ASSESSMENT OF HSE PREREQUISITES AND DEVELOPMENT OF HSE PROPOSAL IN TENDERING PROCESS A CONTRACTOR'S PERSPECTIVE

Final Year Project Report

Submitted by

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In partial fulfillment for the award of the degree of

MASTER OF TECHNOLOGY

IN

HEALTH SAFETY & ENVIRONMENT

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2015

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Certified this titled "**Assessment of HSE Prerequisites and Development of HSE Proposal in Tendering Process – A Contractor's Perspective**" is the bonafide work of **SIDDHARTH V (R080213033)** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree was conferred on an earlier occasion on this or any other candidate.

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Declaration

I hereby declare that the work entitled "**Assessment of HSE Prerequisites and Development of HSE Proposal in Tendering Process – A Contractor's Perspective**" is submitted in partial fulfilment of the requirement for the award of the degree in **M. Tech – Health, Safety and Environment** at **University of Petroleum and Energy Studies**, is a record of the my own work carried out by me during the academic year 2014 - 2015 under the supervision and guidance of **Mr. Venkatakrishnakanth & Mrs. Madhuben Sharma**, Department of Health, Safety and Environment, University of Petroleum and Energy Studies. The extent and source of information are derived from the existing literature and have been indicated through the dissertation. The matter embodied in this work is original and has not been submitted for the award of any other degree, either in this or any other University.

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Acknowledgement

Any piece of work that has proved its way remains incomplete if the sense of gratitude and respect is not being deemed to those who have proved to be supportive during its development period. Though these words are not enough, they can at least pave way to help understand the feeling of respect and admiration I have for those who have helped the way through.

I express my sincere and whole hearted thanks to **Dr. N.A. Siddiqui**, Head of the Department of Health, Safety and Environment for his invaluable guidance and providing all facility for completing this project successfully.

I take this opportunity to express my deep sense of gratitude to my guides **Mr. Venkatakrishnakanth & Mrs. Madhuben Sharma,** Department of Health, Safety and Environment for their valuable ideas and encouragements given to me in bringing this work successfully.

I also express my deep sense of gratitude and indebtedness to the management of Larsen & Toubro Hydrocarbon Engineering Limited and **Mr. Jeewan S. Mahadik,** Sr.DGM & Head (HSE Capability Centre) for their guidance and constant supervision as well as for providing encouragement during the project & their support in completing the project.

I articulate my heartfelt thanks and deep sense of reverence to my guide **Mr. Paresh Pithwa** (Executive Engineer) for his valuable guidance, sincere encouragement and support throughout this project.

I also wish to acknowledge with sincere appreciation and help received from **Mrs. Digantika Ghosh** (HSE Engineer) who took her time for guiding me with utmost passion and dedication, and also to **HSE Department Members of L&T HMD, Mumbai** for their proper guidance whenever I need without whom it would not have been possible to finish the assigned project on time and to complete this report successfully.

I heartily thank my friends for helping me in this project directly or indirectly in making this project a complete success. Words are inadequate to express my heartfelt gratitude to my parents in this pursuit.

SIDDHARTH V

Abstract

Early Integration of health, safety and environmental (HSE) principles is vital to the success of engineering, procurement, construction and commissioning (EPCC) projects, and can avert negative results, such as poor HSE and quality outcomes, rework, schedule delays and expense increments. One of the most ideal approaches to stay away from these short comings is through good planning, communication and coordination – both before and at work. This should begin when the choice is made to proceed on the project, and should consider all subsequent project stages and the parties involved. The tendering process is one of the important stages where HSE aspects should be addressed on a project. In order to ensure the client that the project to be finished without any obstacles, the contractor must portray a clear understanding of the client's HSE requirements. It is revealed that identification and responses to client needs and the satisfaction of client are the most important criteria for the project's success. The aim of this paper is to explicate the HSE activities done by the contractor to match the client's project HSE requirements during tendering process.

***Keywords**: Tendering, Contractor, Client, EPCC, Project HSE Management*

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List of Abbreviations

HSE	-	Health, Safety and Environment
R&D	-	Research and Development
EPCC	-	Engineering, Procurement, Construction & Commissioning
LTHE	-	L&T Hydrocarbon Engineering
LSTK	-	Lump Sum Turn Key
HSE-MS	-	HSE-Management System
OSH	-	Occupational Safety & Health
FEED	-	Front End Engineering Design
ITT	-	Invitation to Tender
GCC	-	General Conditions of Contract
SCC	-	Special Conditions of Contract
ALARP	-	As Low As Reasonably Practicable
IOCL	-	Indian Oil Corporation Limited
EIL	-	Engineers India Limited
PP	-	Polypropylene
PRU	-	Polypropylene Recovery Unit
LPG	-	Liquefied Petroleum Gas
PMC	-	Project Management Company
CISF	-	Central Industrial Security Force
OWS	-	Oily Water Sewage
CRWS	-	Contaminated Rain Water Sewage
ODC	-	Over Dimensional Cargo
DCS	-	Distributed Control System
HAZID	-	Hazard Identification
HAZOP	-	Hazard Operability Studies
SIL	-	Safety Integrity Level
PM	-	Project Manager

CHAPTER 1
INTRODUCTION

1.1. ABOUT THE COMPANY

Larsen & Toubro Limited (L&T)

Larsen & Toubro Limited (L&T) is 14 billion USD a technology, engineering, construction and manufacturing company. It is one of the largest and most respected companies in India's private sector. More than seven decades of a strong, customer-focused approach and the continuous quest for world-class quality have enabled it to attain and sustain leadership in all its major lines of business.

L&T has an international presence, with a global spread of offices. A thrust on international business has seen overseas earnings grow significantly. It continues to grow its overseas manufacturing footprint, with facilities in China and the Gulf region.

The company's businesses are supported by a wide marketing and distribution network, and have established a reputation for strong customer support. L&T believes that progress must be achieved in harmony with the environment. A commitment to community welfare and environmental protection are an integral part of the corporate vision.

L&T Hydrocarbon

L&T's Hydrocarbon Business delivers 'design to build' world-class engineering and construction solutions on turnkey basis in oil & gas, petroleum refining, chemicals & petrochemicals and fertilizer sectors. In-house expertise and experience, synergized with strategic partnerships enables it to deliver single point solution for every phase of a project – right from the front end design through engineering, fabrication, project management, construction and installation up to commissioning. The key aspects of business philosophy are: on-time delivery, cost competitiveness, and high quality standards with focus on best in class HSE practices. Integrated strengths coupled with experienced highly-skilled engineers and workmen, are the key enablers in delivering critical and complex projects in India and in select countries overseas**.** Its capabilities include in-house engineering, R&D Centers, engineering joint ventures, with reputed international companies, offshore installation capabilities, world class modular fabrication facilities, a competent project execution team and a work culture that places high emphasis on safety.

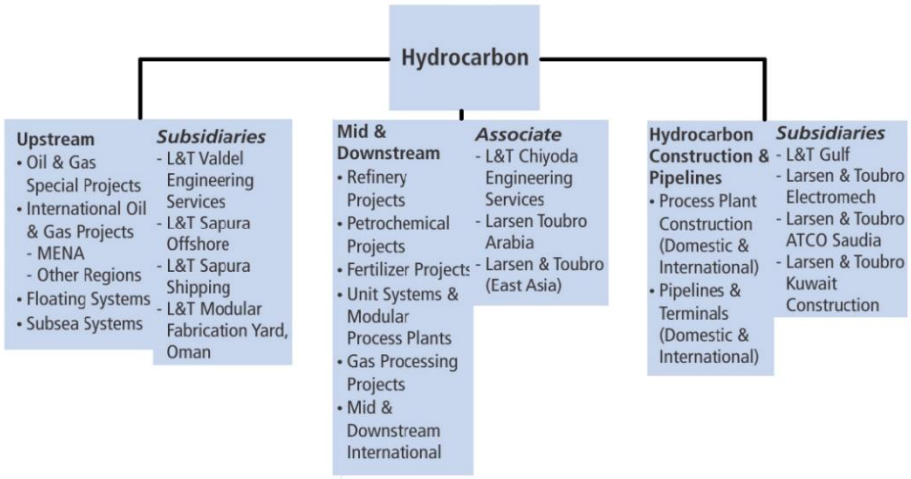


Figure 1.1: L&T Hydrocarbon Groups

Hydrocarbon Mid & Downstream

Hydrocarbon Mid & Downstream provides a wide range of EPCC solutions for turnkey projects – green fuel / fuel quality up-gradation, residue upgradation; cracker complex, polyolefins & aromatics projects for petrochemical industry; hydrogen, fertilizers, gas processing, reformers & cracking furnaces; cross-country oil & gas pipelines, gas gathering stations and crude oil terminals.

Projects are executed on a turnkey basis with detailed engineering support drawn from L&T-Chiyoda Limited – an associate company of L&T and In-House Engineering Resource Centers located at Mumbai, Faridabad and Vadodara.

Range:

- Refinery projects.
- Petrochemical projects.
- Fertilizers.
- Gas processing projects.
- Modular process plants.

Turnkey projects encompass engineering, procurement, construction and commissioning in the petroleum refining, petrochemicals, fertilizer and onshore gas processing facilities. Capabilities have been built and the resources developed to simultaneously execute multiple complex large-value projects meeting stringent delivery schedules, quality and safety norms.

L&T is prequalified with major international oil & gas producers – such as Saudi ARAMCO , ORPIC , PETRONAS , Dragon Oil , PERTAMINA & KNPC for large – value projects. Business development initiatives have been strengthened in South East Asia, where the Company is qualified to bid for major projects.

