Guidelines on Safety Management System
in Petroleum Industry

Oil Industry Safety Directorate
Government of India
Ministry of Petroleum & Natural Gas
Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate
FOREWORD

The oil industry in India is over 100 years old. As such, various practices have been in vogue because of collaboration/association with different foreign companies and governments. Standardisation in design philosophies and operating and maintenance practices at a national level was hardly in existence. This, coupled with feed back from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD), staffed from within the industry, formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safer operations. Accordingly, OISD constituted a number of functional committees comprising of experts nominated from the industry to draw up standards and guidelines on various subjects.

OISD have brought out a number of documents on various topics like layouts of installations, design, engineering, maintenance and operations of various facilities / equipment etc.

In an economic environment of rising cost of various inputs to the industry, in the form of man, material, machine and increasing cost of health care, it is vital for an organisation to effectively manage occupational safety and health. Benefit may be derived from such management in the form of increased productivity and morale. These benefits are a direct consequence of the reduction in workplace accident, injuries and illness. If workmen are to remain productive, they must be protected from injuries and illness.

There is an obvious effort to protect our facilities including personnel and managing the issue of safety and health in totality. The present document outlines the areas, in the form of elements, which need to be given due attention with a view to enhance productivity, morale of personnel and image of the organisation.

This document will be reviewed periodically for improvements based on the experience and better understanding.

Suggestions from industry members may be addressed to:

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These documents are intended to supplement rather than replace the prevailing statutory requirements.
COMMITTEE
ON
SAFETY MANAGEMENT SYSTEM

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANISATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leader</td>
<td></td>
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</tr>
</tbody>
</table>

(In addition to the above, several other experts from industry contributed in the preparation, review and finalisation of this document).
# SAFETY MANAGEMENT SYSTEM

## INDEX

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Content</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Scope</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Definitions</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Safety Management System</td>
<td>2</td>
</tr>
<tr>
<td>4.1</td>
<td>Safety Organisation</td>
<td>3</td>
</tr>
<tr>
<td>4.2</td>
<td>Employees Participation</td>
<td>4</td>
</tr>
<tr>
<td>4.3</td>
<td>Process Safety Information</td>
<td>5</td>
</tr>
<tr>
<td>4.4</td>
<td>Process Hazard Analysis</td>
<td>8</td>
</tr>
<tr>
<td>4.5</td>
<td>Operating Procedures</td>
<td>12</td>
</tr>
<tr>
<td>4.6</td>
<td>Training</td>
<td>13</td>
</tr>
<tr>
<td>4.7</td>
<td>Contractors</td>
<td>15</td>
</tr>
<tr>
<td>4.8</td>
<td>Pre-start up Safety Review</td>
<td>16</td>
</tr>
<tr>
<td>4.9</td>
<td>Mechanical Integrity</td>
<td>16</td>
</tr>
<tr>
<td>4.10</td>
<td>Work Permit</td>
<td>23</td>
</tr>
<tr>
<td>4.11</td>
<td>Management of Change</td>
<td>23</td>
</tr>
<tr>
<td>4.12</td>
<td>Incident Investigation and Analysis</td>
<td>24</td>
</tr>
<tr>
<td>4.13</td>
<td>Emergency Planning and Response</td>
<td>28</td>
</tr>
<tr>
<td>4.14</td>
<td>Compliance Audit</td>
<td>31</td>
</tr>
<tr>
<td>4.15</td>
<td>Occupational Health</td>
<td>33</td>
</tr>
<tr>
<td>4.16</td>
<td>Off-the-job Safety</td>
<td>33</td>
</tr>
<tr>
<td>4.17</td>
<td>Customers and Products</td>
<td>34</td>
</tr>
<tr>
<td>4.18</td>
<td>Road Transportation</td>
<td>38</td>
</tr>
<tr>
<td>4.19</td>
<td>Trade Secrets</td>
<td>44</td>
</tr>
<tr>
<td>5.0</td>
<td>References</td>
<td>44</td>
</tr>
</tbody>
</table>
SAFETY MANAGEMENT SYSTEM

1.0 Introduction
An effective Safety Management System is required to prevent hazardous incidents and eliminate or mitigate their consequences. A number of catastrophic incidents in hazardous process industry have drawn attention to the safety of processes. Employees have been and continue to be exposed in their workplace to the hazards of chemicals which may be toxic, reactive, flammable or explosive. The present document emphasises the application of management controls for tackling the risks associated with handling / working with or near to hazardous substances in petroleum industry.

2.0 Scope
This document provides guidelines for development of detailed procedures for Safety Management System and covers the petroleum industry as a whole.

3.0 Definitions

Competent Person : A person duly designated / authorised by the management to carryout a specified job

Material Safety Data Sheet (MSDS): Data sheet incorporating safety information / properties of a chemical / product and useful for handling the material

Incident : An unplanned event (occurrence, condition or action) which did or could have resulted in personal injury or damage to the plant, community or environment.

Near-miss : An incident which does not result any injury or damage to property but has the potential to result in injury and / or property damage.

Process : Any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or on the site movement of such chemicals, or combination of these activities.

For the purpose of this definition, any group of vessels which are interconnected or separate vessels which are located such that a highly hazardous chemical could be involved in potential release should be considered as single process.

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Catastrophic release: A major release involving one or more dangerous substances that leads to serious danger to persons as well as environment both within and outside the workplace and results from uncontrolled developments.

Critical equipment: refers to columns, vessels, machinery, piping, interlocks, and controls determined by management to be vital for preventing the occurrence of a catastrophic release.

Facility: Buildings, containers, piping and equipment that could reasonably be expected to participate in catastrophic release as a result of being physically interconnected or of their proximity and in which hazardous substances are used, stored, manufactured, handled or moved.

Process Hazard Analysis: Process Hazard Analysis (PHA), sometimes called process hazard evaluation, is an organised and systematic effort to identify and analyse the significance of potential hazards associated with the processing or handling of highly hazardous chemicals.

4.0 Safety Management System
System for managing safety intend to cover all aspects of plant and facilities like to control loss to personnel, equipment, material and environment. Objective of developing such a system is to standardise the procedures which should continue to be followed by one and all unless a change in the system is duly authorised by a competent person. Such a Safety Management System should comprise the following basic elements:

1. Safety Organisation
2. Employees Participation
3. Process Safety Information
4. Process Hazard Analysis
5. Operating Procedures
6. Training
7. Contractors
8. Pre-startup Safety Review
9. Mechanical Integrity
10. Work Permit
11. Management of Change
12. Incident Investigation and Analysis
13. Emergency Planning and Response
14. Compliance Audit
15. Occupational Health
16. Off-the-job Safety

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17. Customers and Products
18. Road Transportation
19. Trade Secrets

Each of these elements should be taken care of as given below:

4.1 Safety Organisation

4.1.1 Safety Policy
Every organisation should have safety policy duly approved by the Board of Directors of the organisation. It should contain intentions and commitment from the top management. It should be made available to all employees in a language easily understood.

It should be displayed at various locations in the organisation.

Organisational set-up for implementation and monitoring of safety policy should be in place. Safety target and objectives for each position in the organisation should be set and pursued. It should be revised as and when required.

4.1.2 Safety Committees
Safety Committees should be formed in the organisation. The Committees should encourage employees participation.

It should meet at least once in a quarter and minutes of the meetings should be recorded.

Deliberations of safety reports, audits, incident enquiries should be a part of agenda of safety meetings.

For implementation of safety committee recommendations, time bound programme should be enforced.

