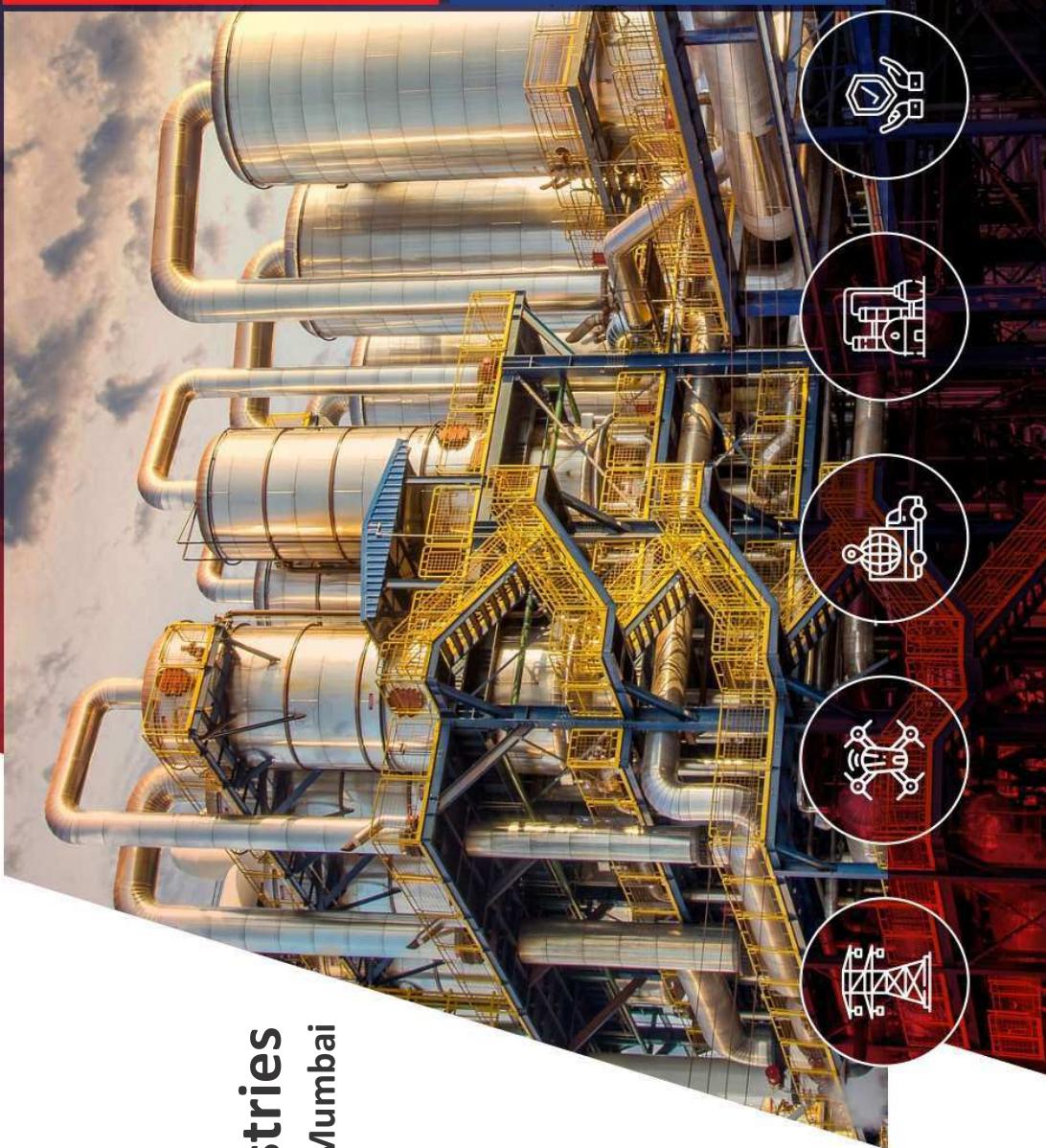




PSM Implementation and challenges for Chemical Industries

18th April 2023 at Bombay Exhibition Centre, Mumbai

Sarbajeet Mukherjee
GM – Business Development



**LEADERS IN RISK
ENGINEERING
AND HSSR SOLUTIONS**
AN ISO 9001:2015 CERTIFIED CONSULTING AND
TRAINING ORGANISATION

In this presentation

About Chola MS Risk Services

Process Safety Management System –
Introduction

Implementing Process Safety Management
System – Chola MS Risk Approach



murugappa

Many things to many people

A legacy of over a century marked by milestones across the world. 28 businesses, comprising of market leaders and best sellers, in a robust portfolio.

Everlasting bonds created by impacting lives in myriad ways. Welcome to the many splendored INR 300 billion Murugappa group.

The Murugappa Group founded in 1900 is one of India's largest diversified conglomerates, with 28 business and 32,000 employees in 234 cities.



Over 25 Sterling years of
experience

Executed over 10,000 HSSR
consulting projects

Spanning 42 industrial
sectors world wide

1

2

3



Our Vision

To be known as an innovative Risk Management and Engineering Solutions provider across the globe, while offering customers world class services.

Core Values



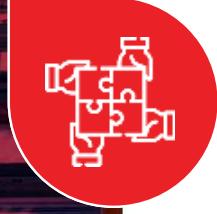
Uphold
honesty,
integrity
and ethical
values



Strive for
Technical
Excellence
through creativity
and innovation



Commitment
to
customer
satisfaction



Promote
challenging
and
vibrant
work
environment



Encourage
teamwork
and
continual
development
of the individual



MEMBER OF INOGEN

65 TMs over 10 years of experience

300 STRONG

ACCREDITED BY NABET

ISO 45001 Certified Lead Auditors

LARGEST EMPLOYER OF EHSS CONSULTANTS 15 TMs over 20 years of experience

Certified Industrial Hygienist (American Board of Industrial Hygiene)

NFPA Certified Auditors

From the best colleges in India - IITs, RIEs, NITs

CIDC EMANELLED

BEE Certified Energy Auditors

Certified EIA Coordinators

CERTIFIED FUNCTIONAL SAFETY EXPERTS

DGFASLI

Certified Safety Auditors by DGFASLI

IEEX CERTIFIED PROFESSIONALS



About Our Partners:

Mitsui Sumitomo

- **MS&AD Insurance Group** contributes to the development of a vibrant society and help secure a sound future for the earth, by bringing **security** and **safety** through the global insurance and financial services business.
- Making full use of over **50 years' experience** in **overseas business**, it provides products and services to alleviate the wide variety of risks occurring throughout the world.

| | |
|------------------|---------------------------------|
| Date Established | October 21,1918 |
| Paid-in Capital | ¥139,595 million |
| Employees | 14,691 (Non-consolidated basis) |
| Domestic Agents | 42,198 |

Technical Collaboration:

InterRisk

- **InterRisk Research Institute & Consulting** is one of the largest risk consulting companies in Japan. This is one of the Directly Invested Affiliated Operating Companies of Mitsui Sumitomo Insurance.

| | |
|------------------|--------------|
| Date Established | January 1993 |
| Headquarters | Tokyo |



Associate Of Inogen Alliance

Inogen Alliance is provide global coverage through one point of contact for environmental, health, safety, and sustainability efforts at your company. Together by choice for 20 years, our Alliance has unparalleled global coverage and a committed team that will partner with you in solving your EHS challenges, resolving liabilities from the past, addressing today's requirements and delivering innovative solutions for the future.

As a global Alliance with over 200 locations worldwide Inogen Alliance bring the best expertise, innovation and new services based on client demands, new trends and shifts in the areas of environment, health, safety and sustainability (EHS). With their long-standing relationships between associate companies Inogen Alliance share best practices, expertise and learnings to enable superior services and results to our clients.



| | | |
|---|---|-----------------------------------|
| ✓ Efficient & consistent work product | ✓ Site investigation | ✓ Cleaner production |
| ✓ One point of contact | ✓ Remediation | ✓ Corporate social responsibility |
| ✓ Access to all of our global resources | ✓ Liability transfer | ✓ Life cycle analysis |
| ✓ The broadcast base of industry experience | ✓ Portfolio liability management | ✓ Risk management |
| | ✓ Training | ✓ Assurance services |
| | ✓ Knowledge & accountability management | ✓ Water resource management |
| | ✓ Audits & Assessments | ✓ Value chain optimization |

| |
|---------------------------------------|
| ✓ Resolving liabilities from the past |
| ✓ Site investigation |

| |
|-----------------------------------|
| ✓ Addressing today's requirements |
| ✓ Due diligence |

| | |
|------------|---------------------------|
| Continents | Present in all continents |
| Countries | 120 |

Delivering solutions for a sustainable future

Electrical Safety



Digital EHS



Deployment (Secondment)



Industrial Hygiene



Safety Academy



Scope of our Health, Safety, Sustainability and Risk (HSSR) Engineering Services

Our expertise blends with clients' technical requirements, resulting in a spectrum of services across the lifecycle of a project from the conceptualizing stage till decommissioning.

We Partner with clients to manage the Risk Profitably

Process Safety



Environment & Sustainability



Construction Safety



Logistics & Road Safety



Process Safety

Process Safety

11



PSE STUDIES

HAZOP, QRA and other PHA Studies

- Hazard & Operability Study (HAZOP)
- Quantitative Risk Assessments (QRA)
- Hazard Identification Studies (HAZID)
- Bow-Tie Analysis
- What-if Analysis
- Reliability, Availability & Maintainability (RAM)
- Fire & Explosion Risk Assessment Study (FERS)
- Escape, Evacuation, & Rescue Analysis (EERA)
- Emergency Planning Zoning Study (EPZ)
- FTA/EIA/FMEA studies
- Dispersion modelling
- HAZOP Re-validation
- Building Radiation
- Impact Assessment
- Functional Safety**

Project Safety Solutions

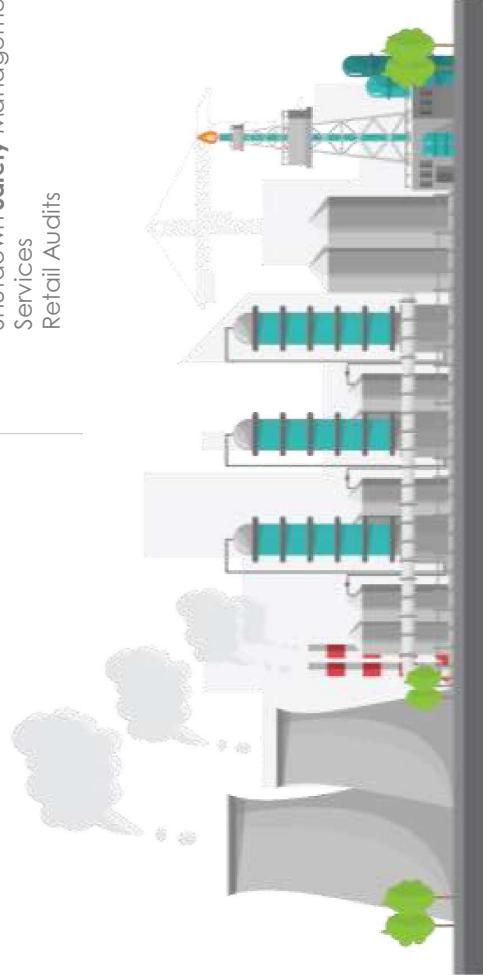
- Project, Health, safety & Environment Review (PHSER)
- Project Quantitative Risk Analysis (PQRA)
- Pre-Commissioning Audit
- Pre-Start Up Safety Review & Ready For Start Up study
- Pre-Occupancy Audit
- Shutdown Safety Management Services
- Retail Audits