During last year, three ammonia modernization plants were completed: for Gujarat Narmada Valley Fertilizers Corporation, Bharuch and National Fertilizers Limited, Bhatinda and Panipat. Strategic alliances with internationally renowned companies have made it a strong contender for fertilizer projects.

The Company has an excellent track record of executing hydrogen generation units, synthesis gas generation units, diesel hydro-treating (DHDT) units, sulphur recovery units (SRU), naphtha cracker and associated units and PTA plants. The DHDT unit for MRPL, Mangalore, hydrogen generation units for HEML, Bhatinda and MRPL, Mangalore, and a gas processing facility for ONGC (Hazira) were commissioned during last year. Other major projects include the world-scale aromatic complex at ONGC Mangalore Petrochemicals Ltd. (OMPL), Reactor Regenerator Package as part of the FCC unit for Indian Oil Corporation (Paradip) and a gas processing facility for ONGC (Uran).

1.2. ABOUT THE PROJECT

The Health, Safety and Environment (HSE) issues are considered as one of the major risks in any industry. Effective planning for HSE is an important requisite if projects are to be completed on time, without increase in expenditure, and without causing accidents or harming the health of site staff. These targets get to be progressively hard to attain, nonetheless, in EPCC projects. Due to the rapid change that is occurring in the industry, together with the different client-contractor interface systems and management practices that are evolving, it is also recommended to integrate HSE into the project at the very early stage to avoid obstacles.

Dynamic and continuous participation by both the client and contractors are crucial to attain to this objective. While each has a distinct part to play in guaranteeing the continuous planning for HSE included, there is a chance to further improve the client - contractor relationship by clearly characterizing roles and responsibilities, creating expectations and keeping up correspondence all through the relationship. For a client, contractor selection and appointment is critical in determining the overall success and management of a project. And for a contractor, Incorporating HSE into tendering and the tender proposal, and adequately assessing the HSE requirements of clients, is one way to introduce HSE into a project in the

early stages. Contractor and the client each have a duty of care, one to the other, to all personnel and to society at large to ensure that all work is conducted in a safe, healthy and environmentally sound manner whilst maintaining an efficient operation. Health, Safety and Environment are the critical viewpoints that need to be considered by the client and contractor in the tendering process.

1.3. PROJECT BACKGROUND

An EPCC project is basically a partnership between the contractor and the client, however only for a particular, and normally constrained, purpose. Larsen & Toubro Hydrocarbon Engineering Limited (LTHE) as the EPCC contractor will bid for the projects and after the contract award, will do the detailed engineering design of the project, acquire all the materials and equipment necessary, develop and deliver a functioning facility or asset for their clients. Normally the EPCC Contractor has to execute and deliver the project within an agreed time and budget, commonly known as a Lump Sum Turn Key (LSTK) Contract. An LSTK Contract places the risk for HSE issues, schedule and budget on the EPCC Contractor.

HSE management in the work space, particularly in the EPCC ventures, is of focal importance, irrespective of profession, industry or area. The existing approaches to HSE management seem to put emphasis on national and international standards, management functions, guidelines, quality and maintenance principles, precautionary safety measures to establish the HSE management system (HSEMS) in the project site. Despite this, the activities incurring intensive HSE planning and management, almost run smoothly at all times. There is minimal chance of a dangerous occurring, because of the elevated risk awareness level, resulting from the careful HSE management. These approaches may represent a step forward in managing HSE but may not be enough to address the HSE management more effectively.

In order to manage HSE more effectively, HSE aspects must be integrated as early in the project as possible, that is, in the tendering process. Tendering is the process by which offers are welcomed from interested contractors to complete particular bundles of development work. It ought to observe and adopt the key values of simplicity, decency, clarity and responsibility as well as strengthen the idea that is the reduction of risk in the project. The process includes the invitation of tenders from contractors on a pre-approved or specially appointed list, selected because they meet certain base standards in general criteria, for example, monetary standing, ability, competence and excellent HSE performance.

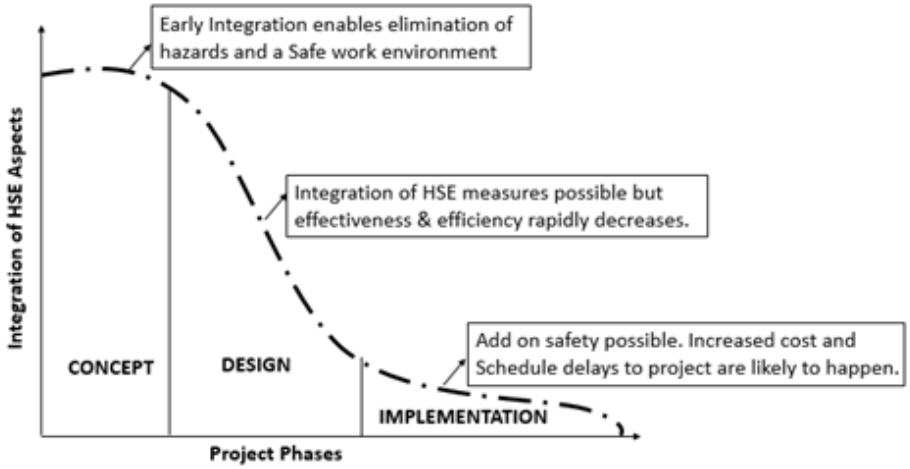


Figure 1.2: Effectiveness of HSE Integration on various Project Phases [2]

HSE issues are not confined to the construction phase of a project but occur throughout a project's lifecycle. Many of the common HSE problems encountered during construction and operation could be avoided if due consideration and effort were invested during the project tender and design phases. Client and the contractors, both have a distinct role to play in ensuring the HSE planning for the project. The importance of assessing HSE issues during the prequalification and tender process by the contractor was stressed and it was certainly confirmed that bad HSE performance will lose contracts.

1.4. AIM

- The aim of this Project is to analyse the HSE activities being done in tendering process purview of the Contractor**.**

1.5. OBJECTIVES

- To assess the HSE prerequisites of the Clients
- To Prepare a Preliminary HSE Plan
- To Provide Inputs to the Risk Register
- To prepare a Responsibility Chart

1.6. SCOPE

- The General Scope of the Project is confined to the EPCC Contractor's activities related to HSE from the Prequalification Stage to the Project Proposal stage during the Tendering Process.

CHAPTER 2

LITERATURE SURVEY

Extensive review of literature from journals and proceedings had been conducted to identify and analyse the HSE activities done by the contractor during tendering process. The following section describes the literature review for this project.

S.No	Title of the paper referred	Year	Author Name	Objective / Aim	Methodology	Findings
1	Integration of Occupational Safety and Health during Pre-construction Stage in Malaysia	2012	Saifullah, Napsiah Mohamad, and Faridah Ismail.	This paper aims to investigate the Pre-Construction Planning in Malaysia and the integration of OSH Elements in Early Project Planning.	This paper analysed the accidents happened in the industries and came out with the conclusion that OSH elements must be included in the pre-construction stage of the project. It also explains the personnel involved in the different phases of the project.	This paper is an initial study with the hope the finding will lead its way to the output of OSH indicators for pre-construction phase in Malaysia. It analyses the accidents in the industry during a specific time period and analyses the results for the OSH element at various stages.
2	Assuring Protection of Health, Safety, and Environment in Engineering Projects	2011	Ellis, R., English, A., Chosnek, J., Edwards, V. H	This paper aimed at the development of a methodology for early integration of HSE during FEED stage.	Methods for the development of the HSE philosophy and design basis, process hazards analysis that includes an inherently safer process approach, preliminary safety integrity level assessment, conceptual fire protection systems design, and equipment layout and facility siting.	It was concluded that the early planning and application of HSE principles were essential to minimize risks to personnel and the environment throughout the life cycle of a project.

3	Identifying key factors in the evaluation of tenders for projects and services	2009	Watt, D. J., B. Kayis, and Keith Willey	This paper sought to identify a suite of representative (principal) tender evaluation and contractor selection criteria.	The literature survey was conducted on Corporate Environment Policy, Safety Plan, Safety Incidents, Occupational Health Safety Assurance (OHSA), and Incident Rate. The exploratory survey was conducted on Environmental Compliance,	For the category of HSE, Health Safety Environment (HSE) Record, and Safety Performance. It is concluded that in terms of the individual components of the study, HSE was considered as one of the four categories of criteria that were unique.
4	Planning tools for integrating health and safety in construction	2008	Cameron, Iain, and Billy Hare.	This paper is aimed at the development of planning tools which will aid the integration of health and safety into construction.	A mixture of group and individual interviews were undertaken, with subjective techniques of analysis, to develop integrated management methods for all individuals of the project team.	The tools developed are following; a responsibility chart; an option evaluation chart; risk management workshops; safety information on drawings; designer checklists; health and safety milestones on programs; and design change control process that incorporate health and safety checks.
5	Exploring the integration of health and safety with pre-construction planning	2006	Hare, Billy, Iain Cameron, and A. Roy Duff.	This paper is aimed at how best to promote the effective integration of H&S management into construction project	A 19-month investigation on behalf of the UK's Health and Safety Executive (HSE) aided by four Steering Groups and three expert panels where interviewed, using focus group methods, to define critical success factors through qualitative, grounded theory, analysis	The main outcomes from the analysis are: critical success factors rely on adopting integrated teams; and effective two-way flow of information is important. Also, available design and management tools can be adapted to satisfy the success factors.