4.1.3 Enforcement of Safety
In the organisation, Safety should be ensured through repeatedly highlighting it's utility in preventing loss of life and property and providing training / retraining to employees in safe working. Following modes should be followed for enforcing safety:

a) Work Permit System
b) Job safety analysis
c) Training of employees and contractors

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d) Surprise checks  
e) Drills  
f) Operating manuals / Safety manual  
g) Periodic MIS reports for monitoring by top management  

4.1.4 Monitoring of Systems  
Following systems should be monitored regularly for effective implementation:

a) Checking of safety interlocks  
b) Internal audits of plants / facilities in line with OISD-STD-145  
c) Management of change  
d) Testing / Inspection of equipment  
e) Checking of fire detection and protection system  

4.1.5 Safety Promotion  
Visuals play an important role in reminding personnel of safety information. Therefore, display of following information should be done in the premises:

(a) Safety precautions for critical operations at strategic locations  
(b) Safety posters and slogans  
(c) Safety records  
(d) Do's and Don'ts at toxic chemicals handling/storage/operation areas  
(e) Wearing helmet and other Personal Protective Equipment (PPEs)  
(f) Labeling of chemicals  
(g) Material Safety Data Sheet (MSDS)  
h) Safety manuals, Rules and Regulations  
l) Safety News Letters & bulletins  
j) Dissipation of incident information  

4.2 Employees Participation  
Following activities should be undertaken to involve employees in the working of the plants / facilities:

1. Company should develop a written action plan to implement the employees’ participation.  
2. Employees should be involved in Internal Safety Audits and Job Safety Analysis.  
3. Employees should be explained about operation of the plant, including safety & health hazard associated with products & work environment.

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4. Employees should be trained on use of personal protective equipment (PPE).

5. Means & methods should be established to keep employees informed about relevant safety & health issues.

6. Safety & health committee at floor level should be formed with participation of employees & employer's representatives to review safety & health related issues of the plant. The committee should meet periodically to discuss the relevant issues & suggest and implement remedial measures.

7. Written information about process, chemicals including MSDS and equipment should be accessible to employees.

8. Critical procedures & instructions should be prepared in English and in a local language, understood by employees.

9. Employees should be involved in management of change related to process & equipment.

10. Safety quiz / suggestion schemes / competitions etc. should be conducted to enhance participation of employees.

4.3 Process Safety Information
Process safety is defined as the operation of facilities that handle, use, process or store hazardous materials in a manner free from episodic or catastrophic incidents. Knowledge of chemicals, process and plants is one of the prime asset. This knowledge is required for developing other modules of the management system like process hazard analysis, operating procedures, training, emergency preparedness plans etc.

4.3.1 Process Information
Complete and accurate written information should be compiled for the following three categories:

1) Process chemicals
2) Process technology
3) Process equipment

This information should represent current operation. All data sheets, drawings, specifications and other documents should be updated / revised based on the present condition of the process. Care should be taken for incorporation of all modifications. Field verification of drawings

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to ensure consistency with the actual process equipment and arrangement may be made.

Information should be so located that it can be easily available at the time of need. Computerisation of the information is desirable. It facilitates easy up-dation and retrieval. It may be put on local network for easy accessibility by all concerned.

A master-index indicating the location of information and the medium in which it is available should be prepared.

4.3.2 Process Chemicals
Process chemicals should include all raw materials, intermediates / finished products and chemicals used in the process. Data pertaining to process chemicals should help in assessing fire and explosion characteristics, reactive hazards, safety and health hazards to workers and the corrosion and erosion effects on the process equipment. Complete inventory of the process chemicals should be prepared. For each process chemical, following information should be available wherever applicable:

(A) Physical properties:
Physical state, calorific value, heat of vapourisation, Boiling point, Vapour pressure, Melting / Freezing point, Vapour density & specific gravity

(B) Fire & explosion Hazards:
Flash point, Auto-ignition Temperature, Explosive limits, Burning rate

(C) Reactive Hazards:
The tendency of the material to react violently when subjected to heat or the presence of other process chemicals, water, air (oxygen) or other possible contaminants.

Hazardous combustion/decomposition products.

(D) Health Hazard Data:

Personnel exposure hazard properties (long term & short term)

Information of toxicity of the material and exposure limit values such as Threshold Limit Value (TLV), Short Term Exposure Limit (STEL), Permissible Exposure Limit (PEL), Lethal Dose 50 (LD 50) etc.
(E) Corrosive properties of the chemical, runaway reaction and over-pressure hazards

(F) Information on fire fighting media, use of personal protective equipment (PPE), emergency treatment for exposure and release / spill containment.

Note:
Material Safety Data Sheet (MSDS) : OISD-STD-114 on 'Hazardous Chemicals and Their Handling’ may be referred.

4.3.3 Process Technology

Process technology information should include the following:

a) Written process descriptions

b) Process chemistry

c) Process Flow Diagrams (PFD)

d) Safe operating limits of process parameters like pressure, temperature, flow rate etc. and the consequences or results of deviation that could occur if operating beyond the established process limits

e) Maximum inventory levels for process chemicals

f) Material and energy balances

A block flow diagram (BFD) showing major process equipment and pipelines is a preliminary tool for understanding about the process. Flow rates, pressures, temperatures and stream composition may be indicated for better clarity.

Process flow diagrams (PFD) are more elaborate than block flow diagrams. PFD should indicate all main streams including critical valves. Major process parameters like flow rate, temperature and pressure should be indicated at the ins and outs of major process equipment and at the control points. Whenever necessary, pump capacities, compressor power and other such relevant information may be mentioned. Major control loops and key utilities may be preferably shown in the PFDs.

Piping and instrument diagrams (P&ID) are the detailed representation of the plant. Each and every piece of equipment, pipelines, valves and

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instrument along with their interconnection are shown and most appropriate to show relationship between equipment and instrument. Information mentioned under PFD and all the components of the control loops are depicted to enhance clarity. P&IDs should be updated whenever any modification is carried out.

4.3.4 Process Equipment
Process equipment include columns, vessels, heat exchangers, reactors, pumps & compressors, valves, piping; drilling rigs & work-over rigs; cross country pipelines; tanks, loading & un-loading facilities and other equipment that contain process chemicals. Design data of process equipment should be documented and should include the following:

a) Materials of construction

b) Design specifications

c) Codes, standards and industry accepted engineering practices used for design and fabrication

d) Electrical classification

4.3.5 Design basis for the pressure relief system and arrangement of shut-down & interlock system should be documented.

4.3.6 For the existing plants where the codes used for design are no longer in general use, design and construction of such equipment should be documented. It should be ascertained that the equipment is still suitable for its intended use and testing/inspection carried out for this purpose should be documented.

4.3.7 When process technology requires departure from applicable codes, it should be documented that the equipment is suitable for the intended use.

4.4 Process Hazard Analysis
The purpose of Process Hazard Analysis (PHA)) is to minimise the likelihood of the occurrence and the consequences of a dangerous substance release by identifying, evaluating and controlling the events that could lead to the release.

A PHA provides information which assists in making decisions for improving safety and reducing the consequences of unwanted or unplanned releases of hazardous chemicals.

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The PHA of existing facilities should be performed in order of priority in terms of hazards of the process. A preliminary hazard analysis may be useful in determining the coverage of the process safety management standard. The factors like quantities, susceptibility to failure, mode of failure, proximity, severity, process complexity, operating history etc. should be considered while establishing priority.

In performing the PHA for a new process or facility, special consideration should be given to previous experience with the process and design circumstances, such as shorter-than-normal design periods or changes in the design team or the design itself after the project is under way.

4.4.1 Conducting Process Hazard Analysis (PHA)
Following considerations should be taken into account for conducting PHA:

1) A process hazard analysis should be performed for all facilities and processes.

2) The process hazard analysis should be appropriate to the complexity of the process.

3) The priority order of conducting process hazard analysis should be determined and documented based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process.

4) A PHA is directed toward analysing potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals and major spills of hazardous chemicals.