DESIGN STUDIES

Fire Safety

- Design of Fire Detection System
- Design of Fire Protection System
- Fire & Gas Detection Mapping System
- Fire Water Network Analysis Fire Hazard Management
- Fire Safety Audit
- Support & Monitoring of Fire Protection Execution and Commissioning



AUDITS & ASSURANCE

Safety Management

- Comprehensive Safety Audit
- Hazard Identification and Risk Assessment
- Development of EHS Systems and Manual
- Safety Culture / Perception Survey Gap Analysis & Benchmarking of Safety Management System
- Safety Case Development
- Behaviour Based Safety (BBS)
- E2s-Emotion & Engineering Driven Safety
- Developing emergency Response & Disaster Management Planning (ERDMP)
- Machinery Risk Assessment
- Building Safety Audit
- Job Safety Analysis
- Accident Investigation
- Process safety Training Programmes



CULTURE TRANSFORMATION

Safety Management

- Hazard Identification and Risk Assessment
- Development of EHS Systems and Manual
- Safety Culture / Perception Survey Gap Analysis & Benchmarking of Safety Management System
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- Accident Investigation
- Process safety Training Programmes

Environment Management & Sustainability Services

Our strength lies in the simple fact that we understand the environmental setting, culture and social system & regulations. Besides this we have expertise across sectors be it Ports & Harbors, Fertilizer units, Power Plants, Paper & Pulp, Gas Processing units, Pharmaceuticals or Refineries.

Marine Environmental Studies



- Certified SCUBA divers
- NABET accredited marine ecologists
- Mangrove ecological management
- Hydrodynamic modelling

Flood Risk Assessment



- Flood level data simulation
- Prediction of peak flood levels for varied precipitation levels
- Developing flood level contour maps

Ecological & Biodiversity Modelling



- Green belt and afforestation technical feasibility study
- Prediction of biodiversity dynamics of large deforestation program
- Ecological Dynamic Simulation Model (EDYS)

Fugitive Emissions and Odour Management



- VOC-LDAR program
- VOC emission mapping - Imaging technique
- Odour emissions monitoring and modelling

Wastewater Treatment Consulting



- Wastewater characterization
- Trends analysis of wastewater (influent) characteristics
- ETP unit operations and performance assessment
- Treatability studies
- ETP upgrade schemes
- Preliminary engineering design
- Developing bill of quantities

Water Pinch Studies



- Sources and sinks analysis
- Water reuse/recycle and regenerate opportunities
- Water net work modelling and synthesis
- Conceptual plans

Surface Water Quality Modelling



- River water flow measurements
- Effluent dilution studies
- Eco-toxicity modelling of industrial discharges

Environment Due Diligence



- ASTM Phase 1 site assessment
- Initial environment assessment
- Preliminary soil and ground water contamination mapping

Social Impact Assessment & CSR Schemes



- In-house social scientist
- Primary surveys
- Focus group discussions
- Advisory on land acquisition for industrial operations
- Developing need based CSR programs

Water Audits and Management



- Water security and water resource management study
- Exploring alternative water resource Improvement measures
- Innovative methods
- Preliminary water management syntheses



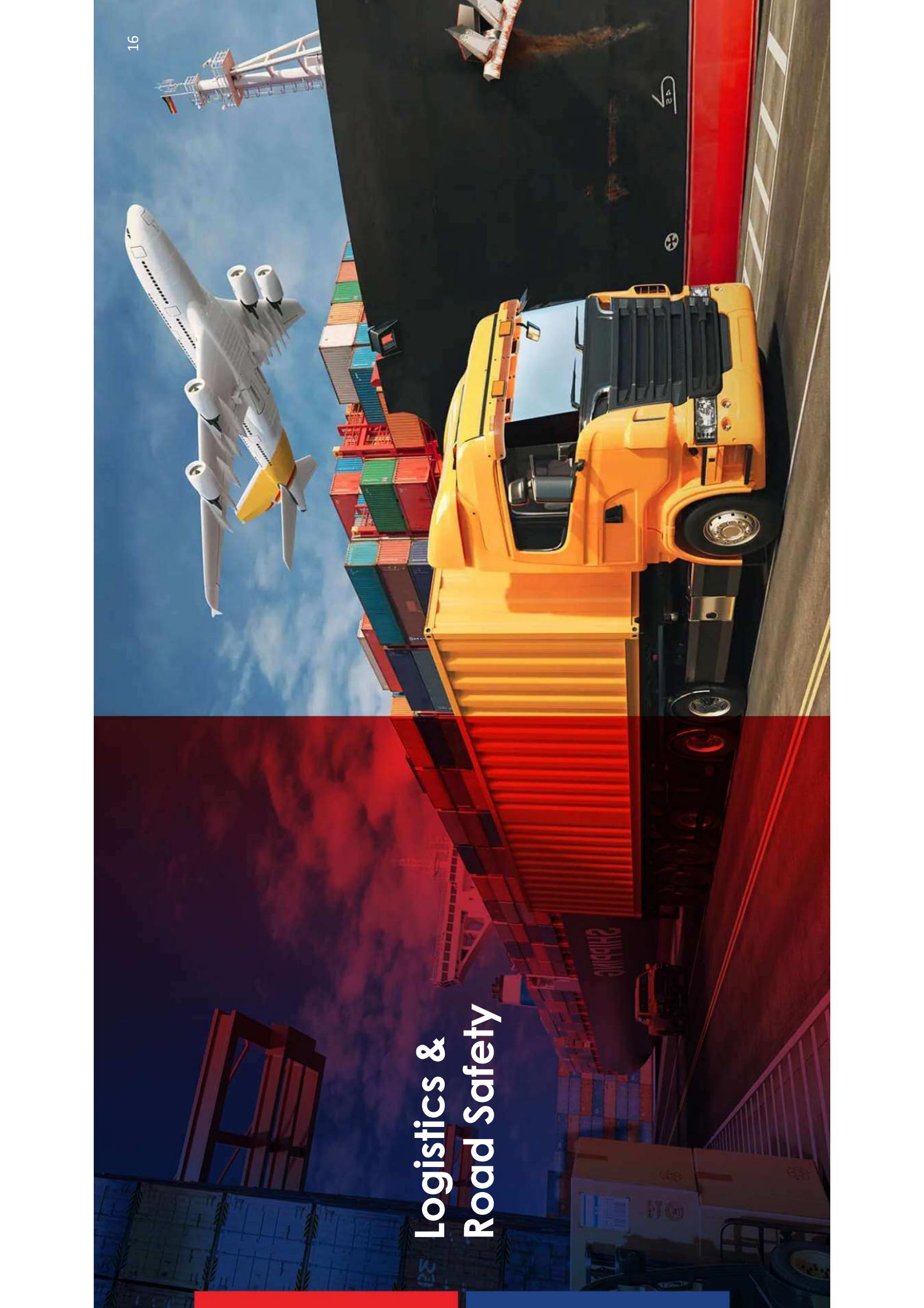
Construction Safety Management



Considering the many challenges faced by the construction industry, in particular pertaining to an unskilled & migrant work force, project delays and cost over-runs, we've evolved a suite of services towards a Comprehensive Construction Safety at Site Excellence Program. The services are based upon our immense experience in working on mega infrastructure projects for some of the best power plants, Oil and Gas, Cement, Chemical, Telecom, Steel and Real estate companies in India.

We therefore fully understand your requirement in implementing a successful safety management system in any type, scale and stage of a construction project.





Logistics & Road Safety

Safety as they say is priceless and does not come without focus. It requires careful and sustained intervention to reach excellence. It requires working with a knowledgeable partner and that's where we can step in and work alongside you to bring in the right interventions to ensure you see the right benefits. We **also provide assistance in implementing CSR initiatives.**



Transportation Safety Management

- Transportation safety Management System –
- Base line studies, audits & hand-holding**
- **Contractor Safety Programs**
- **Journey Risk Management**
- **Fleet Audits**
- **In-plant Traffic Layout study**
- **Road Accident Investigation**
- **ISO 39001 Management System**
- **Traffic Layout studies**



Cargo Loss Minimization

- CBU Risk Management
- Cargo Loss Minimization Studies



Warehouse Risk Management

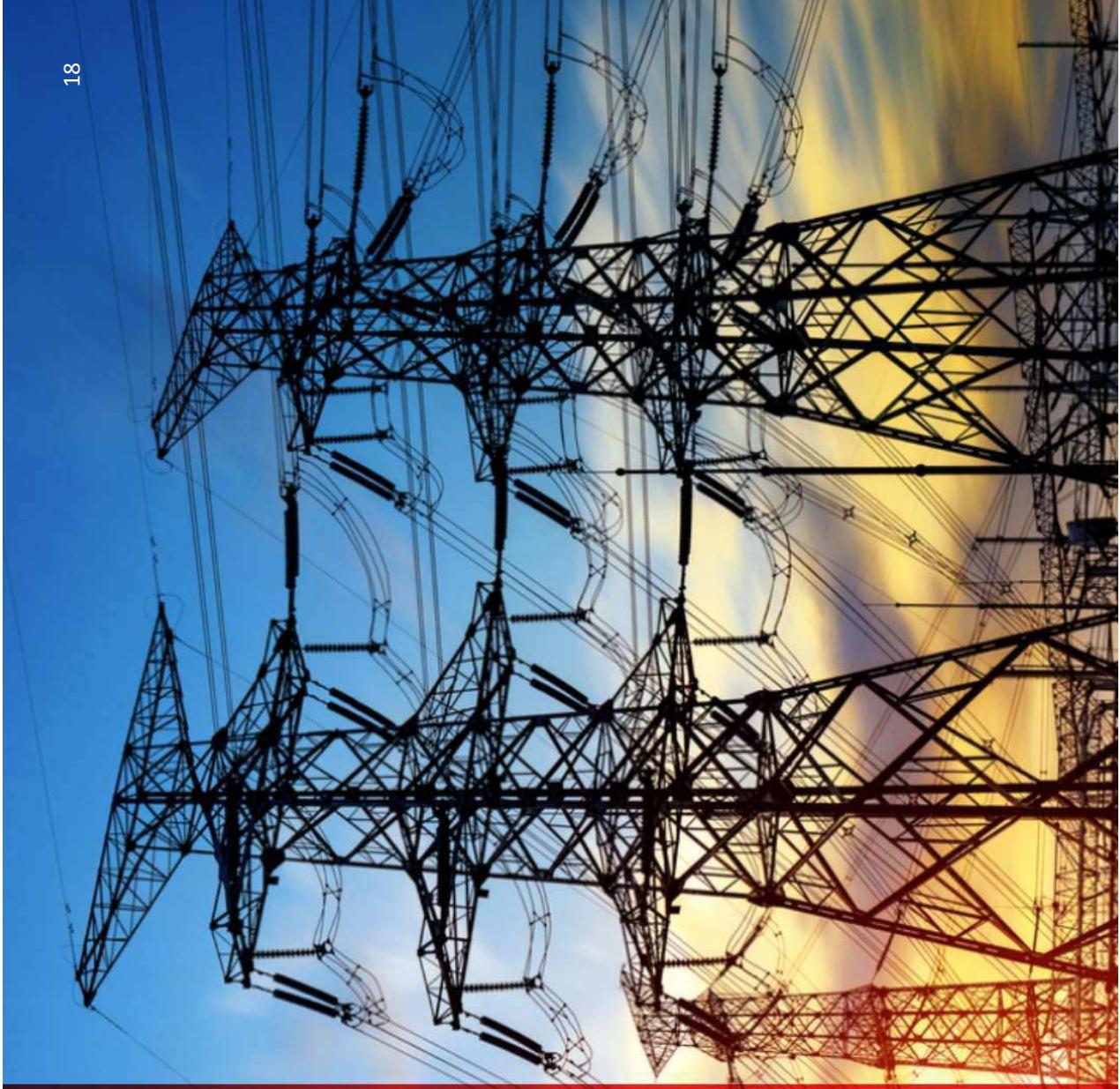
- Warehouse Throughput
- Calculation Warehouse Layout
- Design Forklift Audits
- Forklift Operator Training and Evaluation