6	The development of a methodology to match the client's project requirements with the knowledge of the project team in refurbishment projects	2006	Lee, C. C., and C. O. Egbu	The aim of this paper is to explicate the process of developing a methodology to match the client's project requirements with the knowledge of the project team in refurbishment projects.	This report was based on an on-going doctorate study which is aided by literature survey, Questionnaire, Semi Structured Interviews to develop the methodology.	The paper commences with the need to meet and satisfy client requirements. Next, the significance of staffing the project with knowledgeable team members so as to increase an organization's competitive advantage is presented.
7	Client/contractor relationships in managing health and safety on projects	2006	Winkler, C	The primary aim of this study was to investigate a number of projects undertaken by a publicly recognised contractor (AMEC) and to assess the direct and indirect contribution to best practice health and safety performance through the adoption of partnering relationships	The investigation was aided by questionnaires, interviews, reviews and observations of covering all the projects and assess the health and safety elements in the project. The focus for the programme was to investigate and evaluate six separate projects being undertaken by AMEC in different industry sectors.	The importance of assessing H&S issues during the prequalification and tender process was stressed and it was suggested that this should form a large part of the quality element.
8	Capturing client needs in refurbishment projects	2005	Lee, Cynthia Chintian, and Charles Egbu	This paper aims at the differentiation of Clients' requirements and clients' needs and the client needs for refurbishment projects are explored	A research in the management domain of refurbishment project was conducted and the client's needs in refurbishment projects are identified. The client's needs are captured through the examination of the characteristics of refurbishment projects.	It was concluded that capturing the client's needs and requirements is essential in the comprehensive briefing of the project. So the better way to understand and capture the client's needs (quality, safety, economy, scheduling, functionality, etc.) is provided in this report.

9	RR263-Integrated gateways: planning out health & safety risk. Health and Safety Executive	2004	Cameron, Iain, and H. S. E. Roy Duff and Billy Hare	This report is aimed to investigate how best to promote effective integration of health and safety management into project planning, communication and control to achieve improvements in both general project management and HSE management.	A Gate way Model of Project Planning is developed for the effective integration of HSE in different Project Phases.	The main findings from this report are the drivers used for the integrated planning and the tools which are used to integrate HSE into the project planning. A gateway process, that facilitates consideration of the critical aspects of a project at key points through its life, is recommended by this report.
10	The influence of clients on health and safety standards in construction	2003	Sumner, Shaun, and Peter Farrell.	This paper aimed to investigate the influence of clients on health and safety standards in construction	Research was conducted through a postal questionnaire distributed to clients operating in the Northwest of England in the commercial market	A full scale statistical study of client's use of health and safety criteria at tender stage revealed that client's should consider paying more attention to health and safety at tendering process, as there are direct advantages and enhancements in standards of health and safety during the construction phase.

Table 2.1: Literature Survey

CHAPTER 3

TENDERING PROCESS

3.1. INTRODUCTION

The Contractors need to understand the client's requirements and satisfy them by portraying their ability to finish the project without causing any lapse. The key HSE activities of the client and the contractors are given in the diagram below.

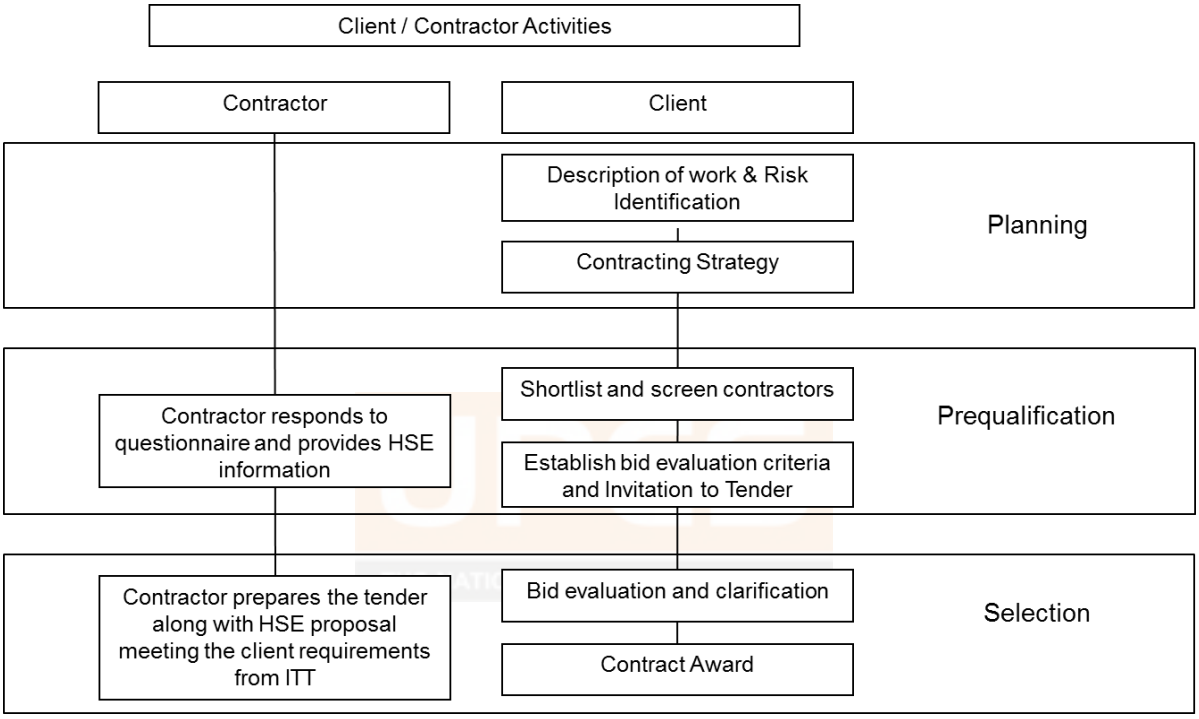


Figure 3.1: Client – Contractor HSE Activities

3.2. PREQUALIFICATION

The objective of the Pre-qualification phase is to screen potential contractors to establish that they have the necessary experience, capability and financial viability to undertake the activities in question safely and in an environmentally sound manner.

Pre-qualification is usually achieved by issuing a standard format document for the contractor to complete, supported where necessary by historical performance records. It may be necessary to review the content before issue and to add, remove or emphasise requirements specific to the activity. The level of detail to go into for pre-qualification on each project is a matter for clients and their advisers to assess by looking at a number of factors, including, among other things, the complexity of the project.

The level of pre-qualification should be appropriate for the type of project being undertaken. Listed below are some of the areas that can be considered for pre-qualification at the pretender stage.

- Company HSE documents (such as general HSE policy)
- Management commitment to HSE
- Risk assessment and safety procedures
- Injury and ill-health records
- Records of previous enforcement actions
- Training records (such as safety induction procedures, national qualifications, certificates of competency)
- Quality assurance procedures
- Project review and monitoring of HSE practices
- Key personnel and their level of training
- Management of subcontractor safety
- Planning and monitoring processes

Many in the industry already use question schedules or checklist-type tools. These can be integrated with supporting documents or may stand alone. Considering the areas that were identified above, as well as incorporating any HSE information specifically required for your organization or project. If a pre-qualification check list is not used at the pre-tender stage, the information will still need to be requested and considered during the tendering stage. It is important to remember that supporting documentation will also need to be provided with the checklist as evidence that HSE procedures are in place and that they are carried out.

Benefits of Prequalification

- Makes it clear from the beginning of the project that HSE is an important issue
- Limits the numbers of contractors, so only contractors who have appropriate HSE practices in place are invited to tender. (I.e. it will generally prevent contractors with little HSE practice in place from tendering for the work).
- Comes at a stage when there is more time to begin to assess HSE credentials.
- Helps contractors to evaluate their commitment and plans for pro-active HSE management.
- Ensures early involvement of HSE Department in the Project

3.3. CLIENT PREPARATION FOR THE PROJECT

The client will have a prepared plan to undertake the project. This will include all aspects of HSE management, licence requirements, local government requirements, its own corporate HSE policies and procedures, any joint venture input and the political, economic and security viability of undertaking the project. It is important that the client has assessed major HSE hazards that may impact the project. There has to be sufficient lead time to ensure that all parties involved (client, contractor & subcontractors) can fully discharge their responsibilities in terms of tender, bid and project preparation. A list of client responsibilities is listed below, which may not be all inclusive or exhaustive, regarding to HSE:

- Client HSE goals and objectives.
- Client HSE-MS.
- Definition of the scope of the HSE Plan
- List of HSE controls procedures and compliance issues for the contract.
- Definition of the client/contractor anticipated
- Interfaces, the company supervision strategy and interaction with client operations, interaction with specific client plans such as emergency response.
- Type and schedule of company and contractor training requirements and competencies.
- Specification of the minimum pre-execution requirements.
- Identify any support facilities in the prospect area that may be required in emergency situations.
- Hazard Identification
- Relevant historical events associated with the prospect that may impact the project
- Historical health events/endemic health problems
- Commission assessments, including environment, social, and health impacts.
- Security risk assessment
- Identify potential contractors and subcontractors through Prequalification who will be invited to tender

The client will issue an ITT (Invitation to Tender) to its selected contractors for them to submit a tender. The ITT must identify the major HSE hazards that the client became aware of during the planning stage. This will enable the contractors to submit a tender proposal that can fulfil the client requirements efficiently and operate with an expectation of zero HSE incidents.

3.4. CONTRACTOR PREPARATION FOR THE PROJECT

Contractor must familiarise with the tender documents, the project site and the HSE requirements of the project. Adequate information must be queried and received from the client to determine what is necessary for health and safety on the project. Contractor shall develop a clear specification of the resources needed to control and manage the HSE risks and hazards of the project. It is the contractor's role to give information outlining management of any specific risks and hazards during the project and providing evidence that the tender proposal meets the HSE requirements of the project and the ITT documents. The contractors can also provide any additional HSE information relevant to the project which has not been asked for. Much of this information will contribute to the Site-specific HSE Plan developed by the selected contractor once appointed. Finally the contractor must ensure that the tender HSE proposal shows a full understanding of the level of HSE Management required for the project. The contractor must make sure that the tender includes site-specific procedures for,

- The assignment of HSE responsibilities for implementation on-site
- Involvement of senior management in the project HSE planning
- Methods for hazard identification (such as task analysis)
- Incident and accident investigation and reporting methods
- On-site emergency procedures (such as fire, earthquake, chemical spills)
- Strategies for site communications (such as site meetings)
- A site safety audit programme (from full audits to site inspection)
- Information regarding awareness and motivation programmes
- The system for co-ordination of on-site trade activities (such as methods for information sharing).