5) The PHA focuses on equipment, instrumentation, utilities, human action (routine and non-routine), and external factors that might impact the process. These considerations assist in determining the hazards and potential failure points or failure modes in a process.

6) The process hazard analysis should also address:
   a) Human factors
   b) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

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4.4.2 Basic Steps
Steps to be incorporated in PHA should include:

a) Identification - Based on the process safety information, expertise and experience with similar facilities, failure scenarios that could result in catastrophic release should be identified.

b) Assessment - The likelihood and consequences of the failure scenarios should be assessed using qualitative or quantitative techniques judged to be appropriate.

c) Alternatives - Feasible changes to reduce the risk of occurrence and the consequences of the failure scenarios should be identified.

4.4.3 Methodology and Technique
The selection of PHA methodology or technique should be influenced by many factors including the amount of existing knowledge about the process, age of the process, operational experience of the process, changes, limitations and assumptions.

The PHA should take an orderly, systematic approach. One or more of the following methodologies that are appropriate to identify, determine and evaluate the hazards of the process being analysed should be used. What if, checklist, Hazard and Operability Study (HAZOP), Failure Mode and Effects Analysis, Fault Tree Analysis, an appropriate equivalent methodology.

The application of PHA may involve the use of different methodologies for various parts of the process. A process involving a series of unit operations of varying sizes, complexities, and ages may use different methodologies and team members for each operation. The conclusion can be integrated into one final study and evaluation.

When there is large continuous process which has several control rooms for different portions of the process such as for distillation tower and blending operation, each segment can be done separately and then integrate the final results.

4.4.4 The Team
The process hazard analysis should be performed by a team with expertise in engineering and process operations, and the team should include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team

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must be knowledgeable in the specific process hazard analysis methodology being used. Following aspects should be considered while constituting such teams:

a) The team conducting the PHA should understand the methodology being used.

b) The team should have intimate knowledge of the standards, codes, specifications, and regulations applicable to the process being studied.

c) The selected team members need to be compatible.

d) The PHA team can vary in size from two people to number of people with varied operational and technical back ground.

e) The team members should be fully knowledgeable in the proper implementation of PHA methodology that is to be used and should be impartial to the evaluation.

4.4.5 Frequency
The process hazard analysis should be updated and revalidated by a team, having requisite back ground, at least every 5 years after the completion of initial process hazard analysis.

The PHA for a new process or facility or modification in existing facility and recommendations resulting from the PHA should be completed before start-up.

4.4.6 Recommendations and Follow up
Following approach should be adopted once recommendations of Process Hazard Analysis are made available:

1. System to promptly address to the team’s findings and recommendations should be established.

2. Recommendations should be resolved in a timely manner and resolution should be documented.

3. Written schedule should be drawn for completion of the recommendations and should be monitored.
4. The actions taken should be communicated to the operating, maintenance and other employees who may be affected by the recommendations or the actions.

5. Process hazard analysis, updates or revalidation for each process as well as the documented resolutions of recommendations should be retained for the life of the process.

4.5 Operating Procedures

4.5.1 Operating procedures describe tasks to be performed, data to be recorded, operating conditions to be maintained, samples to be collected and safety & health precautions to be taken. Written down operating procedures should be available for all process plants for safe operation.

4.5.2 Operating procedures should be based on process safety information so that all known hazards are taken care of. Operating parameters should be consistent with the process safety information.

4.5.3 The operating procedures should provide specific instructions on what steps to be taken or followed while carrying out the following:

(a) Startup - including procedure for initial startup of the process or equipment as well as startup after normal and emergency shut downs.

(b) Normal operation - including limits of the "normal" operating ranges for parameters such as pressure, temperature and flow, the consequences of operating outside these limits, and the actions that should be taken to correct or avoid deviation from the normal ranges.

(c) Temporary operation - including special requirements while operating in the temporary mode and the acceptable duration of the temporary operating mode.

(d) Normal shut-down - including actions to be taken to safely shut down the process or equipment and conditions to be avoided.

(e) Emergency operation and shut-down - including the conditions under which an emergency shut-down is required. This should also include assignment of authority and responsibility to qualified operators to ensure that shutdown is executed in a safe and timely manner.

4.5.4 Operating instructions should be specific to the plant / facility.

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4.5.5 Operating manuals should contain hazards of exposure of the chemicals being handled. Preventive methods and control measures adopted for exposure protection should be clearly brought out. These information may be provided in a separate volume of the operating manual. MSDS provides majority of such information. Operation manuals should also describe the following:

I. Purpose and function of safety interlocks
II. Equipment handing over procedure
III. Work permit system
IV. Fire protection/fighting facilities

4.5.6 Manuals should be available to the employees. All operators must understand thoroughly and should be fully conversant with the operating manual. Training should be imparted to the operators on operating procedures and should be certified as competent.

4.5.7 Computerised process control system has added a new dimension. Logic of the software and relationship between the equipment and the control system should be described.

4.5.8 Operating manuals should be updated as often as necessary. Every year, operating manuals must be certified as updated by competent person.

4.6 Training
Personnel in the plant / facilities should be trained and retrained for improving their understanding and upgrading skill in their area of work based on identification of their training needs.

4.6.1 Initial Training
Each employee, before being involved in operating a newly assigned process, should be trained in an over view of the process and in the

a) operating procedures viz., initial startup, normal operations, temporary operations, emergency shutdowns including the conditions under which emergency shutdown is required, emergency operations, normal shutdown and startup following a turnaround or after an emergency shutdown.

b) Operating limits viz. consequences of deviation and steps required to correct or avoid deviation.

c) Safety and health considerations viz. properties of, and hazards presented by, the chemicals used in the process, precautions

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necessary to prevent exposure, including engineering / administrative controls and PPEs.

d) Control measures to be taken if exposed (physical, airborne), Quality control for raw materials and control of hazardous chemical inventory levels and special/unique hazards

e) Safety systems and their functions

f) Each employee should be given training on operating procedures & safe work practices, emergency preparedness or disaster management plan, safety procedures, work permit system and areas pertinent to process safety & health.

g) Each employee should be explained action to be taken in the event of unwanted release of hazardous chemicals.

The training should also include/reflect

I. current operating practice, changes that result from changes in process chemicals, equipment and facilities;

II. on safe work practices to provide for the control of hazards during operations such as lockout / tagout, confined space entry, opening process equipment and piping and maintenance.

4.6.2 Refresher Training

Refresher training should be provided at-least every three years and more often, if necessary to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process.

4.6.3 Training Documentation

Record should be prepared containing the identity of the employee, the date of training and the means used to verify that the employee understood the training.

Refer OISD-STD-154 for further information.

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4.7 Contractors
In petroleum industry where contractors are deployed to accomplish various types of jobs of different nature, it is very much essential to formulate an elaborate system for ensuring their safety at work place. Suitable space for contractors camp, if required, inside factory area for any construction activities to be made available at a safe distance from hazardous area. The camp should be dismantled on completion of the job. To meet the requirement, following measures should be incorporated in the system:

1) Management should ensure that contractor personnel are trained in the work practices necessary to perform their job safely.

2) Contractor should provide & maintain work places, plant, equipment, tools, machinery and so organise construction work that as far as reasonably practicable, there is no risk of accident or injury to workers.

3) Contract personnel are to be informed about the known potential fire, explosion or toxic release hazards related to their job & the process and in the applicable provisions of the emergency preparedness plan.

4) Contractor must ensure that each of their personnel has received and understood their roles in safe working practices by preparing a record and should verify the efficacy of dissemination of the safety information. He should also ensure use of PPEs at work place.

5) Contractor should ensure that each of their personnel follows the safety rules of the owner's facility including safe work practices.

6) Contractor should keep owner informed about any unique hazard presented by their personnel's work.

7) Management should ensure for regular safety inspection of its own as well as contractors' construction equipment / tools & tackles by competent person

8) Contractor should assign workers only that job for which they are suited by their age, physique, state of health and skill.