Driver Skill Improvement

- Defensive Driving Training
- Driver Management Center
- Driver Clinics
- Deputation of Logistics Safety Officers Road Safety Awareness Campaigns Driver Accreditation Program





Electrical Safety Engineering

Electrical Safety Engineering

19



AUDITS, ASSURANCE & COMPLIANCE

- Statutory Compliance based risk assessment
- Hazardous area Ignition risk analysis
- Electrostatic hazard analysis
- Lightning protection system gap assessment
- Protection systems audit
- Electrical safety audit
- Power quality study
- Electrical & fire accident investigation studies
- Lightning protection risk assessment



ASSESSMENT & VERIFICATION

- Arc flash risk assessment
- Relay co ordination & Load flow studies
- Ex survey - EExHA inspections
- Ignition risk assessment
- Static electricity risk assessment
- Illumination & Lux study
- Thermography
- Power quality study
- Electrical & fire accident investigation
- Lightning protection risk assessment



DESIGN CONSULTING & ADVISORY SERVICES

- Drone Based Audits
- Remote Auditing through Wireless Wearable Tech
- VR / AR based Training for Hazardous Operations
- Sustainable Energy & Energy Saving Technologies(consulting)
- E-vehicles Safety / IOT (consulting)



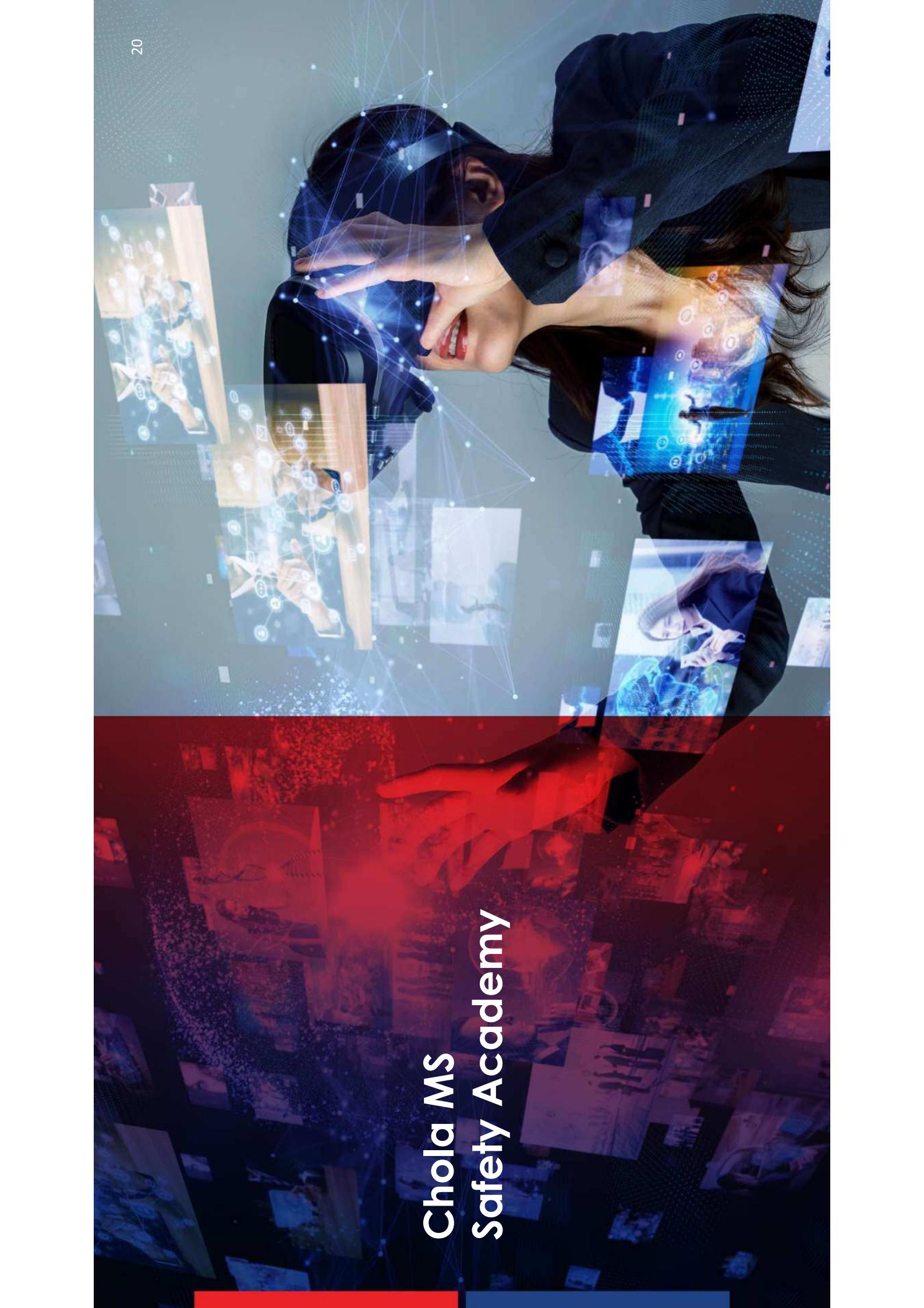
DIGITAL BASED ELECTRICAL ENGINEERING

- Manpower deployment of Electrical Safety Officers, Qualified Electrical Engineers – for audits, verification, investigations, training and implementing world-class electrical operations at plants/sites.



CAPACITY BUILDING – EXPERT DEPLOYMENT

- Manpower deployment of Electrical Safety Officers, Qualified Electrical Engineers – for audits, verification, investigations, training and implementing world-class electrical operations at plants/sites.



Chola MS Safety Academy

27 years of experience in EHS Consulting across multidisciplinary domains & industries with a strong grounding in both domestic & international markets gives us an edge over others in offering training. 5,000 training hours clocked till date.

TRAINING MODELS

E - Learning

Many organizations are using **e-learning** or **technology enabled learning** because of its benefits over traditional classroom training. Of course, you have to collaborate with the best to maximize the benefits. Our Instructional Designers and Domain Experts can build customized e-courses to specifically cater to your training requirements, policies & practices



In Company Training

We are able to address **complex problems and convey solutions** using simple and easy to comprehend language. Programs are designed as stepping stones or **Certification Enablers** to acquire industry recognized Credentials in EHS. Our experienced team can bring out the best outcomes and participation.



Centre for Excellence

If you are an ambitious **HSE professional** and wish to gain from our experience and **interact with our Senior Domain Experts**, join us for specialized learning programs offered only at our Centre for Excellence. Learn from the Leader and stay ahead of the rest. Alliances with RGIP, IITs and STI for e.g. is a step in this direction



Technology Enabled Learning

We believe in the meaningful adoption of technologies like VR/AR and Apps to engage with the Learner and make learning safer and engaging.

Corporate
Premier Training Partner

Individual
First Choice for competency building for a HSE professional

Formal Education
Preferred Education Partner



Industrial Hygiene



Industrial Hygiene



INDUSTRIAL HYGIENE ASSESSMENT AT WORK PLACE:

- Industrial Hygiene Qualitative Exposure Assessment
- Industrial Hygiene Quantitative Exposure Assessment
- Statistical Data Interpretation of Occupational Exposure
- Exposure Control Plan



INDUSTRIAL HYGIENE PROGRAMS:

- Occupational Hygiene Program
- Hearing Conservation Program
- Respiratory Protection Program
- Heat Stress and Strain Prevention Program
- Respirable Crystalline Silica Program



INDUSTRIAL HYGIENE ENGINEERING CONTROL VALIDATION:

- Local Exhaust System Capture Velocity Validation
- Chemical Fume Hood Face Velocity Validation
- Measurement of Hazardous Substances
- Evaluation and Control of Heat Stress & Strain
- Control of Hazardous Substances
- Ergonomic hazards identification & control
- Health effects of hazardous substances



INDUSTRIAL HYGIENE TRAINING:

- Measurement of Hazardous Substances

- Evaluation and Control of Heat Stress & Strain
- Control of Hazardous Substances
- Ergonomic hazards identification & control

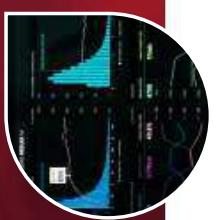
- Health effects of hazardous substances



Digital
EHS Solutions

Digital EHS Solutions

Partner with us in your digital transformation journey to ensure business continuity and to manage your risk profitability.