3.5. TENDER REVIEW, EVALUATION AND SELECTION

Tender submissions are received, evaluated and assessed by the client and their advisers to make sure that potential contractors have complied with the tender documents – including the requirements relating to health and safety for the project – and are competent to carry them out. Once the contractor is appointed, a Project Site-specific HSE Plan is developed by the contractor and provided to the client and their advisers. The construction and commissioning process on-site is managed by the contractor.

This report explicates the HSE activities of the contractors during the tendering process.

CHAPTER 4

METHODOLOGY

4.1. METHODOLOGY - FLOW CHART

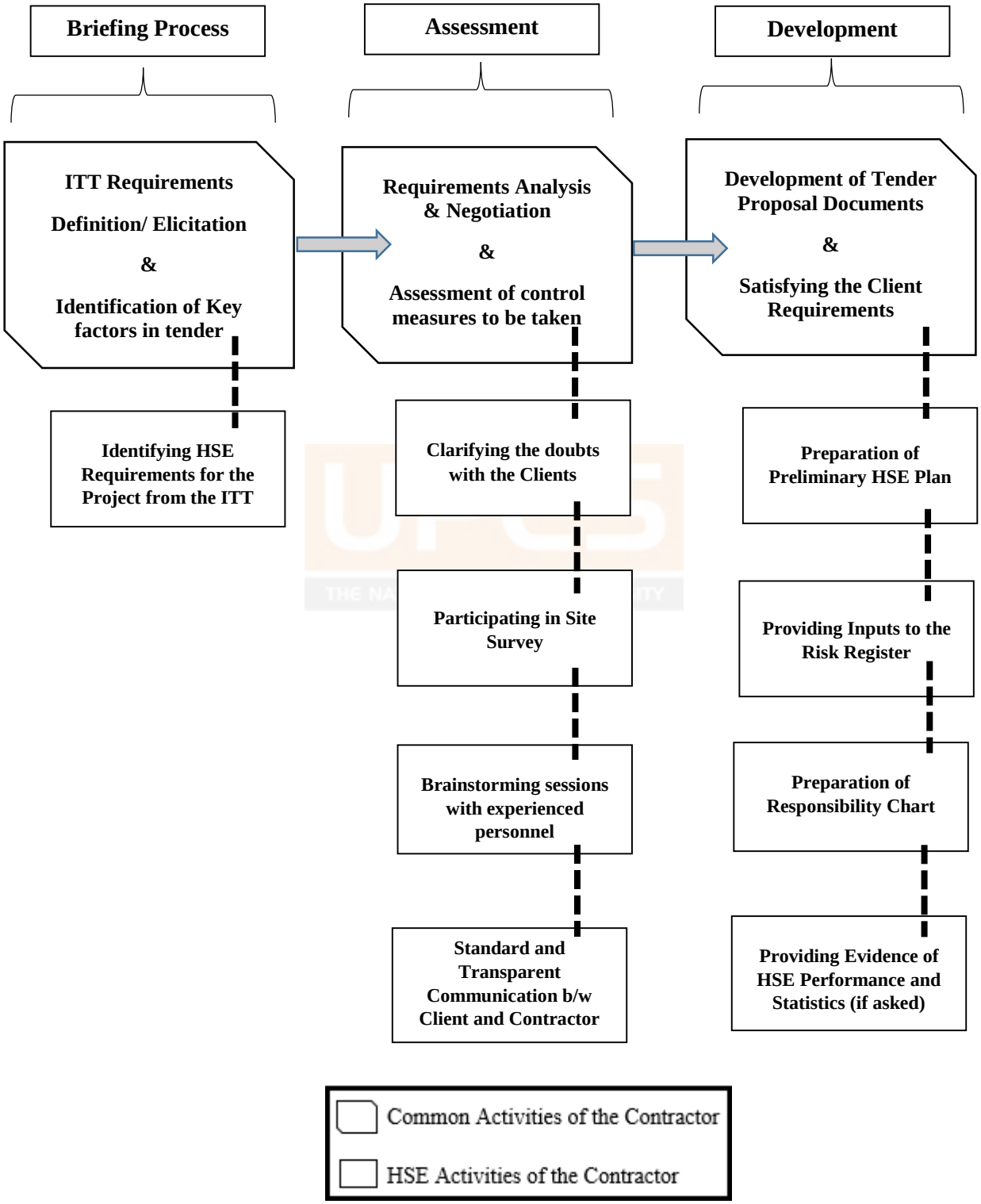


Figure 4.1. Methodology – Flow Chart

4.2. ASSESSMENT OF HSE PREREQUISITES OF CLIENTS

Assessment of the Client's HSE requirements and matching it is a crucial task in tendering for the project. This section outlines some key considerations specific to the HSE activities done by the contractor to assess and match the client's requirements.

- Early involvement of HSE team in tendering process

  The HSE Department must be notified early in the tendering process so that they have sufficient time to assess the critical elements of the ITT and provide with the effective proposal to the tender.

- Client HSE objectives at feasibility stage

  At feasibility Stage, the HSE objectives are one of the important factors to be measured and assessed by the Contractor's HSE Team.

- Clarifying the doubts by going through the GCC and SCC

  General Conditions of Contract and Specific Conditions of Contract from the Clients will provide the details of the complete project summary. Going through those documents and clarifying any doubts with the Clients must be done clearly.

- Standard and transparent correspondence between Contractor and the Client

  Regular Communication between the clients and contractors must be crucial to the inputs of the tender. HSE must be incorporated in all departments of the project. In view of that, the regular communication must be done for continuous improvement.

- Knowledge Transfer

  Knowledge transfer between contractor and the client can be done by training, information sharing, e.g. on drawings and other issues.

- Participating in Site visits and clarifying any doubts

  HSE Team member must be in the project Site visit Team, to evaluate the risks might be present in the site due to the factors such as surrounding environment, weather, site terrain, specific physical hazards, layout problems etc.

- Consulting with experienced HSE Personnel

  Experienced HSE personnel must be consulted while assessing the risks of the project so that the valuable inputs from the personnel can be noted and included in the proposal.

  The Site Visit Survey checklist and photographs are detailed in the subsequent chapter.

4.3. PREPARATION OF A PRELIMINARY HSE PLAN

- The preliminary HSE plan is the framework for documenting the HSE-MS applicable to the client.
- Scope and complexity of the development process will depend on the size and type of the operation, and the level of experience of the members and the level of continuity of the crew as an entity.
- There should be a strong emphasis on continual improvement. The target audience of the preliminary HSE plan will be the client's tender evaluation team. But ultimately this plan will be used as a basis to prepare a Project HSE Plan for the line management and for them to communicate the plan to all site personnel.
- As the project HSE plan is only valid for a single project, and may change significantly from project to project, it is essential that a significant effort is made at the start of any project to make it tailored for the specific project.
- Staff should especially be made aware of all key policies and procedures that will be applicable during the tender phase. The contents of the preliminary HSE plan will depend on the nature of the project itself.

However, the following areas are considered:

- Nature of the project (location, terrain, nature of construction work, etc.).
- The existing environment (existing services, surrounding land use, ground conditions)
- Existing drawings (available drawings of the structure and the HSE file if there is one).
- The design (information on the significant risks which cannot be avoided).
- Construction materials (HSE hazards from construction materials which cannot be avoided).
- Site-wide elements (positioning of site access or egress points, location of unloading, layout and storage areas, traffic routes, etc.).
- Overlap with the client's undertaking (particularly where construction work is to take place at the client's premises).
- Site rules (laid down by the client when work takes place at the client's premises).
- Continuing liaison (procedures for dealing with design work prepared for the construction phase).

While preparing the preliminary HSE plan, the following key HSE issues and activities shall be taken into account to understand the risks from detail design stage through commissioning and handover which will be subject to execution and review. It does not mean that the other deliverables are not applicable.