9) Contractor should be made responsible for application & enforcement of safety & health measures in respect of the workers at site and should maintain constant liaison with management.

10) Management, while selecting a contractor, should obtain information regarding their safety performance.

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4.8 Pre-startup Safety Review
One of the most critical period in an operation is the start up of the process. Before a new or modified unit is started, a systematic check should be made to ensure that the equipment has been installed properly, operating procedures have been reviewed, items needing attention from PHA’s have been resolved and personnel have been trained. The main purpose of the review is to reduce chance of some item being overlooked that could create a hazard or introduce un-expected safety problem as process is brought to normal operating conditions.

The management should perform a pre startup safety audit for new facilities, for modified facilities when the modification is significant enough to require a change in the process safety information as well as for startup of existing facility / plant after turn around.

Pre startup safety review should confirm that construction is in accordance with design specifications. Safety, operating, maintenance and emergency procedures are in place and are adequate.

For new facilities, process hazard analysis is performed and recommendations have been resolved or implemented before start up and modified facilities meet the requirements contained in management of change

4.9 Mechanical Integrity
Mechanical integrity of the plant or the facility need to be ensured so as to perform intended activities without the chances of its failure. Following aspects should be taken into considerations:

1. Applicable requirements of the codes of practices should be met or exceeded & mechanical integrity should be maintained by use of clearly defined maintenance, inspection and corrosion control procedures.

2. Equipment used to process, store or handle hazardous materials should be designed, constructed, installed and maintained to minimise the risk of releases of such materials.

3. The overall maintenance plan should be drawn taking into consideration the safety, reliability and quality objectives.

4. Feedback from maintenance activities should be given to other elements of safety systems i.e. design & operations for up-dation of P&IDs and operating manuals as required.

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5. Safety aspects with regard to organising maintenance activities should be focused in the maintenance plan and prioritised as below:

(a) Annual plan
(b) Tasks and responsibilities
(c) Manpower (number and type)
(d) Contractors, if any
(e) Equipment control and calibration
(f) Control of spare parts
(g) System of work permits, records
(h) Recording of conditions of parts during use and replacement
(i) Incident reporting

6. The procedures, methods and techniques should be so selected as to eliminate risk in carrying out maintenance activities.

4.9.1 Mechanical Integrity Program

Mechanical integrity program should be in place to assure continued integrity of process equipment. The appropriate working procedures, methods and techniques should used, which are considered most fit for the purpose and in line with the codes of practices.

Elements of mechanical integrity program should include:

(a) Identification and categorisation of equipment and instrumentation, inspection and tests, training of inspection personnel, testing and inspection frequencies, development of maintenance procedures, the establishment of criteria for acceptable test results, documentation of test and maintenance results, and documentation of manufacturer recommendations as to meantime to failure for equipment and instrumentation.

(b) The information pertaining to process equipment design should be documented as to what were the codes and standards relied on to establish good engineering practice.

(c) Documented system should be in place to confirm that equipment complies with recognised and generally accepted good engineering practices.

(d) For existing equipment designed and constructed in accordance with codes, standards or practices that are no longer in general use, it should be determined and documented that the equipment is designed, maintained, inspected, tested and operating in a safe manner.

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4.9.2 Equipment Data

Information should be documented covering following:

1. The list of process equipment and instrumentation should be compiled and categorised to be included in the mechanical integrity program. The list should include pressure vessels, storage tanks, process piping, relief and vent systems, fire protection system components, emergency shut down systems, and alarms and interlocks and pumps.

2. The list of equipment should be prioritised to determine which piece of equipment requires closer scrutiny than others.

3. Information pertaining to the equipment in the process should include material of construction, piping and instrumentation diagram, electrical classification, relief system design and design basis, ventilation system design, design codes and standards employed.

4.9.3 Inspection and Testing

This should consider the following:

1. Inspection and testing should be done on all process equipment.

2. Inspection and test procedures should follow recognised and generally accepted good engineering practices.

3. Each inspection and test done on equipment and its components should be documented.

4. The applicable national / inter-national codes and standards provide criteria for external and internal inspections including frequency and methodology which should be adhered to.

5. Procedures should be developed and be in place to ensure that tests and inspections are conducted properly and that consistency is maintained even where different employees are involved.

6. Internal inspections should cover items such as vessel shells, bottom and head, metallic linings, thickness measurement for vessels and piping, inspection for erosion, corrosion, cracking and bulge, internal equipment like trays, baffles, sensors and screens for erosion, corrosion, or cracking and other deficiencies.

7. The relevant OISD standard and guidelines should be used for developing inspection and maintenance systems.

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8. Frequency of testing / inspection should be based on following considerations:

a) Meantime between failure of various instrumentation and equipment parts would be known from manufacturer's data or operating experience with the parts which will influence the inspection and testing frequency and associated procedures.

b) Failure data from operating experience should be documented and analysed.

c) The frequency and methodology of test of process equipment should be consistent with applicable manufacturer's recommendations, national/international codes, OISD standards / recommended practices / guidelines, good engineering practices. Such inspections/testing should be done more frequently if determined to be necessary by prior operating experiences.

4.9.4 Non-routine Work Authorisation

Following issues should be considered:
1. All non-routine jobs should be carried out in line with OISD-STD-105.

2. List of non-routine jobs should be prepared and procedures defined to carry out them.

3. Roles and responsibilities for work authorisation, issue/receipt of permit, handing over, taking over should be documented and implemented.

4. In case of any change in procedures and practices system of proper authorisation should be instituted.

4.9.5 Maintenance Procedures

The maintenance programs and schedules should be reviewed and analysed to see if there are areas where break down maintenance is used rather than an ongoing mechanical integrity program consisting predominantly of preventive & predictive maintenance.

1. The maintenance procedure should address the safety aspects with regard to organisation of maintenance (system of work permit and non-routine work), determining whether execution should be on line/off-line, regulations to be followed, harmonising with operation, incident reporting system, maintenance analysis, do it one self or contract out.

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2. Use of personal protective equipment should be laid down for specific maintenance activities.

3. The task, role and responsibilities should be defined.

4. Records of trend analysis of machine and equipment should be taken into consideration.

5. The risks associated with different phases of maintenance should be established.

6. All maintenance procedures should be duly authorised.

7. Maintenance manual should be formulated, regularly certified, updated and approved.

4.9.6 Inspection and Test Results

Inspection programme should cover the following:

a) Each inspection and test performed on the process equipment should be documented.

b) The list of process equipment, components, instruments should be made for inclusion in the mechanical integrity/maintenance program.

c) The documentation should identify the date of inspection or test, the name of the person who performed the inspection and test, the serial number or other identifier of the equipment on which the inspection and test was performed, a description of the inspection or test performed and the results of the inspection or test.

4.9.7 Criteria for Accepting Equipment after Maintenance

Following considerations should be taken into account while accepting equipment after maintenance:

1. Equipment that has been out of service for maintenance should be taken over after due testing and documentation.

2. Criteria for acceptable test results should be well defined taking into consideration codes of practices, manufacturer’s recommendation, anticipated life and operating experience.

3. Any deviation accepted should be approved by competent person.

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4. Equipment deficiencies which are outside acceptable limits as defined by the process safety information should be corrected before further use or in safe and timely manner when necessary means are taken to assure safe operation.

5. Proper records for handing / taking over of equipment to be maintained.

4.9.8 Documentation of Manufacturer's Recommendations

Documentation should cover:
1. Manufacturer's recommendations for periodic inspection / testing / maintenance of equipment supplied by them should be documented.

2. In case of any deviation from the inspection procedure as recommended by manufacturers reason for the same should be documented.