Suraksha Sathi our driver management app to engage with our truck drivers virtually to understand driver behavior on ongoing basis to result in reduced road accidents & cargo loss

Audit management software to deliver quality & standard reports with focus on tracking action items for implementation

Flying high with our Drones equipped which are equipped with latest sensor and technologies to mitigate risk at your work place and to perform asset inspections

Hands free remote auditing tool integrated with Microsoft team to Collaborate with our HSE Expert for your safety studies anytime, anywhere in real time

Smart Data analytic EHS solutions for meaningful insights and predictions on the risks & behavioural challenges

Prominent Hardware & Software

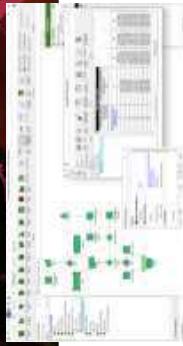
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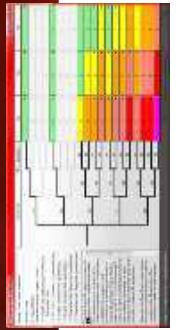
PHAST RISK & Safeti 8.4



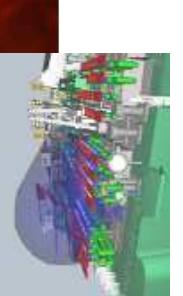
PIPE NET



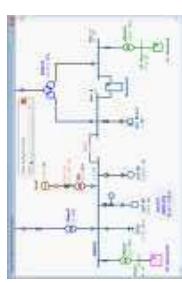
BLOCK SIM 18



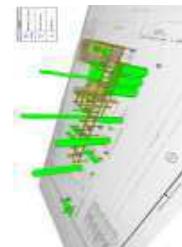
EXSILENTIA 4



HAZMAP-3D- 20.10



ETAP 16.1



Detect 3D - 2.54



Winvent 4



SKETCH UP



EHS SOFTWARE



CAI PIFFF



Intrinsic safe
electrostatic
voltmeter



P-Drive System



Heavy Vehicle
Driving Simulator



Thermal
Imaging System

Power Quality Analyzer



Ultrasonic Flow meter



Surface resistance & LUX

Comprehensive Regulatory Compliance Digital Tool



denxpert

Denxpert Legal - Choose
Digital; Be Compliant

Chola MS In association with
Denkstatt Hungary Is Introducing
a one stop shop for EHS and
sustainability IT solutions in India

A green circular icon containing a white checkmark inside a clipboard-like shape.

What we offer?

Classification This book includes first year Spanish for you. It is divided into four main sections: **Language**, **Culture**, **Geography**, and **History**. Each section contains several chapters that cover various topics related to the subject.

Inaugurated by **H.E. Mr. András László Király**, Ambassador of Hungary and
Ms. Tania Friederichs, Minister Counselor, Head of Research
And Innovation Sector, Delegation of the European Union to India

Expertise across industries

28



Chemicals



Construction



Electrical



Engineering



Refineries



Oil & Gas



FMCG



Retail



Fertilizers



Automobiles



Mining & Minerals



Textile



Telecom



Gas Distribution



Steel



Data Centers



Infrastructure

Spectrum Of Services Across The Life Cycle Of A Project

As a multi disciplinary risk engineering consultancy firm, we work as a 'Sustainable Partner' with organizations for a greener world, setting benchmark of going beyond mere statutory compliance and help organisations make the right decisions.

Our expertise blends with clients' technical requirements, resulting in a spectrum of services across the lifecycle of a project – from the Conceptualizing stage till Decommissioning .



Partial List Of Customers



Clientele – Middle East

31



Clientele – Agro & Fertilizers



Global Footprint



Abu Dhabi
Bangkok
Doha
Dubai
Egypt
Hong Kong
India
Indonesia
Italy
Kenya
Kuwait
Malaysia

Nigeria
Pakistan
Philippines
Saudi
Singapore
South Korea
Sri Lanka
Taiwan
Texas
Thailand
UAE
Vietnam

What is PROCESS SAFETY MANAGEMENT?



PROCESS SAFETY MANAGEMENT is the proactive identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in processes, procedures, or equipment.

PSM is a disciplined framework for managing the integrity of operating systems and processes that handle hazardous materials.

Process Safety vs. Personal Safety

| Process Safety | Occupational Safety |
|---|--|
| <input type="checkbox"/> Focuses on preventing fires, explosions and toxic release incidents in process facilities, which can lead to multiple fatalities and heavy asset, production, environmental & reputation damage. | <input type="checkbox"/> Concerned with protecting the safety, health and welfare of people engaged in work or employment. <input type="checkbox"/> Focuses more on work injury prevention, occupational health, driving safety, etc. |
| <input type="checkbox"/> Prevention of high consequence low frequency risks. | <input type="checkbox"/> Prevention of low consequence and high frequency risks. |
| <input type="checkbox"/> Process Safety is preventing Loss Of Containment (LOC) | <input type="checkbox"/> Occupational Safety is preventing Hazards Affecting People (acute & chronic) |



PSM Standards

INTERNATIONAL STANDARDS AND REGULATORY REQUIREMENT

Standards

OSHA 1910.119: Process Safety Management of highly hazardous chemicals.

CCPS: 20 Elements Risk Based Process Safety (RBPS)

* Some companies have their own internal company standards and norms to be followed.

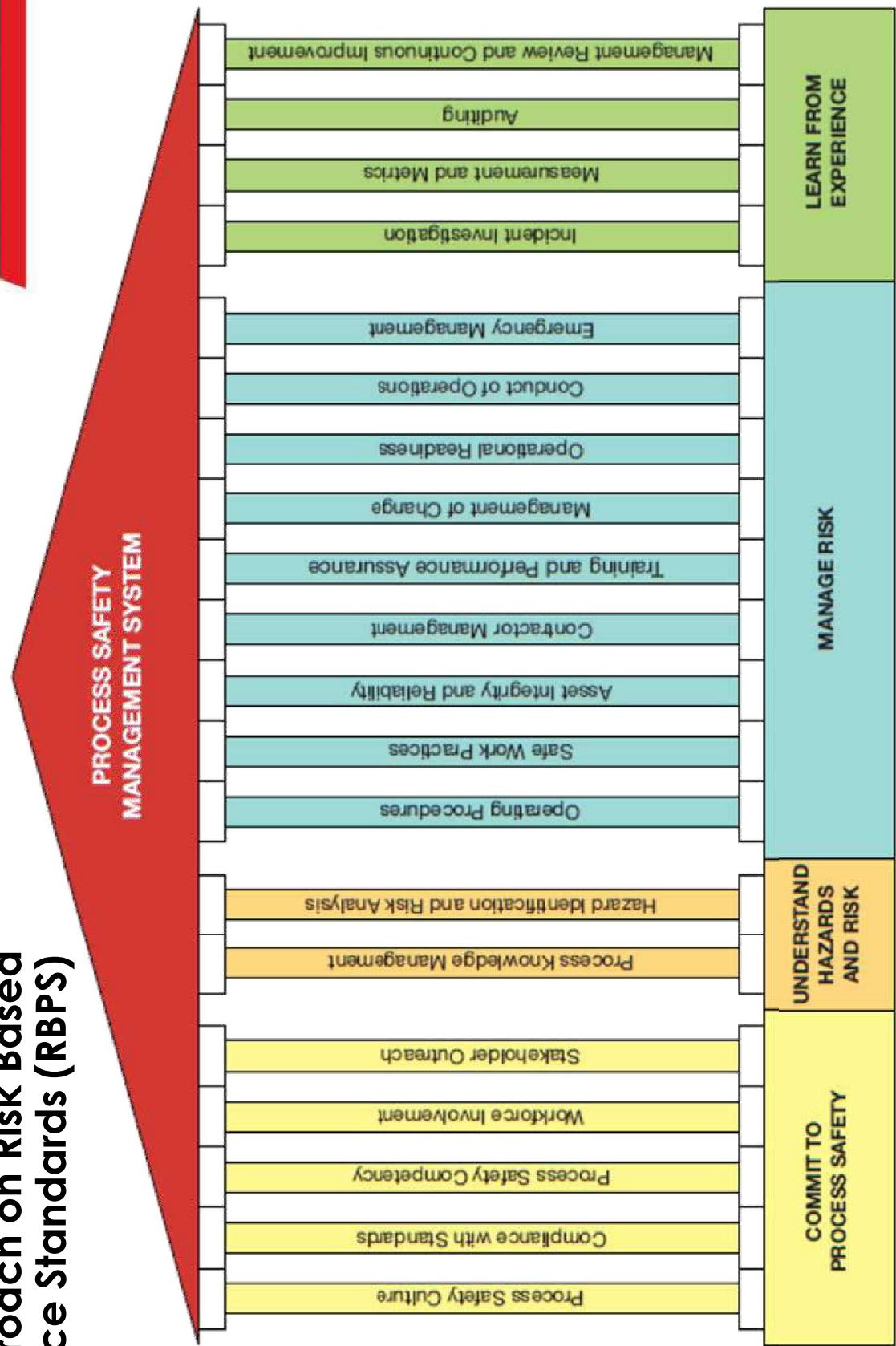


Elements of PSM as per OSHA

- ① Management Commitment
- ② Process Safety Information
- ③ Process Hazard Analysis
- ④ Operating Procedures
- ⑤ Employee Participation
- ⑥ Training
- ⑦ Contractor Safety
- ⑧ Pre-Startup Safety Review

- ⑨ Mechanical Integrity (Asset Integrity)
- ⑩ Hot Work Permit (Safe Work Practices)
- ⑪ Management of Change
- ⑫ Incident Investigation
- ⑬ Emergency Planning & Response
- ⑭ Compliance Audits
- ⑮ Trade Secrets

CCPS Approach on Risk Based Performance Standards (RBPS)



PSM EVOLUTION IN INDIA – THE INDIAN CONTEXT

No Mandatory

- Safety Management system is not mandated by Indian law, a number of chemical industries in India are voluntarily adopting the PSM system

Adoption

- Largest Player proactively adopting management systems for process safety



Future Driven

- Process Safety Management is increasingly being woven into business strategy, during the project conceptualization stage itself

Limitations / Challenges for Indian Industries

- Ageing assets.
- Low or NIL return on investment in Safety.
- Installations located in thickly populated areas.
- Non adherence to SOPs.
- Top-down safety culture.
- Shortage of skilled man power.
- Lack of proper maintenance
- Training & retraining of manpower to assimilate the upcoming technology



Implementing Process Safety Management System

Objectives of Process Safety Management System (PSM) Implementation Project

- To evaluate the status of existing OH&S management system elements against OSHA PSM Standard 1910.119 and CCPS RBPS Elements
- Establish an action plan for Implementation of Process Safety Management
- Implementation of Process Safety Management system through handholding