- Contractors; HSE organization, roles and responsibilities
- Project Description and project HSE philosophy (considering; Guiding Principles: HSEMS & its documents, Industry standards & Practices, The Project Operations & Maintenance Philosophy, etc.)
- HSE Objectives: Minimum manning, Reduction in manual handling, etc.
- HSE Performance Targets:
- Summary of Regulatory requirements
- Description of Hazard identification, risk management and control (i.e. the tools such as QRA: Hazop, EIA, ETA, FMEA, Gas dispersion, Explosion impact study etc.)
- Description of HSE Audits and Reviews
- Summary of HSE Inspections
- Description of Mitigation Measures

Description of Project HSE issues as per the table below but not limited to:

Safety	Occupational Health	Environment
System integrity level High pressure/low pressure interfaces and overpressure protection Fire and explosion protection Fire, smoke & gas detection Flare, vent, drains, sampling Access to system & equip. Lifting, shifting/handling Working at heights PTW, Excavations Driving & Vehicle Mgmt. ESD and blow-down Simultaneous operations EOD LOTO, Safe maintenance Escape & Evacuation Accident/Incident Mgmt. Remote safety monitoring	Storage & handling of hazardous materials Exposure to toxic & Hazardous substances Noise pollution Ergonomics & manual handling Working hours Working in heat & cold Ventilation Lighting House Keeping Sanitation First Aid and site clinic	Emissions to air Wastes Water supply Effluent disposal Leaks & Spills containment Oil and chemical spills Waste water treatment and disposal Site restoration Environment sensitive areas Soil contamination Natural drains Preservation of heritage/artifacts /monuments

Table 4.1. Specific Project HSE Issues

4.3. PROVIDING INPUTS FOR RISK REGISTER

- The use of a risk register or log is well established in the field of risk management. Here the aim is to determine the most cost-effective risk management strategy.
- More recently those involved in the design of construction and commissioning projects have started to use the same tool to manage HSE risks.
- Since the process for managing commercial risks is similar to the assessment process for HSE risk there is scope for consolidation and indeed integration of the two.
- The process for managing commercial risks is similar to the assessment process for health and safety risk.
- This means the two can, theoretically, be integrated. Risk sources or health and safety hazards, the potential impact of each risk, the risk owner, action to be taken and 'date to be done by' are essential requirements of any risk register.
- The commercial risk register is usually developed early in the project and is one of the first documents produced. Obviously health and safety risks, with the ability to disrupt the project, should be included in the commercial register.
- A commercial risk register is formed from three main sources,
    (1) Checklists specific to project sites
    (2) Brainstorming with project participants
    (3) Historic data from similar projects
- If an integrated risk register is used it will invariably be managed by someone who has overall control of the project. This may be the client, client's agent, lead consultant or project manager. If a separate design or health and safety risk register is developed then the lead designer or planning supervisor may manage it.

	Risk Description		**Assessment**				**Revision :**	
Sl. No	**Identified Risk**	**Detail**	**S**	**P**	**L**	**Mitigation Plan & Action**	**Target Date**	**Responsibility**
S – Severity, P-Probability, L- Likelihood								

Qualitative or Quantitate Risk Assessment

Table 4.2.: Project Risk Register - Sample

4.4. PREPARATION OF A RESPONSIBILITY CHART

A responsibility chart is a matrix or chart that indicates the required actions from each individual or organisation for each task. It is used to show who does what during a project and when it is to be done, which defines interfaces between disciplines and avoids possible conflicts or misunderstandings. Tabulating this information on a chart creates a structured approach that can be communicated easily, in a transparent and robust manner and helps the team to allocate resources.

- Lists of possible responsibilities should be kept to a minimum
    - **L: Lead & co-ordinate**. This person is in charge and makes the final decision.
    - **O: Output information received**. This person is informed of decisions made.
    - **A: Advise**. This person is consulted and gives advice to be considered.
    - **D: Does the work**. This person has to do the task

The process of completing the chart begins with listing the tasks, processes or functions vertically. This information can flow from the same initial list that is used to develop the project programme. Other activities, for example, may come from contractual and legal obligations. Activities specific to the management of HSE risk may come from existing project procedures contained in a HSE Management System.

The chart should be authorized by a person with authority and ultimate responsibility for delivery of the project or stage. This may be the client, agent, project manager or lead consultant. Consultation is essential with those who are implicated in the chart. A competent planning supervisor would be able to advice on the type and level of input required to manage HSE risks. It is the process of developing the chart that is most useful as these issues will be discussed anyway, the chart facilitates this in a structured and orderly manner.

L: Lead & co-ordinate O: Output, receive info A:Advise D:Does the work	**DUTY HOLDER**									
	CLIENT			**CONTRACTOR**				**DESIGNER**		
Activity	Board	Project Manager	HSE Engineer	Senior Management	Project Manager	HSE Engineer	Site Engineer	Architect	Engineer	Mechanical & Electrical
Activity 1										
Activity 2										
Activity 3										
Activity 4										

Table 4.3.: Responsibility Chart - Sample

4.5. VALIDATION AND GENERALIZATION

Usefulness, practicality and applicability of the developed methodology will be assessed at this stage. This is to be achieved through by developing the HSE proposal for several tenders and gaining a detailed feedback from the experts on how effective this adopted methodology will constitute in contractor's tender proposal.

CHAPTER 5

CONTRACTOR'S HSE ACTIVITIES

5.1. SITE SURVEY

Techno Commercial Tender Proposal is invited for IOCL Rath Chakra Project (Polypropylene Project), Paradip Refinery, Odisha. (LSTK-2). A Site Survey was undertaken at the site on February 10, 2015 for the inspection of the site where the Polypropylene refinery was to be setup.

1) Introduction meeting held at IOCL office with IOCL, UHDE, EIL/L&T, Punj Liyod & 13th Construction Co Ltd of China National Chemical Engineering.
2) No presentation made for the subject visit
3) Visited Flare stack area, Cooling tower for PP plant, Nitrogen Generation unit, Pipe rack, BHEL gate & warehouse portion in north refinery
4) Visited LPG Treater unit , Satellite rack room & existing pipe rack in south refinery adjacent to PRU

1. General Conditions of Construction Site: -

Check Point	**Comment**
Grading:	Site is generally graded with few places of heaps of earth , levelling will be required
Nature of Vegetation:	Lot of vegetation is there to be removed
Any Obstacle or Obstructions like existing facility/UG Condition, Lighting (Cables, Pipelines etc.):	Pitholes along the pathway near BHEL Gate. Drain was being constructed by a subcontractor near the BHEL Gate.
Bridges, Culverts if any with weight restrictions:	Temporary culvert for material movement will be required over the exiting drain near BHEL entry gate
Site Access Plan:	Through BHEL gate
Swampy/Soft patch/Contaminated Soil if any:	As plot is fully covered with vegetation, chances of soft patches are there.
Any Dismantling of Permanent Facilities like pipe supports, drains, paving, tanks, RCC Structure or masonry structure:	Green Field for PP PRU – Have to break the paving for reactor column foundation

Table 5.1.: General Conditions of Construction Site

2. Confirmation of Location & Space Availability of: -

Check Point	Comment
Material Stores:	As per Layout. Green field, Approach road to be made
Site Offices:	As Above
Fabrication & Lay down yard:	As Above

Table 5.2.: Confirmation of Location & Space Availability

3. Confirmation of land availability for Batching Plant, Labour Colony/Camp.

Comment: Outside the Refinery

4. Entry routes to site from Refinery Main Gate: -

Check Point	Comment
Man/Labour Gate:	Through BHEL gate,
Material Route:	Through BHEL gate, however Area strengthening , specially over the drain for material movement will be required
ODC Route:	culvert suitable for ODC required
Crane Movement:	Strengthening of route must be made.

Table 5.3.: Entry routes to site from Refinery Main Gate

5. Overhead Obstructions from Material / ODC Entry Gate up to Site. (Height clearances).

Comment: Nil

6. Any restrictions- like sharp turning, overhead pipe racks in ODC route.

Comment: Route survey to be made by logistics

7. Distance of site from Sea Port?

Comment: app 20 Km

8. Disposal facility at site: -(Distance in Km) :-

Check Point	Comment
Sanitary & Sewage Wastes:	Not Known, Planning must be kept ready
Construction Material:	House Keeping procedures must be given

Table 5.4.: Disposal facility at site

9. Availability of Services and Utilities at Site/ If Chargeable then rates:

Check Point	Comment
Electricity (provided by Client as per GCC 3.5.1.0)	As per contract which to be confirmed by PMC, As per IOCL, Site marked up drawing has been issued. need to be taken up for exact location
Construction Water (provided by Client as per GCC 3.6.1.0)	As Above
Availability of Other Utilities (Potable Water, Steam/Nitrogen, etc.) to be checked	Follow the same procedures followed by the RR Package / DCU.

Table 5.5.: Availability of Services and Utilities at Site

10. Approach road (for construction purpose) availability from material/ODC Entry gate up to site? If not available will be constructed by whom?

Comment: Approach road will be constructed by the contractor. (From Entry Gate).

11. Is there any possibility to use the site by the client for storage of material, dumping of debris, back filling of soil etc.?

Comment: No

12. What will be the approximate maximum lead for borrowing earth from outside Refinery limit?

Comment: Available around the site

13. Any stringent requirement for Construction permits and their approval/ renewal?

Comment: Similar to green field refinery

14. Access locally Within District, e.g. from motorway or nearest main trunk Road.

Comment: Refinery is 20 km far away from Paradip city.

15. Permissible Working Hours (any restrictions?).

Comment: No Restrictions as on date, Area is demarcated in the refinery with separate Entry / Exit

16. Skilled / unskilled labour availability.

Comment: As followed for RR Package / DCU

17. Any Labour Agreements in force at Site and the Location of nearest labour colony.

Comment: As followed for RR Package / DCU and the location of labour colony is very close to BHEL Gate

18. Availability of Local construction material market and distance from site?

Comment: Limited availability at Paradip.

19. Other Main Contractor(s) available near site. (List& details).

Comment: ---

20. Requirement of UG scanning, if any?

Comment: No drawing is available. however area is Greenfield with reclaimed soil

21. Rock Cutting, If any?

Comment: Not required

22. Safety & Security: -

Check Point	**Comment**
Client's Security Arrangements	CISF arrangement at Gate
Status & Condition of Security Fencing at Client's Perimeter/Construction area/Temp. area	Boundary wall is available for Refinery premises, No fencing at construction area

Table 5.6.: Safety & Security

23. Co-ordinates revalidation at site:-

Comment: No

24. Distance and Location of Hook up of all u/g networks from the Plant battery limit (Sanitary Sewer, OWS, and CRWS).

Comment: To be taken up with PMC

25. Fire-water Header Location / Scope / Size / Pressure.

Comment: To be taken up with PMC

26. Extent of barricading requirement at site.

Comment: Barricading to be done as per plot plan.

27. ODC route from Port to Site (If possible).

Comment: Available. To be confirmed with the Client.