4.9.9 Training of Maintenance Personnel

Training aspects should consider:
1. Appropriate training is to be provided to maintenance personnel to ensure that they understand the preventive maintenance program procedures, safe practices, and the proper use and application of special equipment or unique tools that may be required.

2. Maintenance training should be integrated with overall training program and records should be documented.

3. The frequency and contents should be in line with OISD-STD-154.

4.9.10 Line of Defence

Following aspects should be considered for safety of plant:
1. The first line of defence is to operate and maintain the plant and the process as designed and to keep the hazardous materials contained.

2. This line of defence is backed up by the next line of defence which is the controlled release of materials through venting to scrubbers or flares, or to surge or overflow tanks which are designed to prevent unwanted releases.

3. The above two are the primary line of defence or means to prevent unwanted releases. The secondary line of defence would include fixed fire protection system like sprinklers, water spray or deluge systems, monitors etc. Dykes, designed drainage systems and other systems.

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will control or mitigate hazardous chemicals once an unwanted release occurs.

4. The primary and secondary lines of defence should be protected by mechanical integrity program and strengthened where ever necessary.

### 4.9.11 Quality Assurance

The quality assurance program is an essential part of mechanical integrity program and will help to maintain the primary and secondary line of defence that have been designed into the process to prevent / control / mitigate unwanted chemical release. This require following:

1. In the construction of new plants and equipment, it should be ensured that equipment as it is fabricated is suitable for the process application for which they will be used.

2. Appropriate checks and inspections should be performed to ensure that the equipment is installed properly and consistent with design specifications and the manufacturer's recommendations.

3. The quality assurance system is needed to help that the proper materials of construction are used, that fabrication and inspection procedure are proper, and that installation procedures recognise field installation concerns.

4. The maintenance materials, spare parts and components should be suitable for the equipment for which they will be used.

5. 'As built' drawings, together with certifications of coded vessels and other equipment and materials of construction need to be verified and retained in the quality assurance documentation.

6. Equipment installation jobs should be properly inspected in the field for use of proper materials, and procedures and to assure that qualified craftsmen are used to do the job.

7. Use of appropriate gaskets, packing, bolts, valves, lubricants and welding rods should be verified in the field and documented.

8. The procedures for installation of safety devices should be verified such as torque on the bolts on rupture disc installations, uniform torque on flange bolts, proper installation of pump seals etc.

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9. If the quality of the parts is a problem, it may be appropriate to conduct audits of the equipment supplier's facilities to better assure purchase of required equipment which is suitable for intended use.

10. Any change in equipment that may become necessary will need to go through the management of change procedures.

11. Calibration / standardisation of all equipment required for fabrication.

4.10 Work Permit
In case work is required to be performed in the plant / facility by any person other than the operating personnel of that area, a duly authorised written permit should be obtained by the person / agency executing the work before commencement of the work.

Based on the nature, the work would be undertaken under different types of permits. For example, following jobs should be undertaken with the duly issued hot work permit:

Cutting, Welding, Excavation, Road/Dyke cutting, Electrical lock out / Energising, Confined space entry, Boxing up of a vessel, Working on fragile roof structures, Radiography, Material Handling in operational areas, Crane operation etc.

Refer OISD-STD-105 on Work Permit System for details.

4.11 Management of Change
Management of Change refers to implementing any change intended to bring in any of the inputs to the plant / facility.

Primarily, plants are modified or changed in order to achieve higher efficiency, improve operability and safety, reliability, to accommodate technical changes etc. Another objective of carrying out such modifications / changes may be to prevent mishaps, improve utilisation and optimisation of facilities, reduce downtime, reduce risk to public, enhance knowledge of plants and process activities.

The procedure for management of change should cover review of the specification of piping and equipment, process engineering, instrumentation, maintenance, relief, safety, health, environment etc. After implementation of the changes, the training of personnel in accordance with the changed process, updation of document, equipment history cards, data sheets etc. to be taken care of before commissioning of plant / facilities.
The modifications may require changes in process / technologies, hardware, addition, alteration or removal of an equipment or a part of it from the plant, in piping system and process equipment, replacement of equipment or machinery that differs from the original equipment, change in metallurgy, change in instrument which may include pressure, temperatures, flow, set points, alarm points, speed, logic and control parameters.

The procedure should be established and documented for implementing a change covering all the stages like commissioning, operation, inspection, maintenance, review of performance of the plant / facility.

Refer OISD-GDN-178 "Guidelines for Management of Change" for details. This should be followed by all plants and facilities.

4.12 Incident Investigation and Analysis

For the management, an incident investigation is a critical feedback about the system of control of a hazard. Feedback control involves gathering information about an occurrence or completed activity, evaluating that information and taking steps to improve the situation in the future. This form of control is valuable as it helps prevent recurrence of the incident.

An incident is a failure in the control of any hazard that results in unplanned event like fire, explosion, runaway reaction release of toxic or flammable material, injury or fatality. A workplace incident is an indication that prevention was ineffective and that prompt changes need to be made.

Feedback control gives management the capability to use information on past performance to improve upon future performance and to meet planned objectives and acceptable standards.

A nearmiss incident is a little better situation in that it is a warning given before actual injury. It gives an opportunity for concurrent control which has the advantage of permitting corrective action before an injury, illness, death or property loss.

Therefore, every incident and nearmiss incident must be recorded and thoroughly investigated.

4.12.1 When to investigate

Incident investigation should be initiated as promptly as possible but not later than 24 hours following the incident.
4.12.2 The Objectives of the Incident Investigation
The basic purpose of an incident investigation is to determine the cause of the incident and to formulate a system to prevent reoccurrence of such incidents.

4.12.3 Who Should Investigate
The immediate and first level investigation should be performed by the immediate supervisor of the effected area. The immediate supervisor is closest to the scene, knows the nature of the work, the employees who do the work, and the nature of the hazards associated with the work.

4.12.4 What should an Investigation Report Contain
A detailed investigation report, prepared at the conclusion of the investigation, should include at a minimum the date of incident, date that the investigation began, a description of the incident, the factors that contributed to the incident, and recommendations resulting from the investigation. Refer OISD-STD-107 format for further details.

4.12.5 Review of the Initial Investigation
The results of the investigation should be presented to and reviewed with the next higher level supervisor.

4.12.6 The Role of the Safety Professional
A Safety professional should also be called in to review the investigation. An independent review and a second opinion in such situations will help.

If necessary, a second investigation should be performed. The safety professional can conduct a joint investigation with the primary investigation.

The primary safety responsibility still rests with the immediate line management. When the nature of the accident is complex and the causative factors are elusive, an outside expert can be engaged to provide additional knowledge. For accidents involving hazardous chemicals or exposure to toxic substances, the services of an industrial hygienist may prove valuable.

4.12.7 Investigation by the Committee
In case of major incident, management should establish multi-disciplinary team to enquire into the incident. Such safety Committee for an accident investigation has the advantages of bringing in a good mix of knowledge / viewpoints as also injects a new dose of objectivity into the investigation.

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In case of catastrophe or disaster where the losses are very large and the consequences are severe, a senior level of inquiry or investigation may be instituted and assigned with completing an independent investigation.

4.12.8 Salient Parameters for Incident Investigation

The incident investigator's job is to gather all available information to essentially explain how the accident happened and how the occurrence may be prevented.

The investigation should be open to input from all persons who were directly or indirectly involved in the accident. The primary thrust of the investigation should not be to cast blame but should be to prevent its reoccurrence.

The six key questions that should be asked and answered are who, what, where, when, how, and why as below:

(1) "Who" Questions
   Who was injured? Who witnessed the accident? Who was involved in responding to the accident? Who contributed to causing the accident, if any? Who has immediate responsibility for safety and health of the work area?

(2) "What" Questions
   What occurred (the complete sequence of events should be determined). What equipment, process, or facility was involved? What chemicals or energy was involved? What Safety controls failed to protect? What did the injured worker do or not do? What did others do or not do? What did management do or not do? What Safety factors did management fail to recognize and evaluate?