Scope of the project

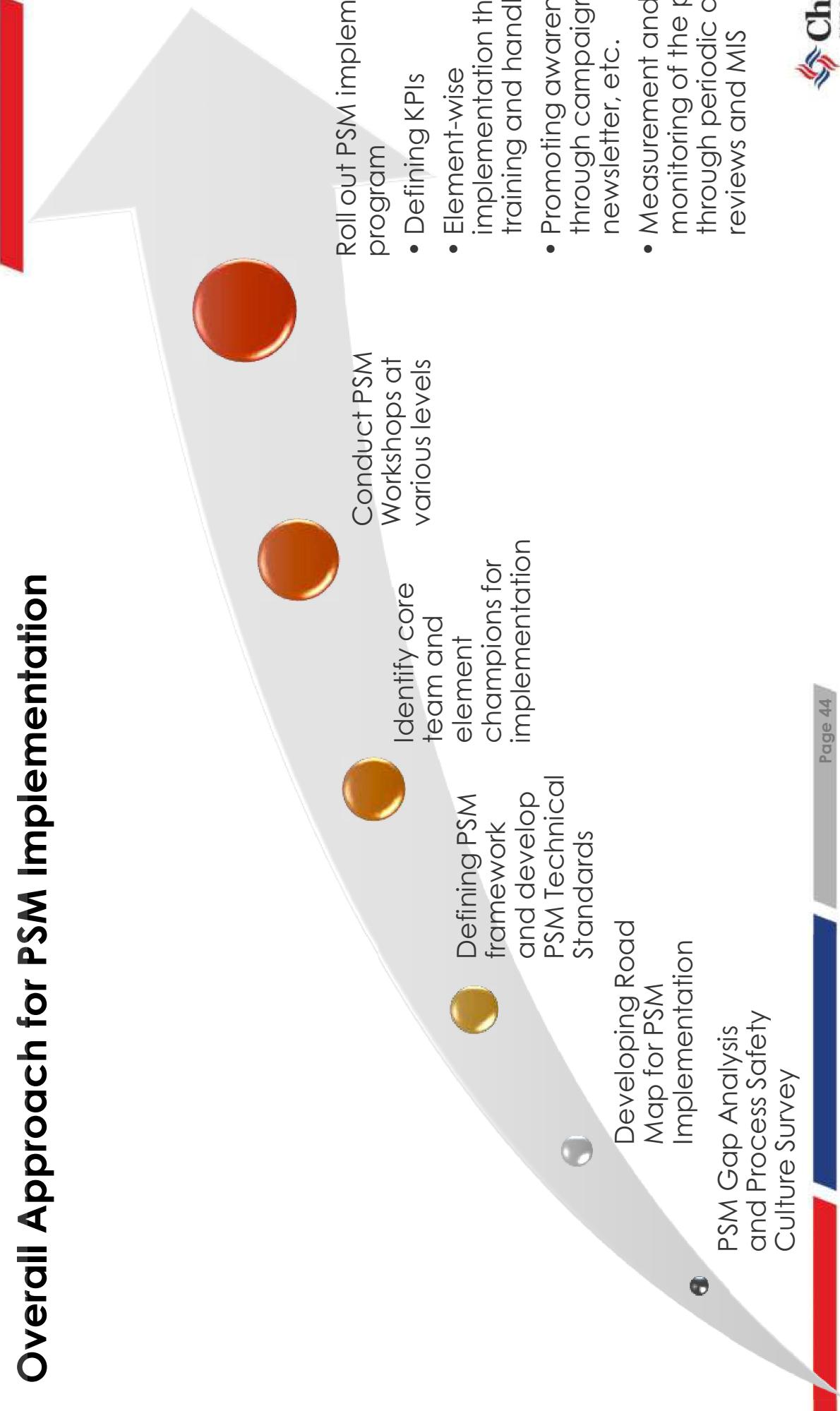
Phase 1 (Gap Analysis & developing Road Map)

- Review of the existing process safety system and work practices to identify adequacy gaps with respect to the OSHA Process Safety Management elements / CCPS Risk Based Process Safety Management pillars.
- Establish an action plan for implementation of PSM.

Phase 2 (Scope drawn up after completion of Gap Analysis Study)

- Implementation of Process Safety Management System.

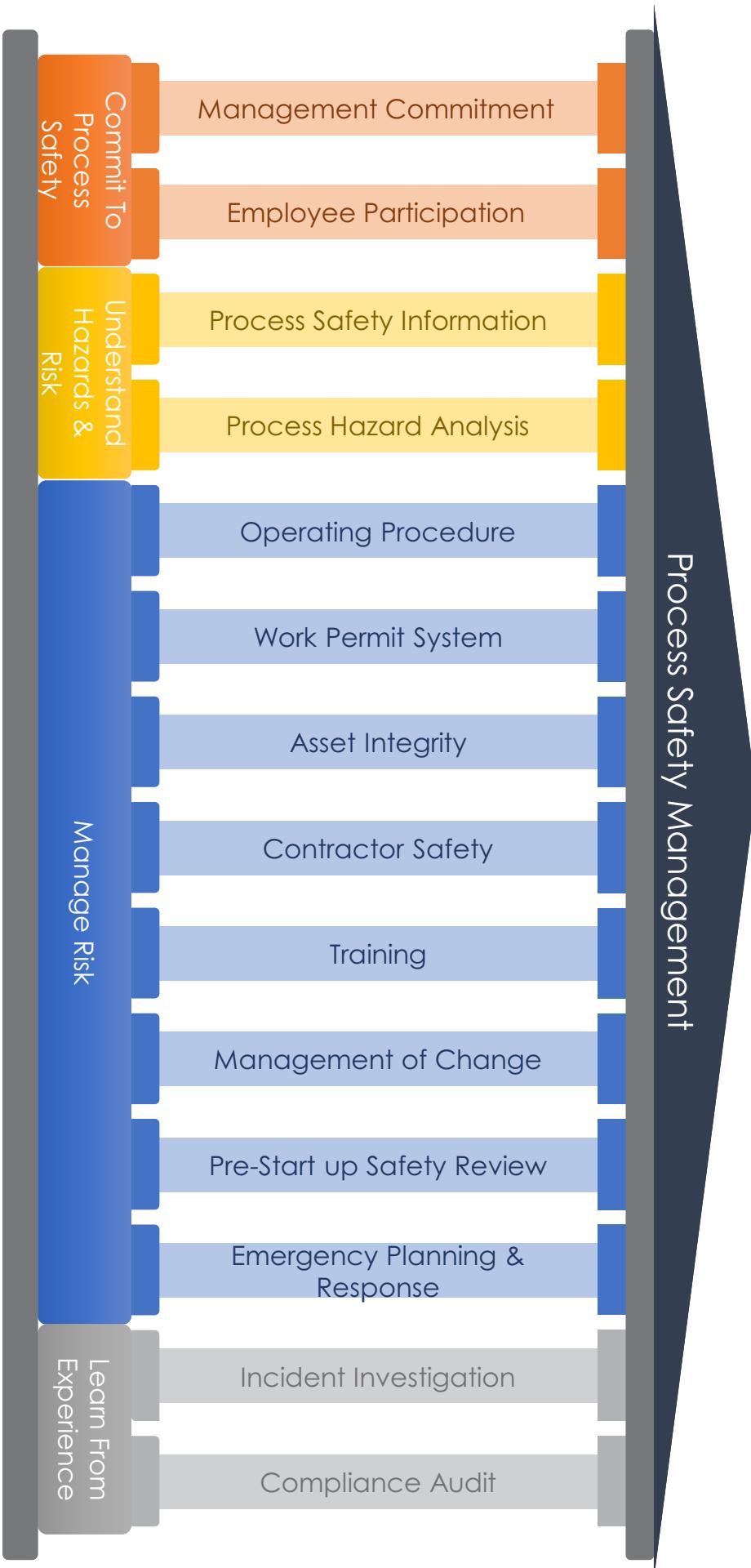
Overall Approach for PSM Implementation



Process Safety Management System

Phase 1 – Gap Analysis

PSM Gap Analysis scope*

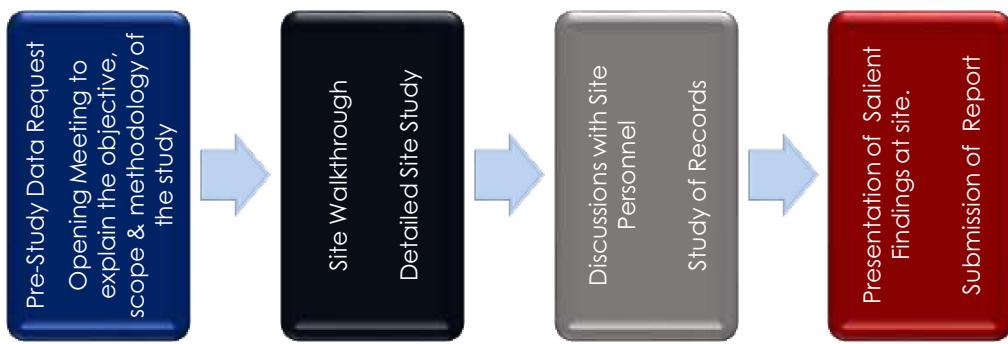


Page 46

* As per CCPS RBPS

Gap Analysis Methodology

1. Pre Visit Preparation:
 - Study of existing PSM system
 - Framework
 - Past Incidents
 - Performance of existing PSMS/SMS
2. Onsite Review: Review of written policies and procedures
 - Interviews with a cross-section of facility staff, reviews of records and documentation, and field observation of work practices and plant equipment for each of the PSM elements.
 - Team Composition:
 - Team Leader (Process Safety Management System Specialist)
 - Process Hazard Analysis Specialist
 - Asset Integrity Specialist
3. Report Preparation



Deliverables – PSM Gap Analysis Report

- The report will contain the observations and recommendations presented for each PSM element as separate chapters.
- A separate chapter will provide PSM Compliance Scores based on compliance questionnaire and road map for implementing the Process Safety Management System.

Developing PSM Compliance Scores based on compliance questionnaire

| Criteria for scoring for each question | | The PSM benchmarking scores for each element shall be ranked on the following broad criteria: | | | | | |
|--|--------|---|------------------|---|---|---|--|
| Degree of Compliance | Points | 0 % | 1 – 40 % | 41 – 60 % | 61 – 80 % | 81 – 90 % | 91 – 100 % |
| Poor - No system | 0 | Poor | Basic | Awareness | Competent | Excellence | World Class |
| Below Average | 1 | Existing system focused on addressing process safety needs in a reactive manner | No system exists | System focusses on complying safety legal requirements and standard certifications. | Proactive initiatives and demonstration of Process Safety as a top priority | Demonstration of Process Safety as a value with consistent implementation of safety systems | Process Safety is instinctive and consistent Implementation of world-class practices |
| Average | 2 | Interpretation | | | | | |
| Good | 3 | | | | | | |
| Excellent | 4 | | | | | | |