28. Area availability for foundation/erection of new add-on equipment (Poison Catalytic Removal Column, Regeneration Nitrogen Heater and V 1012 Discharge Pump).

Comment: Paved area available.

29. Type of foundations for nearby equipment

Comment: Piling requirement is there. - Needs to be checked with PMC as site person was not aware of the same.

30. Routes available for cable laying for new equipment to existing SS & Control Room.

Comment: Existing cable trench available for electrical cable laying

31. Any obstructions and road crossings in possible Cable routings for new equipment to SS & Control Room

Comment: Extensive survey needs to be done.

32. Details of the existing systems for interface:

DCS (UNIT) - Supplier & model	-	Honeywell
LV Switchgear (UNIT) - Supplier & model	-	Multiple suppliers

5.2. PHOTOGRAPHS OF SITE VISIT:

Figure 5.1: Flare Stack Area

Figure 5.2: Revised Proposed Pipe Rack Route

Figure 5.3: Nitrogen Generation Unit Area

Figure 5.4: Approach Road for Warehouse & Fabrication Area

Figure 5.5: LPG Treater Unit Area

Figure 5.6: Warehouse & Fabrication Area

Figure 5.7: Existing Pipe Rack to be extended for LPG Unit

Figure 5.8: Existing Pipe Rack for Utilities

5.3. PRELIMINARY HSE PLAN

5.3.1. Purpose & Objectives

The purpose of this HSE Plan is to define the HSE requirements and programme that will be followed on the Project.

It shall be used to:

- Assist in the implementation of a Project culture that enables and encourages HSE concerns to be identified, discussed and resolved, during all stages of the Project.
- Ensure a coordinated and committed approach to HSE throughout the life of the Project, from engineering and design, to construction, commissioning, and start up, to hand over to Company
- Identify and incorporate HSE considerations as related to design, construction, pre-commissioning, commissioning and start up
- Identify the HSE reporting lines for the Project
- Inform business partners & Subcontractors of the Health, Safety & Environmental requirements that will be strictly enforced on the Project. All business partners & Subcontractors will be required to input and assist in the future development of this Plan and agree to its full implementation.

More specifically, the objectives of the HSE plan are:

- To define the contractual HSE management requirements
- To identify the comprehensive suite of HSE studies and reviews, and corresponding HSE deliverables
- To present the programme of HSE work that ensures the deliverables are achieved in a timely manner and in line with the overall Project programme,
- Specify the HSE related reviews and audits to be performed and the timing of them

5.3.2. Salient Features

- A preliminary HSE plan is a crucial step towards mitigating project risks, yet many companies don’t use them on every project. They may require more time and planning up front, but the payoff can be huge.
- An important element that the contractor should provide is developing a preliminary HSE plan commensurate with the level of risk involved in the project.

- This plan will be the main element considered when carrying out evaluation of the bid and should be regarded as the top document that drives the specific HSE program for major contracts.
- The contractor's Preliminary HSE Plan should clearly identify the contractor's HSE-MS interacts with the HSE-MS of the client and other subcontractors.
- A proposal should be made by the contractor on the approach to managing these interactions and the allocation of responsibilities for overlapping areas.
- The Preliminary HSE plan combines the findings of the initial scouting (Health, Safety and Environment aspects) carried out by the client and any additional more detailed scouting carried out by contractor, which identified the project specific hazards, which the client should have informed the contractor of any such project specific hazards and the minimum required controls and any support resources during the briefing process and the specific controls proposed by the contractor should be documented in the Preliminary HSE plan.
- A large, voluminous document can be difficult to intercept and understand, therefore ineffective. Hence, format and style is extremely important. The layout and structure must help the client find the relevant information. Information must be readily accessible, in clear, concise language and a threshold should be set as to the level of detail to be included.
- The preliminary HSE plan should be seen as a reference document, which points to more detailed documents. It is not necessary to include extensive material from other stand-alone documents except where this is essential to make the document easy to understand and comply with.
- The contractor's preliminary HSE Plan should clearly identify where their HSE-MS interacts with the HSE-MS of the client and the contractors.
- A proposal should be made by the contractor on the approach to managing these interactions and the allocation of responsibilities for overlapping areas.
- When the contracted activities are covered by a contractor HSE Management System including HSE Cases for contracted installations, the preliminary HSE Plan should only address those issues that are unique for the contract under consideration. It should focus on contract specific risks and the management of controls to eliminate, reduce or mitigate these risks.

- During its development the plan can provide a focus at which the health and safety considerations of design are brought together under the control of the planning supervisor.
- It plays a vital role in the tender documentation. It enables prospective principal contractors to be fully aware of the project's health and safety and welfare requirements. This will allow prospective principal contractors to have a level playing field as far as health and safety is concerned on which to provide tender submissions.
- It provides a template against which different tender submissions can be measured. This helps the planning supervisor to advise the client on the provision of resources for health and safety and to assess the competence of prospective principal contractors.
- The preliminary HSE plan should be generated with input from client, contractor and subcontractors. The ultimate responsibility and ownership of the project HSE plan should be assigned to the contractor.
- The preliminary HSE plan should be endorsed or approved by the level of contractor line management above the senior site manager.
- The preliminary HSE plan can be used to demonstrate that:
    - The contractor or subcontractor has an effective HSE-MS which is being applied to the project.
    - Definitive chain of command for resolution of all hazard prevention issues must be present in the plan.
    - Major hazards and effects of – and to – the project (people, the environment, assets and reputation) have been identified, assessed, and controlled and that recovery preparedness measures are in place.
    - The execution and maintenance of all control and recovery measures are the responsibility of specific, named persons.
    - Risks have been evaluated and measures taken to reduce risk to a level that is 'As Low as Reasonably Practicable' (ALARP).
    - Identification highly hazardous operations within the scope of work and specify integrated preventive measures to mitigate the same.
    - The programme of formal major hazards and effects assessments conducted by the contractor and regular subcontractors across their operations.
    - The contractor and the regular subcontractors are making efforts to continuously improve the management of HSE

5.3.3. Preliminary HSE Plan - Subject Material

This section provides a summary of subject material that was used as the basis for defining the key elements of the preliminary HSE plan developed for IOCL Rath Chakra Project (Polypropylene Project), Paradip Refinery, Odisha. (LSTK-2) on the basis of IOCL's requirements. The following are the key deliverables indicated out of this procedure for the purpose of induction only, enabling contractor to estimate basic resource requirements.

Items	Subject Material
Introduction and Purpose	
Revision status	The document(s) should be clearly identified as to the date and revision status
Custodian	The designated contractor custodian of the preliminary HSE plan should be stated together with the identification of the client project leader.
Signatories	The preliminary HSE plan should be signed by a senior contractor representative who will be on site. The preliminary HSE plan should be endorsed or approved by the level of contractor line management above the senior site manager.
Purpose	The purpose of the preliminary HSE plan should be stated, which is to provide a clearly defined Interface between the client, contractor and subcontractor(s) during project execution and to ensure that project specific hazards have been identified and that a management system is in place.
Description of the Project	
Description	For the benefit of all of those parties impacted by the project including client, contractor, subcontractors and other third party organizations, a description of important specific issues such as: • Project area & Terrain • Legal/regulatory license requirements. • Resources – Personnel experience/continuity status. • Restricted areas. • Camp locations • Types of equipment used. • Number and types of vehicles/vessels used. • Cable/energy source configurations. • Local physical major hazards

Project specific	If required for the benefit of relevant Third Parties, a basic description of the project operation and any special characteristics e.g. Lock Out/ Tag Out Procedures, Hot Work, Radiography, Ventilation, and Confined Space.
Leadership & Commitment	
Commitment to HSE through leadership	Promote positive culture towards HSE matters. All senior managers should set a personal example to others. They should be, and seen to be actively involved in HSE matters, e.g. attendance at HSE meetings, personal instigation of HSE audits and reviews, etc.
Management System Interfaces	
Policies	Identify and reference applicable client, contractor and subcontractor HSE policies
Project objectives and Performance	Summarize project HSE performance metrics (KPI)
Organization, resources and documentation	
Reporting structure between client, contractor and subcontractors	A diagram which shows the reporting structure between all involved parties indicating HSE focal points and including any external HSE and medical advisers, client representatives etc. Include a summary of HSE responsibilities and authorities of key project staff.
Resources	Description of other client HSE and operational support resources if considered relevant. Other contractor and subcontractor staff resources should be included if relevant
Communications	A description of the client – contractor HSE communication and reporting schedule (frequency and method of information transfer)
Risk Management	
Risk assessments	Details of the process used to manage project specific risks (e.g. risk assessment matrix; HAZOP meetings; toolbox meetings etc.) Details of all identified project specific risks and risk reduction measures

Environmental impact Assessments	Summarize any EIAs carried out which impact the project and list actions arising from such EIAs
Planning, Standards and Procedures	
Design Studies to be carried out	• Plot Plan/ Unit Layout Reviews • Fire And Gas Detection Evaluation • Fire Protection System Evaluation • HAZID Reviews • HAZOP Review • SIL Study • Quantitative Risk Assessment • Hazardous Area Classification Review • Noise Study • Hazard And Risk Register
Project specific Procedures	A summary of project specific procedures to include, for example, where relevant: • Permit to Work System • Personal Protective Equipment • Construction Hazards • Safety Signs, Signals • Barricading • Working at Height • Work above water • Welding and Cutting • Electrical installation and equipment • Lockout & tag out system • Handling & storage of chemicals • Lifting operations • Management & handling of hazardous chemicals • Explosives • Excavation • Confined space entry • Fire prevention • Toolbox talks • Housekeeping • Waste management plan
Standards and legislation	Describes specific standards (from client or others) and legislation applicable to the project.