(3) "Where" Questions
   Where did the incident happen? Where was the immediate supervisor / operating personnel at the time of the accident?

(4) "When" Questions
   When did the incident happen? When did controls fail to protect? This question should not be answered by a simple hour, day, and month answer. The time of occurrence in relationship to the process cycle and equipment timing must be determined. So is the time in relationship to the work activities of other workers in vicinity / related functions.

(5) "How" Questions

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How did the incident happen? How did all the physical conditions and human behavior come together and combine to cause the accident? How well did the safety controls (all types from engineering to administrative) work or fail? How was personal protective equipment used or not used?

(6) "Why" Questions
Why did the incident occur? Why the controls fail to protect? Why did the workers not recognize the hazard. Why did the worker fail to evaluate the hazard. Why was management unable to prevent the incident from taking place?

Some of the above questions overlap, but the investigation must be thorough. Regardless of the investigation is being done by the first line supervisor or by a Committee, the above questions should be raised and the best answers found. The accident can then be properly analyzed after getting the above questions answered.

4.12.9 Analysis of the Incident
After all the facts and data have been gathered, the information must be analyzed. The function of analysis is to organize the information and mentally synthesize the raw information into useful ones to arrive at conclusion.

4.12.10 Follow-up Questions
If necessary, after the initial facts have been collected and digested, a set of follow-up questions may be raised. Like a computer routine, the same Who, What, Where, When, How, and Why questions may be pursued except with greater accuracy. The basic idea is to fine-tune the inquiry until the sharpest picture of the accident has been obtained.

4.12.11 Findings Should be Put into a Written Report
A major accident or exposure will generate a significant amount of investigative work. The effectiveness of the investigation is enhanced by a well written report. A written report is a permanent record of the results of the investigation.

4.12.12 Communicating the Report
One of the basic purposes of the written report is to communicate the findings of the investigation within and outside the organization. Thus, careful thought must be expended to determine to whom the written report should be released. Additional thought must be given to the legal ramifications of such records and documents.

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4.12.13 Legal Ramifications of the Accident Report
Every written report, document, and physical record have legal ramifications as they have legal significance. The most obvious is that they constitute evidence which may be used during a trial to prove or disprove a fact that is under dispute. For this reason alone, a report should be prepared with the realization that it can, one day, be used as evidence or proof in a legal proceeding.

4.12.14 Post Investigation Actions
A system should be established to promptly address and resolve the report findings and implement recommendations. Resolution and corrective actions should be documented.

The report should be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees when applicable.

Findings should be accessible to all departments and personnel concerned. Communication methods may be safety bulletins, newsletter, meetings, revision of procedures etc. It is important to prepare information in suitable form for the intended recipient.

There should be a system of maintaining an incident database wherein information is properly recorded in a form suitable for easy use.

Trend analysis of causes of incidents is vital and help in setting priorities to reduce risk potential. Information gathered on various incidents provides immediate lessons. In long term, it useful in monitoring performance changes, building up a data base on plant history and trend analysis.

Incident investigation reports to be retained for minimum period of five years in order to determine if an incident pattern develops or exists.

4.13 Emergency Planning and Response
The basis for the Emergency Preparedness Plan should be derived from the hazard analysis and the consequences of identified Maximum Credible Accident scenario. The objective of the emergency plan is to provide a measures to contain and minimise the effects of such incidents.

4.13.1 On-site Emergency Plan should contain the following key elements:
a) Early warning/alarm system
Providing an early warning system is recommended as a standard procedure as it has an advantage of initiating basic action to control over the emergency situation. The warning system can be via telephone, fire sirens etc. Alarm system should have distinctive signal for fire & other emergencies.

b) Immediate response Procedures / Measures
It is essential to list down immediate action in case of an emergency and nominate people / positions to perform the initial task. The people and positions nominated for such task must be available round-the-clock at the site. This goes long way in mobilising further resources in controlling the emergency.

c) Manpower / Organogram and their responsibilities
The organogram should be drawn by appointing key personnel and defining their specific duties, which will be handy in case of an emergency. The number of coordinators at a location would depend on the manpower in location. The roles identified for the positions should be consistent with the normal day-to-day responsibilities of the personnel.

d) Emergency Control Room
The emergency control room location should be identified in the plan. The emergency control room should be set up at a safe location and marked on the site plan. The personnel manning the control rooms and their duties should be identified in the plan. The control room will be activated in case of an emergency to direct and coordinate the operations to handle the emergency. It should be furnished with external and internal telephone connections, PA / Paging / VHF etc.; list of essential telephone numbers; list of key personnel and their address; fire fighting system and site plan. Depending upon site requirements, additional control room can be considered.

e) Resource Mobilisation Plan (internal / external)
The emergency plan must contain resource mobilisation scheme so that key personnel will be able to activate the scheme to mobilise the internal & external resources within shortest time available. Such plan must contain identified resources needed and its availability, location and activation methods.

f) Mutual Aid
It is one of the major resources for fire fighting and emergency handling. Mutual aid arrangements are to be worked out in the

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plan to facilitate additional help in the event of fire fighting or in rescue operation by way of rendering manpower, medical aid or fire fighting equipment etc.

**g) Evacuation procedures / Assembly Points**
In a major emergency, if it is essential to evacuate the non-essential personnel from affected area it is advisable to have a plan for evacuation. There should be pre-designated areas where the personnel like workers, staff, contractor workers etc. not involved in emergency operations (as per Emergency Preparedness Plan) should assemble in case of an emergency. Depending on the location of the emergency, the assembly point can vary. For each potential hazardous zone, a specific assembly point(s) should be identified and marked on the zones/maps. During emergency, Pre-designated persons would take charge of this point and plan for necessary evacuation.

**h) List of Attachments, Sketches**

i) Layout showing various facilities, fire fighting system, hazardous zones and accompanying assembly point(s) and control room.

ii) Address and telephone numbers of Emergency coordinators and key persons in the location; Mutual aid members; Fire Brigade; Police and Hospitals; Higher officials at region / zone / HO; Government officials like District Collector, Inspector of Factories, Commissioner of Police; Local controller of Explosives.

iii) List of fire fighting & safely equipment available at location.

iv) List of Do's and Don'ts during emergency

v) Formats for reporting to Govt. Authorities, Local Agencies, Police and Hospitals.

vi) Material Safety Data Sheet (MSDS) for each hazardous product handled in the location.

**4.13.2 Information to public**
The safety measures to be taken in the event of an emergency should be made known to the general public who are likely to be affected.

**4.13.3 Training / Drills and Updating of the On-site plan**
Mock drills activating the Emergency Preparedness Plan should be conducted periodically for ensuring its efficacy during emergency as well

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as for refinement and updation. The above drills based on the plan will help to achieve the following objectives:-

a) to familiarize emergency response personnel with their roles and duties to be performed.

b) to ensure the efficacy of the emergency response mechanism.

c) to check the coordination of reactions and response of emergency services.

d) to gain experience and confidence,

4.14 Compliance Audit

Safety Audits are the periodic examination of the functioning of safety system. It gives an idea about how effectively the safety system is implemented and how they are being accomplished. It is the feedback mechanism that provides management with the status and measurement of effectiveness of the various safety system elements and activities and leads to the appropriate control over these efforts.