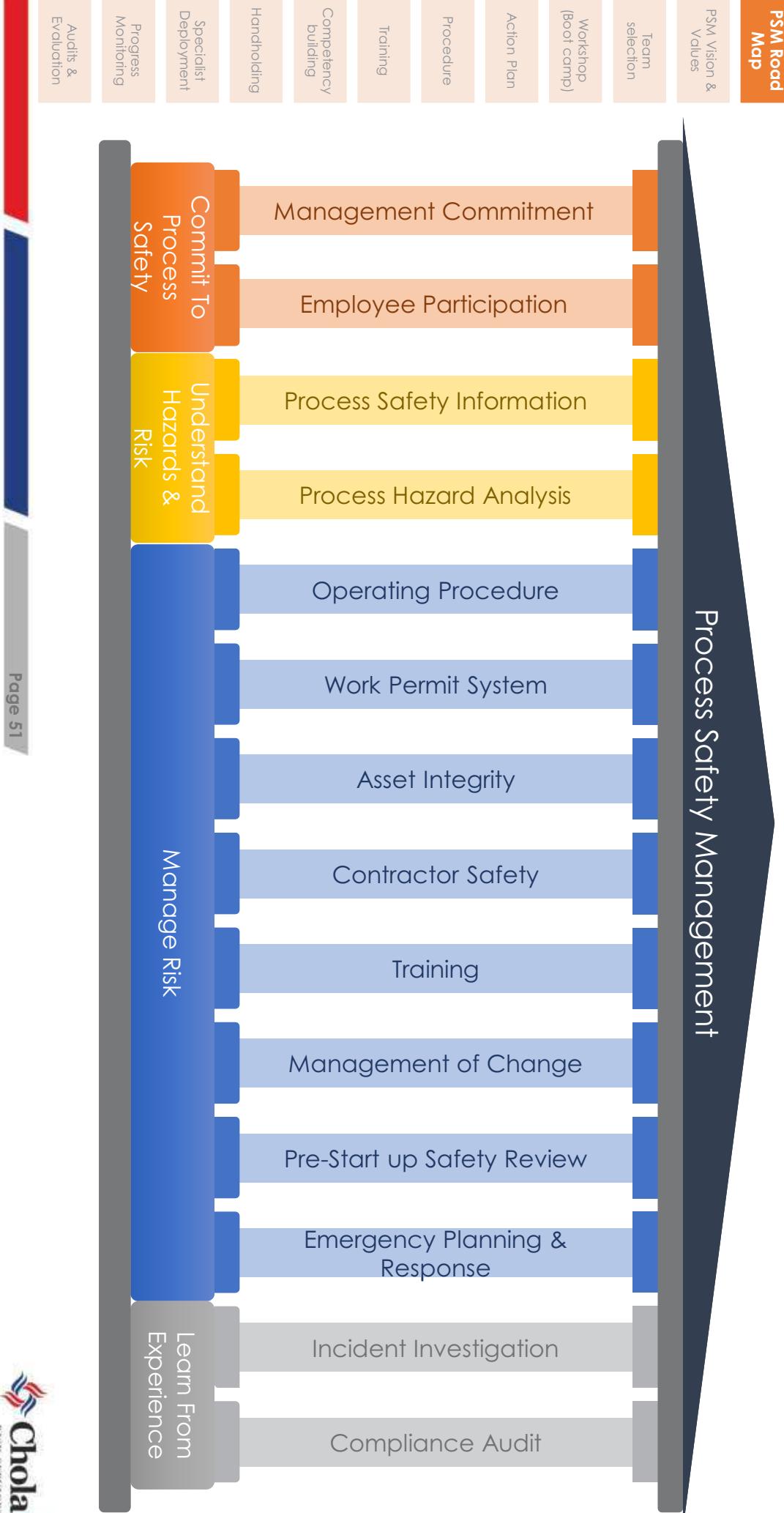
PSM Gap Analysis report



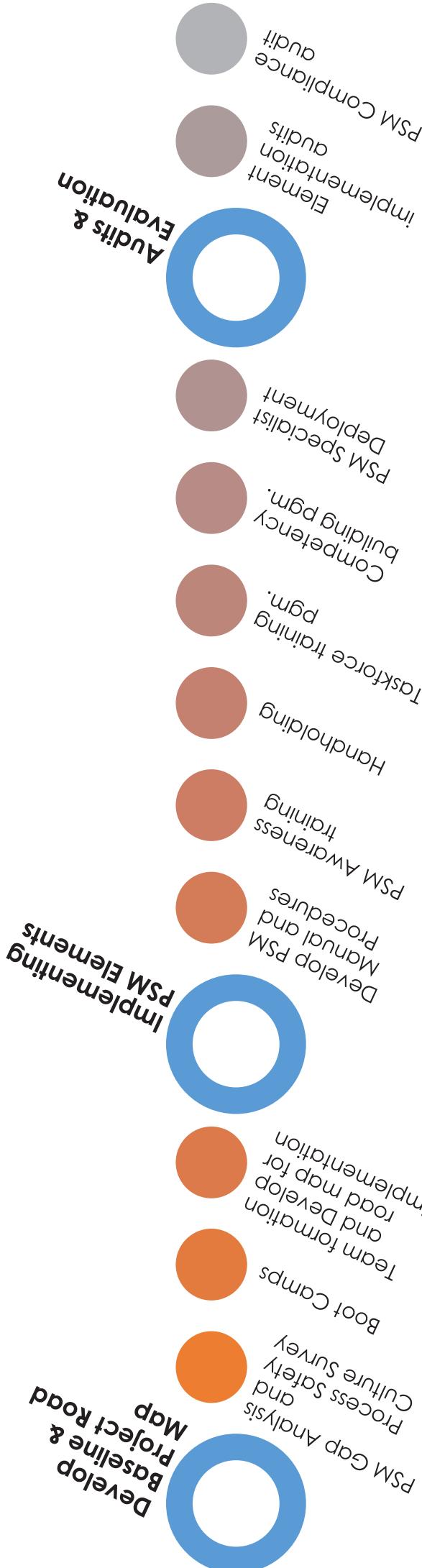
Process Safety Management System

Phase 2 – Implementation Support

Develop PSM Implementation Plan and Project Road Map



Develop PSM Implementation Plan and Project Road Map

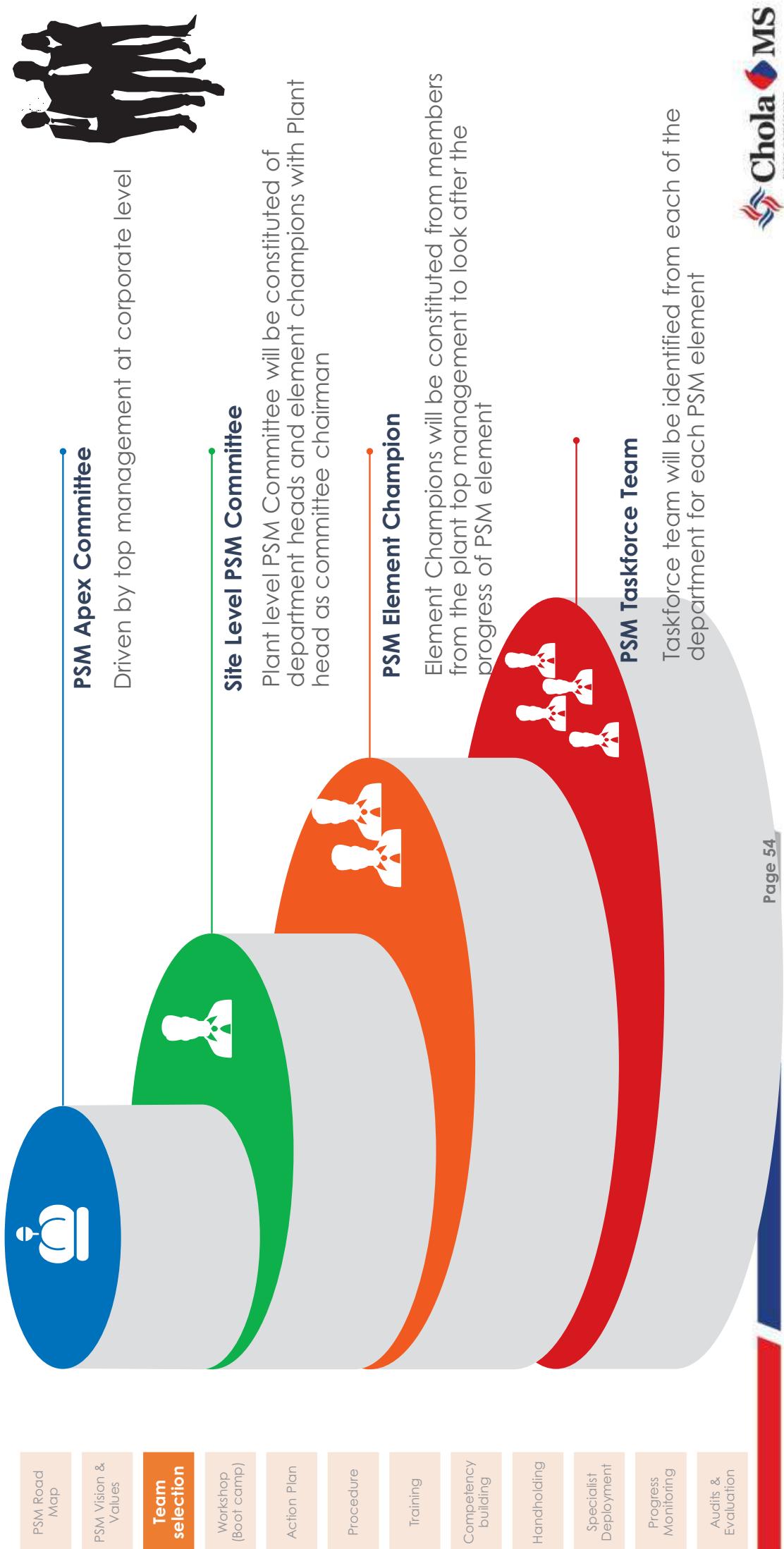


Developing Process Safety Vision, Mission and Core Values

| | |
|-----------------------|---|
| PSM Road Map | ▪ Workshop with Top Management for developing the Process Safety Vision, Mission and Core Values. |
| Team selection | ▪ Identify “what” drives process safety at all levels in the organization in order to create strategy around it. |
| Workshop (Boot camp) | ▪ Clarify how the future will be different from the past and how each level can make that future a reality through initiatives linked directly to vision. |
| Action Plan | ▪ The Process Safety core values evolved from this workshop shall be the guiding principles for PSM journey. |
| Procedure | |
| Training | |
| Competency building | |
| Handholding | |
| Specialist Deployment | |
| Progress Monitoring | |
| Audits & Evaluation | |



Governance Team



Boot Camps

LEADERSHIP BOOT CAMP

- Focused program for top management
- Finalize the focus areas, KPIs and responsibility matrix
- Develop roadmap for implementing PSM elements
- Identify the team members to champion the change