Management of Change	Describe the management of change procedure for e.g. programme, and procedure changes (Authorisation process, hazard/risk re-assessment, etc.). Describe the management of change procedure for staffig level or personnel changes (Authorisation process, etc.). Describe the procedure for exemption to standards, including who can approve such exemptions
Implementation and monitoring	
Performance indicators	A description of the HSE performance indicators for the project (to the extent not covered under policy and objectives above). What are the KPIs for the project?
Incident reporting and Investigation	Describes project incident reporting and investigation requirements as agreed by all parties, and the incident potential rating standards, including: Team composition. Follow - up procedures. Incident seriousness level required to trigger a particular type of investigation, and recovery
HSE records	A summary of the project HSE records that will be maintained.
Training and competence Assessment	Summarises project specific training requirements not described in the crew HSE plan e.g. HSE induction, tests, exercises etc. Summarise project specific competence assurance processes
Sub-Contractors Management Plan	
Subcontractors	Provide details of project specific subcontractors, selection and interface management, roles and responsibilities of subcontractors.
Compliance Assurance	
Inspection programme	Summarise the project HSE inspection programme (routine and random)
Project audits	Describes the joint client/contractor audit and review schedule
Management Review	
Joint review	A process and schedule for a joint review by client and contractor of HSE performance.

Table 5.7.: Preliminary HSE Plan Subject Material

5.3.4. Summary of Preliminary HSE Plan for IOCL Rath Chakra Project, Paradip Refinery, Odisha. (LSTK-2)

5.3.4.1. Introduction

This Health, Safety and Environmental (HSE) Plan has been prepared as a demonstration of CONTRACTOR's commitment to HSE and its compliance with the requirements of the AGREEMENT related to the IOCL Rath Chakra Project (Polypropylene Project), Paradip Refinery, Odisha. It embraces the requirements of the scope of work detailed in the overall project scope of work given in the IOCL Bidding Document No. 6662-PM-CA-0007. Requirements stipulated in this specification shall supplement the requirements of HSE Management given in relevant Act(s)/legislations, General Conditions of Contract (GCC),Special Conditions of Contract (SCC) and Job (Technical) Specifications and relevant Indian legislation. It also compliments the following Project documentation:

- COMPANY and CONTRACTOR's HSE Policy Statements
- Project Execution Plan (Doc No. 6662-PM-BD-0010)
- HSE Instructions to Contractors (Doc No. 3210-8710-PR-0002)
- Construction HSE Special Requirements (Doc No. 6662-CM-BG-0001)
- Health, Safety and Environment Requirements (Doc No. 6662-PE-EC-0030)
- TKIS Construction HSE Manual, Rev -01
- TKIS HSE Requirements (Doc No.: 6662-PE-EC-0047)
- HSE Specification Contractor Requirements (3210-8560-SP-0001,A1)

It describes HSE activities and schedule with respect to the overall Project programme, HSE roles and responsibilities and interfaces with other disciplines and also describes the 'HSE deliverables' e.g. studies, reviews, audits, and reports to be generated.

Each member of the Project team is entrusted with a responsibility for HSE within their scope of activities. Therefore it is the responsibility of everyone employed on the Project to become familiar with this HSE Plan and to apply it conscientiously. The HSE Plan will be subject to periodic review and updating as the Project progresses through the EPC Phase to reflect any changes that may occur.

The term 'COMPANY' refers to INDIAN OIL CORPORATION LIMITED& the term 'CONTRACTOR' refers to LARSEN & TOUBRO HYDROCARBON ENGINEERING LIMITED hereby referred in this document.

5.3.4.2. Project Overview and Brief Scope of Work

CONTRACTOR will execute the work on Lump Sum Turnkey Basis (LSTK).

The scope of work includes Residual Basic Engineering, Detailed Engineering including design, Project Management, Total Procurement, Fabrication, Manufacturing, Quality Assurance, Inspection & Expediting, Construction and Installation, Obtaining all Statutory Approvals (except for Environment Clearance which has been obtained by IOCL) Pre-commissioning & Mechanical Completion of Plant, Start up, Commissioning and Performance Guarantee Test Runs of Coker LPG Treating Unit and Offsite & Utility Facilities (LSTK – 2 Package) on Lump Sum turn Key Basis for Rath Chakra Project of M/S Indian Oil Corporation Limited (IOCL) at Paradip Refinery, Paradip, Odisha.

Process/ other units covered under this package shall be as under:-

- 165 KTPA Coker LPG Treater Unit
- Nitrogen Generation Unit
- FCC Unit modifications
- Oxidizer Column
- DSO Separator Columns
- 1st stage CFC Caustic Wash Separator
- 2nd stage CFC Caustic Wash Separator
- Off sites & Utilities including PP flare system
- Cooling Tower for PP plant
- OSBL Pipe racks
- Fire Fighting system
- Laboratory Building (excluding laboratory equipment)
- Satellite Rack Room etc.

5.3.4.3. Project HSE Philosophy

The project HSE plan shall develop in accordance with project HSE requirements, CONTRACTOR, OHSPM, local legal rules & regulation. Other HSE documents viz. Hazard identification & risk assessment, Legal register, and Emergency plan, shall be developed & implemented during project execution.

CONTRACTOR has a robust HSE Management System framework and HSE Capability centre is committed to further strengthen it with required support to various business units and locations. The HSE Management system of CONTRACTOR is in line with best industry practices and comprises of the following key elements

- Leadership & Commitment
- Policy, Strategic Objectives & Targets
- Organization, Responsibilities and Resources
- Risk evaluation & management
- Planning, standards & procedures
- Implementation & monitoring
- Compliance assurance
- Management review
- Contractor's safety management.

COMPANY places prime importance on health, safety and environmental ("HSE") issues and requires that CONTRACTOR subscribes and actively pursue the highest standards of HSE performance.

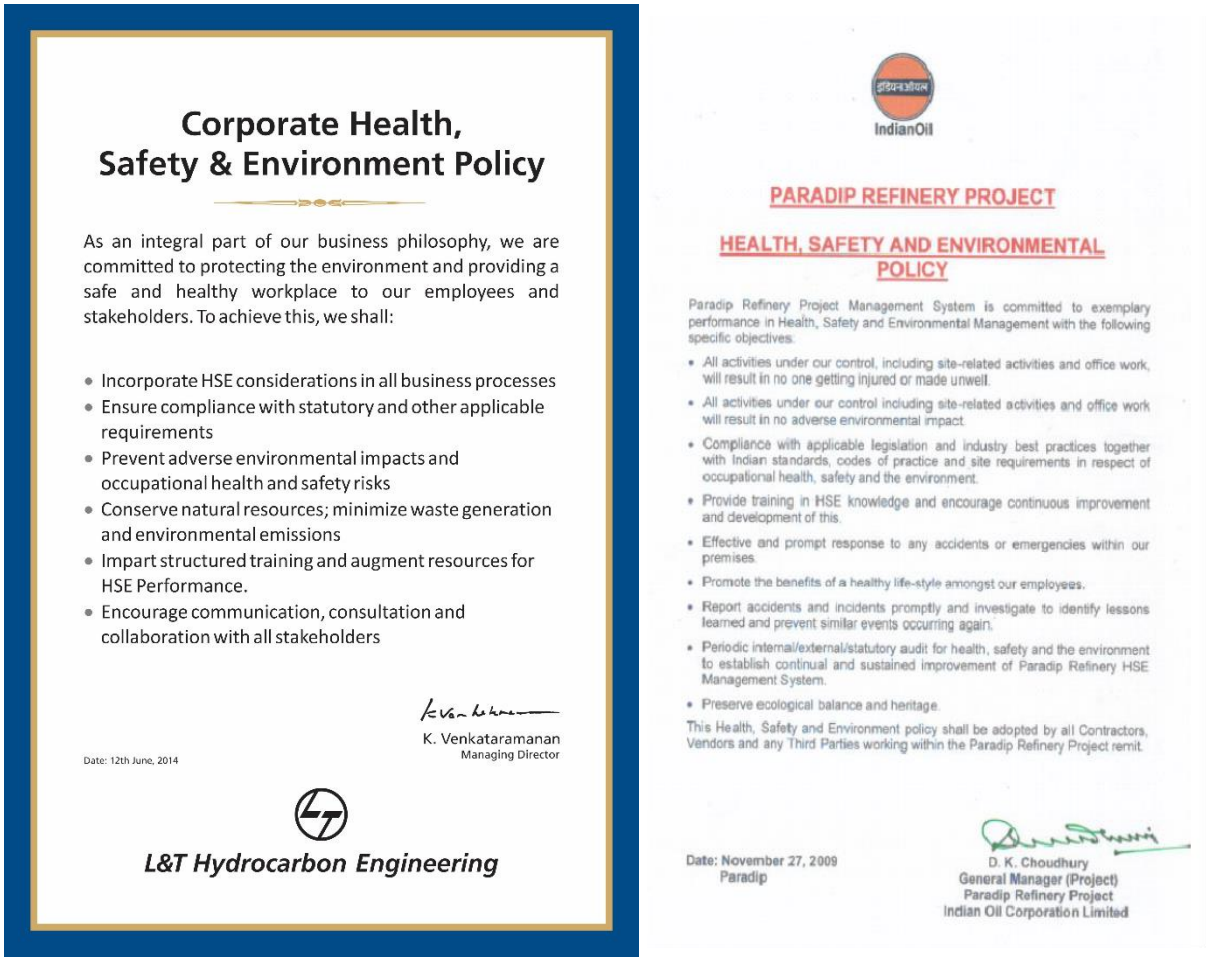
5.3.4.4. HSE Leadership and Commitment

- Senior Management at CONTRACTOR's Board level reviews HSE performance on quarterly basis. Further, to demonstrate high degree of commitment to Health, Safety and Environmental, frequent site visits are undertaken.
- Usually, whenever a Head of SBU (Strategic Business Unit) visits a particular project site, HSE review is always one of the agenda. Senior management commitment to HSE is also demonstrated by means of raising issues / discussing matters related to HSE during the periodic (weekly / monthly) Project Progress Review Meetings.
- CONTRACTOR understands that high standards of HSE shall only be achieved by the dedicated and demonstrated efforts of all project personnel from senior management down. Planning and accountability for HSE precedes all other project objectives.