Following three types of safety audits should be carried out:
1. Internal Safety Audit
2. External Safety Audit
3. Safety Management System Audit

4.14.1 Internal Safety Audit

Internal Safety Audit is important as it is carried out by the personnel who are deeply involved in the operation / maintenance of the facility, thus are aware of each and every aspect of it. Therefore, such audit can best bring out any shortcoming in the work area. Following methodology should be followed for such audits:

a) Processing, storage, handling and transportation facilities should be audited once in a year.

b) A calendar containing the area, names of auditors and period of audit should be prepared for every calendar year in advance and be circulated to all the departments and concerned area managers.

c) Areas to be audited should be logically grouped based on functions.

d) Audits should be carried out through a multi-disciplinary team.
e) Detailed guidelines including checklists as given in OISD-GDN-145 on 'Internal Safety Audits' should be followed.

f) A time bound action plan should be prepared for implementing audit recommendations.

g) Implementation status of the recommendations should be reviewed in the Management Safety Committee Meetings.

4.14.2 External Safety Audit (ESA)
External Safety Audits are carried out by a team of experts. The duration of the audit may be two to five days. Location management should make a presentation for the audit team giving brief description of the process plants / other facilities and the safety management systems. The audit team should study the different manuals, technical documents, implementation status of recommendations of internal and external safety audits, risk analysis / HAZOP studies and enquiry committee recommendations of fires and incidents. The audit team should give more emphasis on system audit as safety survey is carried out by the internal safety audit team. Environment and occupational health aspects may also be included in ESA. Report of the audit team should be submitted within a reasonable time frame.

Time bound action plan should be prepared for implementation of the recommendations and the same should be closely monitored.

Board of Directors should be appraised about the implementation status of the recommendations twice in a year. Whenever, any recommendation cannot be implemented, specific approval should be obtained from the Board of Directors.

4.14.3 Safety Management System Audit
Compliance of the Safety Management System, as per this document, should be assessed by carrying out compliance audit once in 3 years. Companies should develop their own methodology for such audits. Care should be taken to select team member / members who have adequate experience and training for auditing safety management system. Such audit report should be reviewed at an appropriate level with a view to update the procedures.

4.15 Occupational Health
The successful implementation of management plans and polices greatly depend on its adaptability by the personnel (employees) and maintaining their health is vital for productivity and effectiveness. As such, their health should be strongly emphasised in the organisation's strategic plan.

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Promotion of health of employees in the widest sense, should, therefore, be a high priority, both a goal and a challenge for the organisation.

To meet the above objective, it is necessary to have a structured Occupational Health Monitoring so as to have a scientific basis for decisions aimed at protection of human health from any possible adverse consequences of exposure to the hazards in the occupational environment.

Necessary engineering / administrative controls should be exercised to prevent personnel from undue exposure to various hazards at the work place.

Refer OISD-GDN-166 "Guidelines for Occupational Health Monitoring in Oil and Gas Industry" for details.

4.16 Off-the-job Safety

Off-the-job safety is a worthy goal in its own right. Analysis of the off-the-job injuries and rates normally shows that they are more costly than lost-time on-the-job injuries. Encouraging employees to be safe away from the work help to preserve skills that could be temporarily or permanently lost. It has added advantage of keeping the absenteeism low.

Further, being careful everywhere creates good mindset. Individual's concentration on the job is likely to be enhanced by ones concentration off-the-job and the plant or office is a healthier and safer environment because of it. The benefits also are widely shared throughout the plant or office communities. Following measures should be adopted to encourage off-the-job safety:

(a) The company should have policy to encourage covering off-the-job safety of the employees.

(b) The reporting and analysis of the off-the-job injuries to employees and their families should be encouraged.

(c) Findings of the analysis of the off-the-job injuries should be known to all the employees through news letters / bulletins

(d) There should be topics covering off-the-job safety incorporated in the news letters / magazines.

(e) Safety quiz, contests and competitions should be organised for the family members of employees to motivate them towards off-the-job safety.
4.17 Customers and Products
Primary objective of the management should be to make available their customer the intended product without causing any harm to human and the environment.

It can further be elaborated as below:

4.17.1 Customer and Product Safety Goals

The product and customer safety goals of the organisation should be defined to ensure that every product is manufactured, transported, used and disposed off safely. It should cover the following:

(a) The potential safety, health, environmental and liability risks associated with every product sold, every service offered should be recognised and dealt with.

(b) The organisation policy and objectives should focus on long term commitment to continuously improve performance in health, safety and environmental quality.

(c) Product and customer safety should be managed as an integral part of the business and marketable feature of product and services.

(d) Demonstration to the public, government and customers of the organisation's intention to be socially responsible supplier of products and services.

(e) All statutory guidelines with regard to health, safety and environmental aspects of products in their manufacture, processing, storage, transportation and marketing should be incorporated in the safety procedures and manuals and updated as and when there is a change.

(f) Intermediate custodians including transporters, dealers and distributors should understand and accept the safety policy and commitment to product and service safety of the organisation.

(g) Roles and responsibilities should be defined with appropriate procedure.
4.17.2 Products Safety Procedures

Risk associated with the product should be analysed, defined, controlled and instructional material should be developed for the same. It should cover the following:

(i) New products
Assessment should be made for new products prior to marketing and distribution to identify health, safety and environmental hazards with normal use and foreseeable misuse.

(ii) Periodic reassessment of products
Periodic reassessment should be conducted for all manufactured, rebranded products and intermediate streams. This includes a review of adverse effects reported or experienced by those handling these products.

(iii) Existing products
New uses or markets for existing products should be evaluated to ensure that health, safety and environmental hazards and risks are identified and addressed.

(iv) Records and documentation
Records of assessment, background information and conclusions should be kept up to date throughout the product's life and retained as appropriate.

(v) Product Information/ Material Safety Data Sheets
Up-to-date information on health, safety and environmental hazards and risks relating to use, storage, handling, transport and disposal of products should be available to the workforce, customers and community. The database on products should cover following aspects:

Synonyms of chemical names, target organs of chemicals, first aid requirements for skin, first aid requirements for eye, first aid requirements for swallowing, first aid requirements for breathing, symptoms of exposure, protective clothing requirements, washing instructions, clothing change requirements, clothing removable requirements, protective eye gear requirements. OISD-STD-155 on Personal Protective Equipment should be referred to.

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(vi) Reporting adverse effects of product

System should be developed and in place to collect and review adverse effects reported or experienced by those handling the products. Causes for concern should be identified and actions should be taken.

(vii) Product quality certification:
Products should be properly classified, described, packaged, marked and labelled and should be in proper condition for transportation in accordance with the applicable regulations.

(viii) Environmental and Quality standards / systems:
Environmental and quality systems should be in place to assess hazards to employees, community and environment and to take corrective measures by defining compliance programs and commitment to these programs. The quality standards and system should be documented and updated.

4.17.3 Customer Service, Education & Awareness

The following system should be in place:

(a) Receiving and documenting customer complaint with regard to safety, health and environmental aspects of the products and services:
All customer complaint should be reviewed at appropriate level and action taken for manufacturing, distribution and inspection process to prevent its recurrence.

(b) Formal system for responding to the complaint to the satisfaction of the customer:
An effective recall system should be in place for products and services where defects could give rise to health, safety and environmental hazards.

Education should be imparted to the customer on the following:

1) Dissemination of product knowledge
2) Establishing effective method/channel/medium of communication
3) Safe use of product
4) Critical information to be furnished on the product / package

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5) Emergency action and first aid
6) Identification of target/vulnerable customers
7) Inspection of product/ packaging on receipt by the customer
8) Information on crisis communication/emergency cells
9) Do's and Donot's in understandable fashion
10) Creating customer interest
11) Formation of customer council

4.17.4 Activities related with Product and Customer Safety

Product safety management should be a line responsibility and aligned with the business goals. Activities should include:

a) System for disposal of product found not meeting laid down standard/specifications should be in place.

b) Training tools and communications including labels and material safety data sheets should be prepared, kept up-to-date and distributed.

c) Applicable environmental guidelines and other standards should be in place.

d) All product safety records should be maintained.

e) System should be in place to respond on 24hr basis to emergency requests and calls. Emergency Cell for handling emergency involving products and services at customer premises should function round the clock.

f) Excellence in product and service safety should be rewarded.