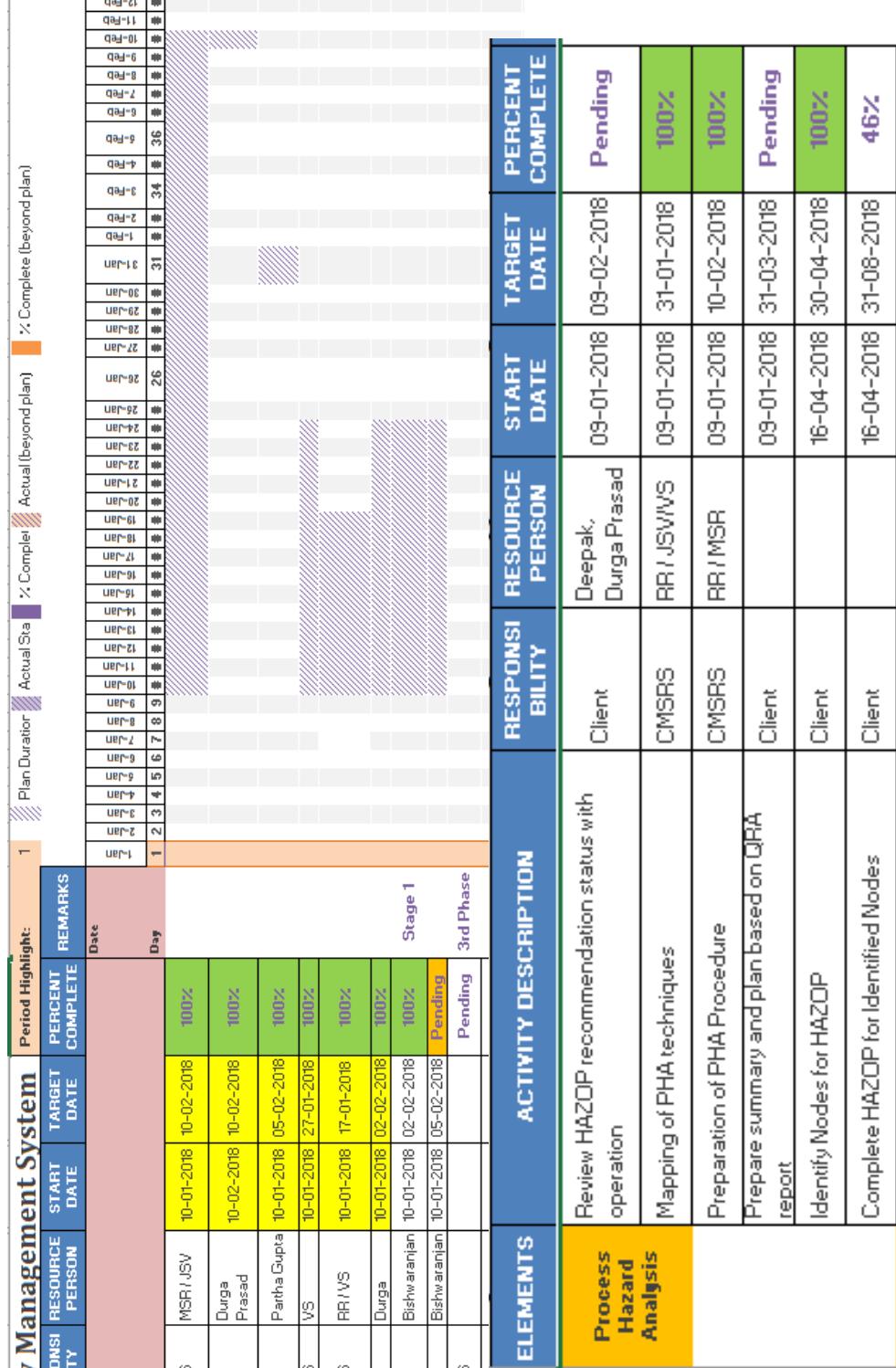
MIDDLE MANAGEMENT BOOT CAMP

Middle Management boot camp

- 2 day workshop
- Participants – Department heads and Immediate reportees
- Create ownership for each level of management

Developing Action Plan and Responsibilities

| PSM Road Map | Implementation of Process Safety Management System | Period Highlight: | | | | | | | | | | | |
|-----------------------|---|---|-----------------|------------|-------------|------------------|---------|----------------------|-----------------|--------------|-------------|----------------------|--------------------------|
| ELEMENTS | ACTIVITY DESCRIPTION | RESPONSIBILITY | RESOURCE PERSON | START DATE | TARGET DATE | PERCENT COMPLETE | REMARKS | Date | Plan Duration | Actual Start | % Complete | Actual (beyond plan) | % Complete (beyond plan) |
| PSM Vision & Values | Preparation of Work Permit System Procedure based on the framework of OHSAS 18001 | CMSRS | MSR / JSV | 10-01-2018 | 10-02-2018 | 100% | | | | | | | |
| Team selection | Work Permit System Assessment and Certification of nominated APAs, APR and API | Client | Durga Prasad | 10-02-2018 | 10-02-2018 | 100% | | | | | | | |
| Workshop (Boot camp) | Nomination of people for APA, APR and API | Client | Partha Gupta | 10-01-2018 | 05-02-2018 | 100% | | | | | | | |
| Action Plan | Preparation and submission of WOPAR | CMSRS | VJS | 10-01-2018 | 27-01-2018 | 100% | | | | | | | |
| | Preparation and submission of Contractor equipment checklist for portable tools | CMSRS | FRI / VS | 10-01-2018 | 17-01-2018 | 100% | | | | | | | |
| | Preparation of list of contractor safety identification of all possible sources for LOTO, Preparation of P&D Sketch | Client | Durga | 10-01-2018 | 02-02-2018 | 100% | | | | | | | |
| | Validation of Energy Control Plan | Client | Eishwaranjan | 10-01-2018 | 02-02-2018 | 100% | Pending | | | | | | |
| | Preparation of training module for contractors | CMSRS | | | | | Pending | | | | | | |
| | Sessions on Scaffolding inspector and tagging system | Client | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| ELEMENTS | ACTIVITY DESCRIPTION | | | | | | | RESPONSIBILITY | RESOURCE PERSON | START DATE | TARGET DATE | | PERCENT COMPLETE |
| Competency building | Process Hazard Analysis | Review HAZOP recommendation status with operation | Client | | | | | Deepak, Durga Prasad | | 09-01-2018 | 09-02-2018 | Pending | |
| Handholding | Mapping of PHA techniques | CMSRS | RRI / JSV / VJS | | | | | | | | | 100% | |
| Specialist Deployment | Preparation of PHA Procedure | CMSRS | RRI / MSR | | | | | | | | | 100% | |
| Progress Monitoring | Prepare summary and plan based on QRA report | Client | | | | | | | | | | Pending | |
| Audits & Evaluation | Identify Nodes for HAZOP | Client | | | | | | | | | | 100% | |
| | Complete HAZOP for Identified Nodes | Client | | | | | | | | | | 46% | |



Developing Integrated Procedure

DEVELOPING PSM MANUAL & TECHNICAL STANDARDS

Offsite support activities for PSM Implementation

- Defining PSM Policy and Objectives
- Developing PSM Apex Manual
- Preparation of technical standards for PSM elements
- Defining Process Safety KPIs
- Developing PSM Element specific templates

| | | | | | | | | | | | |
|--------------|---------------------|----------------|----------------------|-------------|------------------|----------|---------------------|-------------|-----------------------|---------------------|---------------------|
| PSM Road Map | PSM Vision & Values | Team selection | Workshop (Boot camp) | Action Plan | Procedure | Training | Competency building | Handholding | Specialist Deployment | Progress Monitoring | Audits & Evaluation |
|--------------|---------------------|----------------|----------------------|-------------|------------------|----------|---------------------|-------------|-----------------------|---------------------|---------------------|

PSM Awareness, Element Training, and Competency building

PSM AWARENESS PROGRAM

PSM Awareness – Plant Operators / Technicians

- Explaining the roles and responsibilities of the Operators & Technicians on each PSM element.

PSM Awareness – Contract Employees

- Explaining the roles and responsibilities of the Contractors on each PSM element.

TASKFORCE TRAINING ON PSM ELEMENTS

Taskforce training on element framework & rollout

- Element-wise workshop for the respective element owners and team members
- Training via Case Studies and CSB Videos
- Team exercise and Practical sessions

COMPETENCY BUILDING

Advanced Competency Building

- Advanced Competency building programs
- Internal capability building approach
- Assessment of the participants based on written test
- “Certify to operate / use” model to ensure minimum competency

Handholding and PSM Specialist Deployment

HANDHOLDING

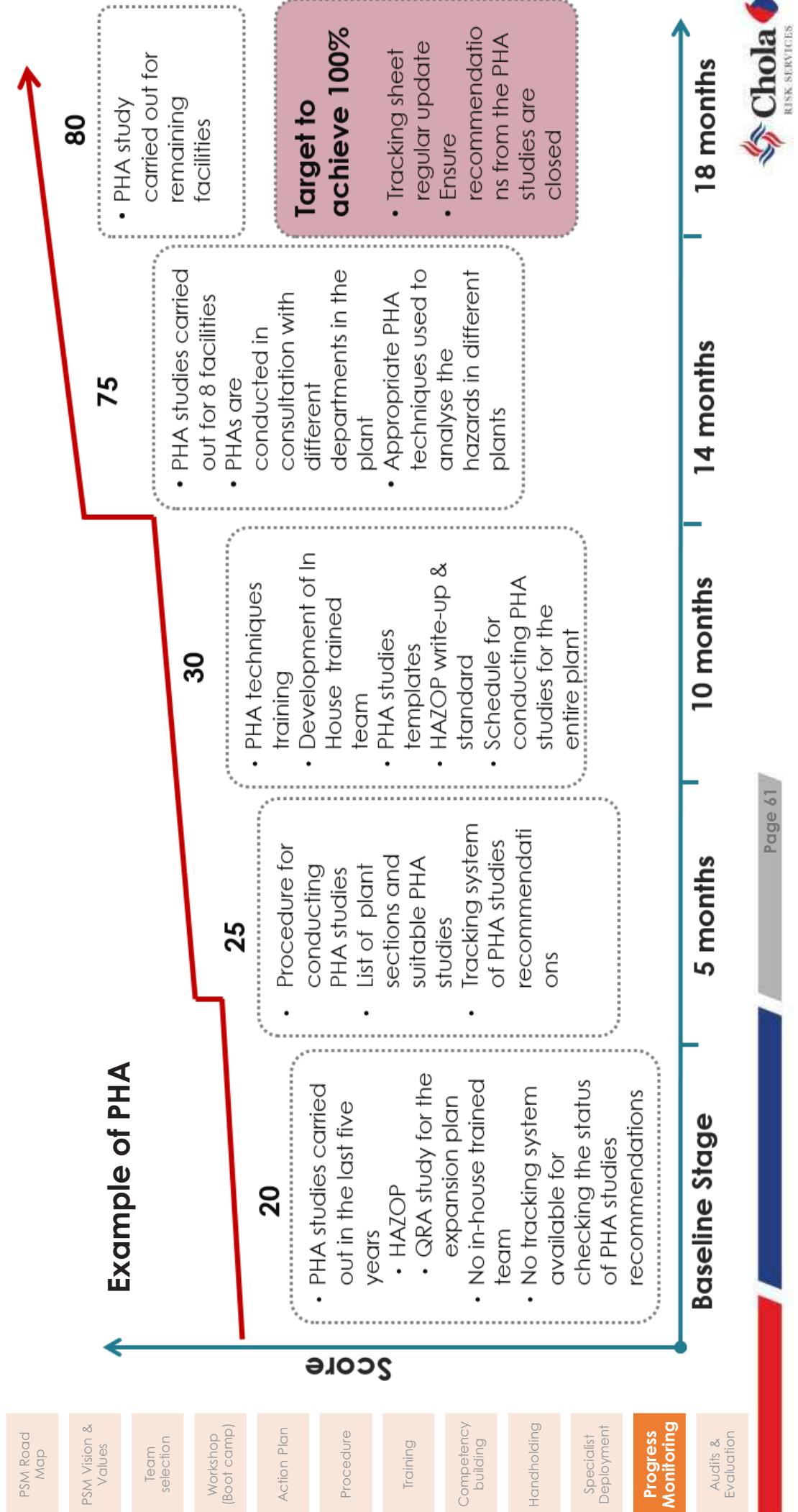
| | | |
|-----------------------|--|--|
| PSM Road Map | <input type="checkbox"/> Handholding for Implementing PSM Elements – Monthly visits <ul style="list-style-type: none">▪ PSM experts visit monthly / bimonthly▪ Preparing the plan of action based on the PSM road map and review of the progress with the respective element team.▪ Roll out of PSM Element specific templates and procedures▪ Review of procedures / records▪ Periodical review of project progress with plant management▪ Dash board for MIS | <input type="checkbox"/> PSM SPECIALIST DEPLOYMENT <ul style="list-style-type: none">▪ Work with plant team in PSM element implementation▪ Participate actively in process safety activities at the plant▪ Technical support in rolling out the plan of action based on the PSM road map.▪ Monitoring of KPIs and developing MIS |
| PSM Vision & Values | | |
| Team selection | | |
| Workshop (Boot camp) | | |
| Action Plan | | |
| Procedure | | |
| Training | | |
| Competency building | | |
| Handholding | | |
| Specialist Deployment | | |
| Progress Monitoring | | |
| Audits & Evaluation | | |

