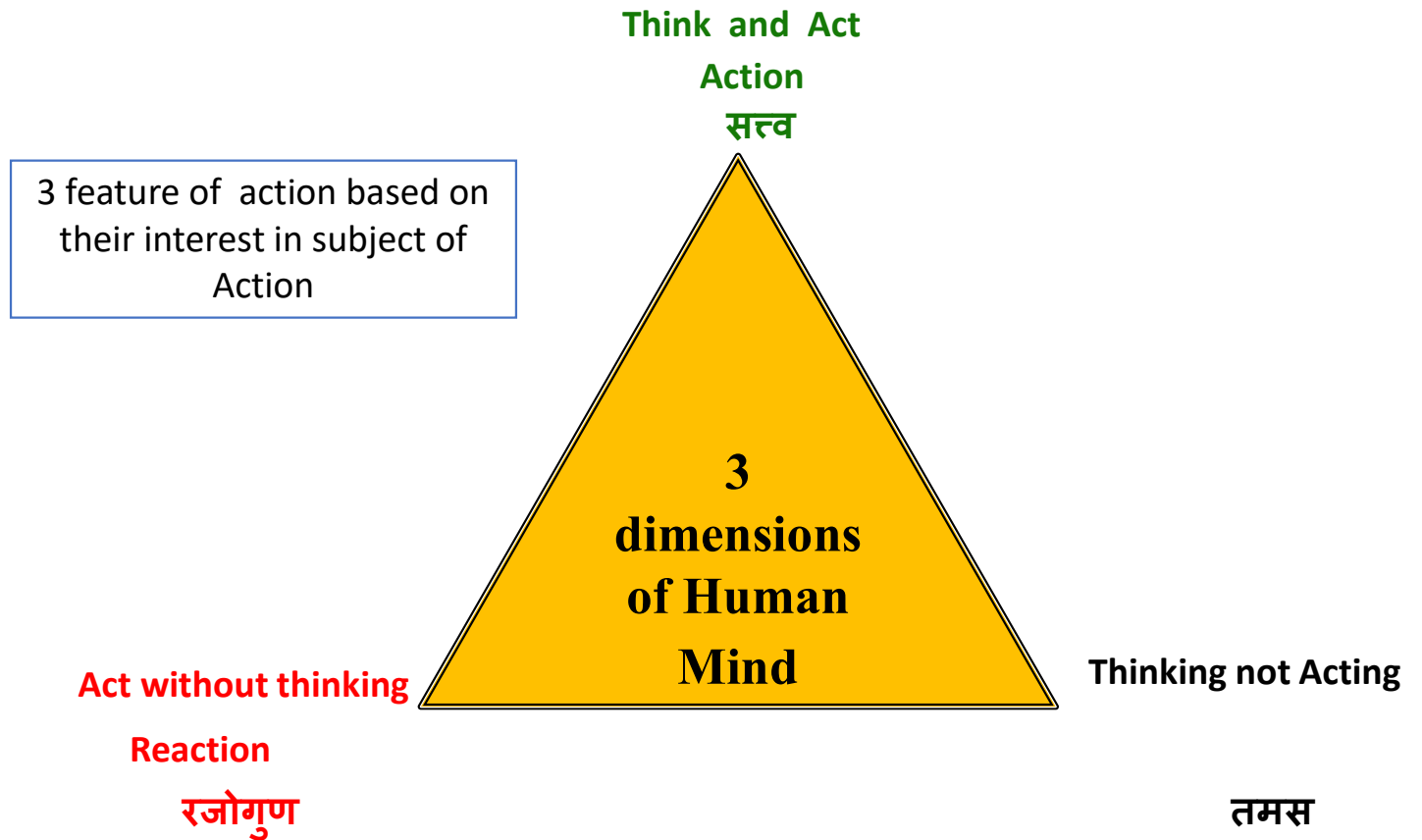


The body, the doer (soul), the various senses, the many kinds of efforts, and Divine Providence— these are the five factors of action.





Feature of Human Mind





Out come of our actions



Results of Action in number of combinations

= (5 Number of factors of our job) ^ (3 type people act)

Number of combinations = $5^3 = 5 * 5 * 5 = 125$

So, there are 125 different combinations of

Quality Results can happen.

There may be many Near misses,

but incidents are few

Spot the Hazards and Take Corrective Action

Learn from each Near miss