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4.17.5 Investigation of Incidents during Product Handling, Transportation and at Customer Premises

1) Establish accident investigation policy & procedures

2) Establish team, level, task and authority for accident investigation.

3) Set up check list, guide lines for identifying the immediate and underlying causes

4) Control coordination with others involved police, fire brigade, CCOE, insurance

5) Set up communication procedure and collect relevant information

6) Activate investigation as quickly as possible.

7) Support investigation/analysis by tests and checks of equipment and product.

8) Analyse all incidents for common causes- management system, installations, technical systems, materials, tools, procedures, tasks.

9) Implement preventive measures.

4.18 Road Transportation
Large volumes of petroleum products are transported through road in tank trucks. To ensure safety of product and human beings involve directly or indirectly, it is essential that such vehicles are designed as per standards and driven by competent personnel. To meet the objective, following aspects should be taken into considerations:

4.18.1 Vehicle
Design of the vehicle should be in accordance with Petroleum Rules, SMPV Rules 1989 and OISD standards.

Periodic inspection of vehicles should cover the following:

1. Periodic statutory inspection in line with SMPV rules, petroleum rules should be carried out by competent person.

2. Inspection at the loading / unloading locations should be carried out and documented in line with the provisions of SMPV Rules, Petroleum Rules and OISD standard.

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3. System should be in place to correct the deviations observed during inspection of vehicles through the contractors with corrective actions for non-implementation.

The relevant provisions of Central Motor Vehicles Rules should be adhered to.

4.18.2 Creating a Road Safety Culture

Following actions would help creating road safety culture:

(a) Motivation to improve road safety performance

(b) Assigning responsibility and accountability to improve road safety performance

(c) Participation and involvement at all levels i.e. transporter, crew, organisation.

(d) Prioritising road safety

4.18.3 Transport Safety System

Following aspects should be considered:

a) Develop activities in line with company HSE policies and strategies

b) Organisation with defined responsibilities.

c) Implementation of standard / specifications / practices, monitoring and corrective action.

d) Raise awareness and standards

e) Accident analysis and corrective measures

f) Improving awareness of drivers to the risks of driving and how to reduce them.

g) Focussed training to the crews in line with CMV Rules 1989 and OISD standards

h) Inspection/audit, corrective action

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4.18.4 Transport Safety Activities

This should cover the following:

I. Establish transportation safety standards, procedures and controls

II. Ensure compliance to standards/specifications for vehicle, accessories, fittings and spare parts

III. Prepare and implement procedure and schemes for inspection of vehicles and fittings

IV. Establish driver/helper competence requirements and responsibilities

V. Assess/review training needs of drivers based on performance and provide necessary training

VI. Develop performance indicators for the vehicle, drivers, contractors

VII. Establishment of road safety committees for identification and mitigation of risk in road transportation.

VIII. Select, assess, qualify, contract and periodically re-evaluate contractors

IX. Monitor contractor performance

X. Co-ordinate with contractors to improve safety performance.

XI. Discontinue use of poor performers

XII. Continuously survey the market to identify new contractors who can provide services with required quality and HSE standards.

XIII. Create movement schedules, monitor journey times and routes

XIV. Constitute road safety committees with company employees, contractors and crews.

XV. Set target and measure road safety performance for employee, crew and contractors.

XVI. Thorough investigation of all accidents and follow-up measures.
XVII. Inspection/audit of transport operations and follow up on action items.

XVIII. Feed back from contractors on matters affecting their safety performance.

XIX. Prepare and ensure that relevant TREM cards are provided to transporters.

4.18.5 Defensive Driving
By exercising the defensive driving skills, the drivers maintain a safety zone around the vehicle. The defensive driving skill is intended to make allowance for the followings-

a) Handling characteristics of the vehicle

b) A lack of skill and knowledge or unpredictable actions on the part of other drivers

c) Vulnerability and unpredictable behaviour of pedestrians and cyclists

d) Unpredictable behaviour of animals

e) Hazardous climate conditions

The skill and art of defensive driving should be inculcated with the drivers by management through -

(i) Improving awareness

(ii) Sharpening the skill of observation, perceptions and anticipation

(iii) Providing time for the driver to correctly assess and respond to a developing situation.

(iv) Educating on Hazardous road features, e.g. curves, hills, narrow roads, bridges, absence of signs, or signals and obstructions.

(v) System of assessment of driver training program in line with OISD-STD-154 should be in place.
4.18.6 Safe Driving Assurance

(I) Competence profile of drivers transporting hazardous products should be as follows:

(a) Defensive driving skills should be identified

(b) Knowledge and understanding of road safety legislation /rules / regulations.

(c) Emergency response including fire fighting.

(d) General vehicle operations and mechanics of the vehicle.

(e) Vehicle inspection

(f) First aid

(g) Product safety knowledge

(II) Management should ensure the following:

a) Legal requirements

b) Emergency response and crisis management

c) The main causes of road accidents

d) Product knowledge

e) Evaluation of contractor’s performance

f) Safety inspections of vehicles and drivers

g) Accident investigation techniques and analysis

h) Scheduling, routing, and journey management

(III) Assessment of driving skill should include:

(a) Use of controls - Accelerator, clutch, brakes, gears, steering, mirrors

(b) Reversing - Control, accuracy, observations

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(c) Road procedure - Move off/stop, signalling, positioning and cornering, use of speed, lane discipline, overtaking.

(d) Reaction to - Signs, hazards, traffic lights

(e) Judgement - Distance, length/width

(f) General - maintenance of progress, temperament, observation, vehicle sympathy, concentration, attitude.

(g) Attitude - tendency to over speed, overtaking, positive/negative

(h) Documentation/records- Available, up to date, authentic

4.18.7 Performance Measurement

Following indicators should be pursued for performance measurement:

a) Number of potential incidents reported

b) Setting targets for transport safety activities and its realisation

c) Implementation of audit recommendations

d) Reported near misses

e) Follow up of non-conformances found in inspections related to vehicle / fittings during loading, unloading operations, non- standard items / maintenance

f) Cases of speed violations/over taking resulting into accidents

4.18.8 Emergency Rescue Operations

This should cover the following:

(a) Each loading/unloading location should develop emergency rescue plan in line with the OISD standard.

(b) Such plan should broadly include limits of individual plants, emergency response preparedness, communication linkages, emergency organisation structure for transportation, emergency action plan action to handle specific scenarios.

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(c) Mutually agreeable emergency action plan for road transportation should be drawn in consultation with the neighbouring oil industry and should be implemented.

(d) Mock drill on emergency handling in road transportation should be carried out once a year.

4.19 Trade Secrets
Trade secrets means any confidential formula, pattern, process, device, information or compilation of information that is used in the business and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it.

The information needed about a process or chemicals must be made available in such a way that both employee and contractor personnel will understand any hazard that may be present and what precautions are necessary to protect them from exposure to these hazards. Such information is required for compiling process safety information, developing PHAs, developing operating procedures, incident investigations, emergency planning and response etc. If required, confidentiality agreement may be made with the supplier.

Its objective is to prevent casual access to critical technical information about a process by limiting the access to certain proprietary data.

5.0 References
I. OISD-STD-105 "Work Permit System"
II. OISD-STD-107 "Format for Incident Reporting"
III. OISD-STD-114 "Hazardous Chemical Data"
IV. OISD-STD-154 "Safety Aspects in Functional Training"
V. OISD-GDN-145 "Guidelines on Internal Safety Audits"
VI. OISD-STD-155 "Personal Protective Equipment"
VII. OISD-GDN-166 "Guidelines on Occupational Health Monitoring"
VIII. OISD-GDN-178 "Guidelines on Management of Change"

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