Key Performance Indicators

■ Developing KPIs for various PSM elements.

| KPI Proposed (Sample for PHA) | | Type |
|-------------------------------|--|-------------------|
| | • No. of open & overdue PHA action items | Lower the better |
| | • Percentage of recommendations for administrative controls, active engineering controls, passive engineering controls and inherently safer alternatives | Higher the better |
| | • Number of PHAs of each type that are overdue | Lower the better |
| | • Number of High and Extreme Risks | Lower the better |

Measuring effectiveness of PSM Element Implementation



Audits and Evaluation

PSM Road Map

PSM Vision & Values

ELEMENT IMPLEMENTATION AUDITS

Audits by Senior Management team of Chola MS Risk

- Audits to evaluate the PSM element implementation
- Periodic evaluation of the PSM project progress
- Presenting the findings to Top Management

Procedure

Training

Competency building

Handholding

Specialist Deployment

Progress Monitoring

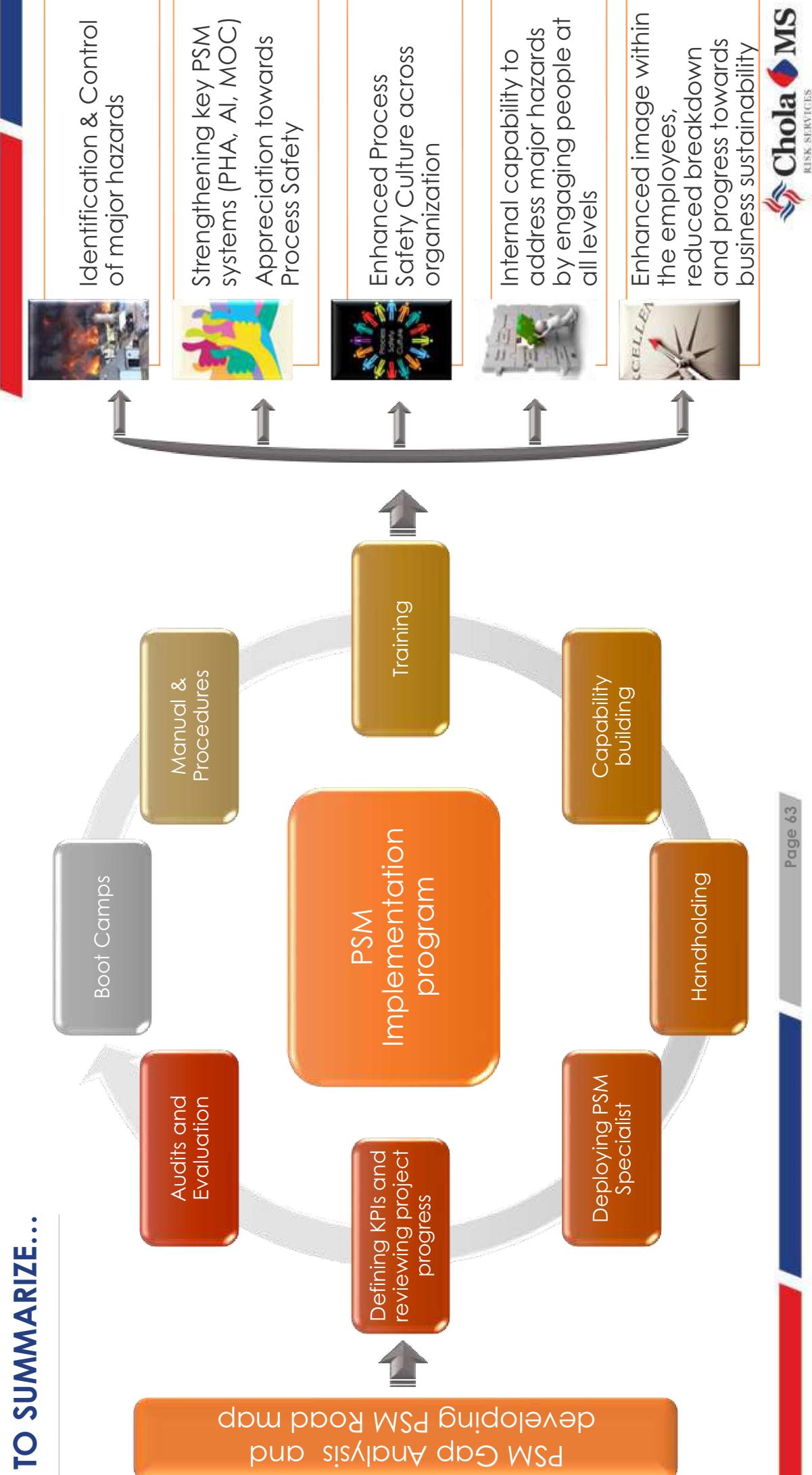
Audits & Evaluation

PSM COMPLIANCE AUDIT

PSM compliance audit

- PSM compliance audit on completion of engagement
- Assessment of the effectiveness of PSM implementation program

TO SUMMARIZE...

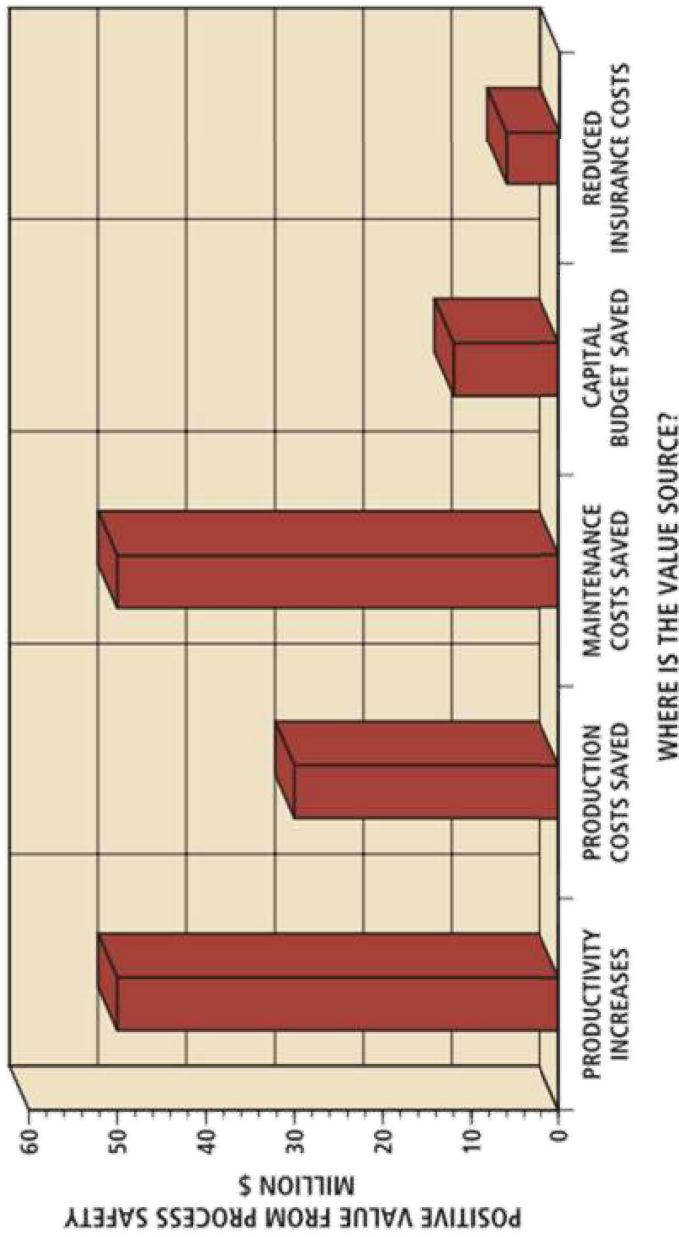


Expected Gains from PSM implementation

| PSM Elements | Gains |
|--|--|
| Process Technology | <ul style="list-style-type: none"> ▪ Updated & Easily Accessible Process documentation |
| Process Hazard Analysis | <ul style="list-style-type: none"> ▪ Structured analysis for Layers of Protection ▪ Timely completion of PHA studies and recommendation |
| Operating Procedures & Safe Practices | <ul style="list-style-type: none"> ▪ Up to date Operating Procedures & Safety Procedures |
| Management of Change –Technology | <ul style="list-style-type: none"> ▪ Review of Hazards before implementing any change |
| Mechanical Integrity & Quality Assurance | <ul style="list-style-type: none"> ▪ Asset Integrity & Reliability |
| Pre Start up Safety Reviews | <ul style="list-style-type: none"> ▪ Safety Review before Facility Start up |
| Training | <ul style="list-style-type: none"> ▪ Systematically trained manpower ▪ Improved compliance of training |
| Contractor Safety | <ul style="list-style-type: none"> ▪ Proper Selection of Contractors, Increased awareness & competence of contractor employee |
| Incident Investigation | <ul style="list-style-type: none"> ▪ Proper Reporting, Investigation & learning ▪ Communication of all Process & Non Process Incidents |
| Management of Change - Personnel | <ul style="list-style-type: none"> ▪ Competency assurance for workforce (new recruitment / internal transfers) |
| Emergency Planning & Response | <ul style="list-style-type: none"> ▪ Improved Emergency Plans & Procedures ▪ Structured Rehearsals |
| Audits | <ul style="list-style-type: none"> ▪ Continuous Assessment & fixing of the identified gaps |

PSM – Sustained Value

- > A study conducted by CCPS shows that companies implemented Process Safety Management program reported significant direct cost benefits as follows:



Source: CCPS – The Business Case for PROCESS SAFETY

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Thank You