- CONTRACTOR management is committed to provide the required resources (training and manpower) to ensure that all work activities are conducted in a safe manner to the satisfaction of COMPANY and its own standards.
- CONTRACTOR Management is also committed to provide the following incentives to encourage workers to participate actively in the HSEMS continuous improvement process. Senior management will carry out site visits at agreed frequencies to ensure compliance.
- Various Incentive schemes shall be implemented as part of employees' motivational program during project execution.
- Also to demonstrate senior management involvement in HSE matters, HSE Audit /Inspection plan shall be performed.

5.3.4.5. Policy, Strategic Objectives & Targets

LTHE & IOCL HSE Policy



Corporate Health, Safety & Environment Policy

As an integral part of our business philosophy, we are committed to protecting the environment and providing a safe and healthy workplace to our employees and stakeholders. To achieve this, we shall:

- Incorporate HSE considerations in all business processes
- Ensure compliance with statutory and other applicable requirements
- Prevent adverse environmental impacts and occupational health and safety risks
- Conserve natural resources; minimize waste generation and environmental emissions
- Impart structured training and augment resources for HSE Performance.
- Encourage communication, consultation and collaboration with all stakeholders

K. Venkataramanan
Managing Director

Date: 12th June, 2014

L&T Hydrocarbon Engineering

IndianOil

PARADIP REFINERY PROJECT

HEALTH, SAFETY AND ENVIRONMENTAL POLICY

Paradip Refinery Project Management System is committed to exemplary performance in Health, Safety and Environmental Management with the following specific objectives.

- All activities under our control, including site-related activities and office work, will result in no one getting injured or made unwell.
- All activities under our control including site-related activities and office work will result in no adverse environmental impact.
- Compliance with applicable legislation and industry best practices together with Indian standards, codes of practice and site requirements in respect of occupational health, safety and the environment.
- Provide training in HSE knowledge and encourage continuous improvement and development of this.
- Effective and prompt response to any accidents or emergencies within our premises.
- Promote the benefits of a healthy life-style amongst our employees.
- Report accidents and incidents promptly and investigate to identify lessons learned and prevent similar events occurring again.
- Periodic internal/external/statutory audit for health, safety and the environment to establish continual and sustained improvement of Paradip Refinery HSE Management System.
- Preserve ecological balance and heritage.

This Health, Safety and Environment policy shall be adopted by all Contractors, Vendors and any Third Parties working within the Paradip Refinery Project remit.

Date: November 27, 2009
Paradip

D. K. Choudhury
General Manager (Project)
Paradip Refinery Project
Indian Oil Corporation Limited

Figure 5.9. HSE Policies

Project HSE Targets

CONTRACTOR's Corporate policy & Zero Incident Credo communicates the commitment of CONTRACTOR management towards Health, Safety and Environment [HSE] . It clearly spells out the management's concern regarding the Health and Safety of all personnel as an important factor and recognizes these factors as very essential for the welfare and morale of personnel as also for contributing to company's growth.

Figure 5.10. Project HSE Targets

During engineering, procurement, construction and commissioning activities, the safety objective is to work towards an injury and incident free work, expressed as follows:

Performance Indicator	**Basis of measurement**	**Target**
Number of accidents during project life cycle	Number of Fatalities	0
	Number of Lost Time Injury	0
HSE Audits	Quarterly	1
Site HSE training	Concerned employees	100%
Site HSE induction	New employees deployed at site	100%
Project HSE Meeting	Monthly	1
Site HSE Meeting(*)	Monthly	1
Near miss Report	Report all near-misses	100%
HSE Rewards	Quarterly	1
Mock drills	Half yearly	1
Number of close out points	No overdue NCR, inspections actions / quarter	100%

Table 5.8. Project HSE Targets

(*) Weekly HSE meeting with COMPANY shall be attended by all HSE Personal including subcontractor HSE staff

. **5.3.4.6. Organization, Responsibilities and Resources**

CONTRACTOR will ensure adequate HSE resources are provided to execute the job. The Typical HSE Organization deployed for this project shall be as below:

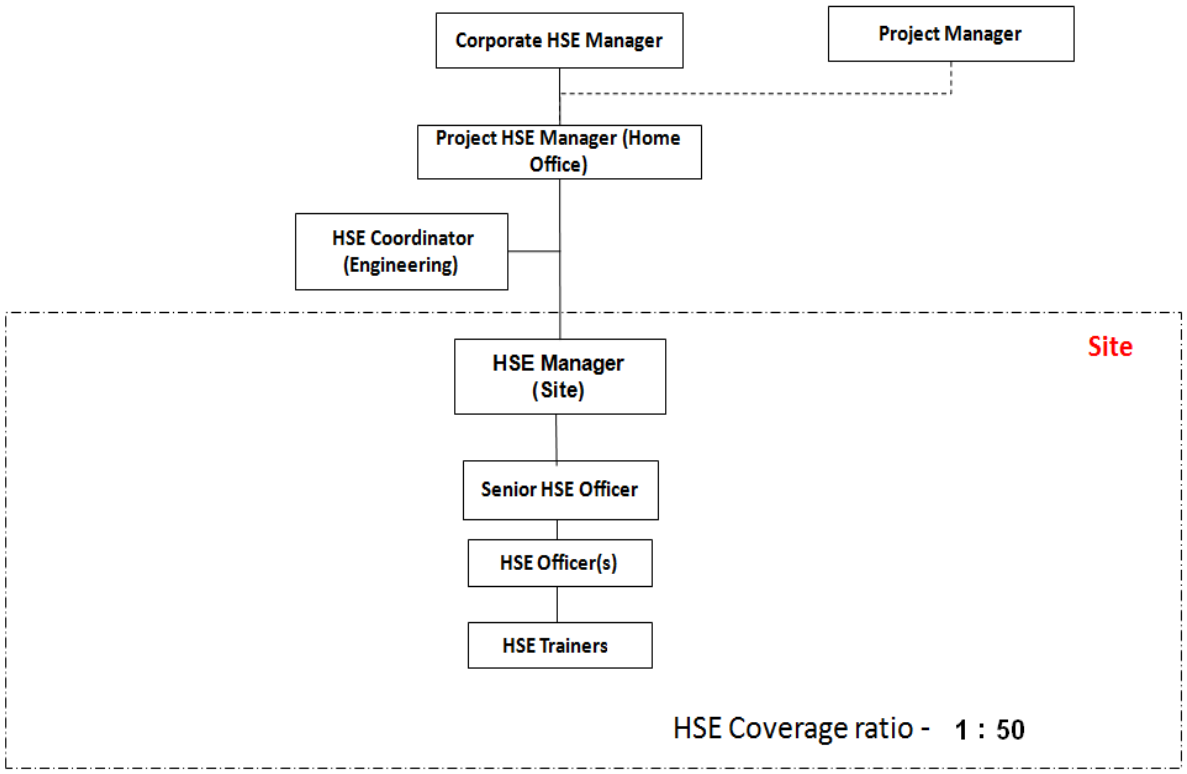


Figure 5.11. HSE Organogram

Site HSE Team shall be led by qualified, experienced HSE Manager (minimum 15 years of experienced). HSE coverage shall be 1:50 at site. The CONTRACTOR will submit a HSE organogram clearly indicating the lines of responsibility and reporting system and elaborate the responsibilities of safety personnel in their HSE Plan.

A pre-mobilization medical test by qualified doctor (Min- MBBS) shall be arranged prior to deployment of all workers and fitness certificates shall be submitted for issue of entry gate pass.

CONTRACTOR will forward CV of all proposed HSE personnel, Doctor and male nurse for COMPANY/ PMC approval. Only approved personnel will be assigned to the job.

CONTRACTOR will have sufficient COMPANY approved resources as back up for replacements as required.

Roles & Responsibilities

Project Director - Responsibilities

The Project Director shall be responsible for the following:

- Approve and be accountable for the overall HSE programme and responsible for HSE Performance.
- Ensure that the modifications to the design under the direct control of the Project Engineering Manager, has included considerations for safety, health and environment during design, fabrication, construction, commissioning, maintenance and operations.
- Ensure that communications are adequate to advise all parties of risks or concerns as they are identified.
- Allocate sufficient resources for the management and the implementation of the HSE programme.
- Contribute to the HSE programme as indicated in the scope of HSE work.
- Ensure that all project personnel take ownership of the HSE programme.

Project HSE Manager – Responsibilities

The Project HSE Manager Reports to the Project Director and has the following responsibilities:

- To provide professional expertise, direction and guidance to the Project
- To take ownership of the initial development and formulation of the Project HSE Plan
- To ensure effective implementation and integration of the HSE Plan by all project personnel throughout the project
- To monitor HSE Performance
- To ensure that the Project receives the HSE service it requires
- To ensure HSE personnel assigned to the Project are suitably qualified by education; training and experience in the type of work involved in this Project; and are suitably experienced in the implementation of safety and EIA Studies
- To review the Project HSE Plans of all sub-contracts and to provide guidance on any corrective actions required
- To inspect, audit and report on the Project HSE programme and HSE performance
- To interface with the Project QA Manager to ensure effective operation of the Project's Management System

The Project HSE Manager maintains daily responsibility for all HSE matters under the overall responsibility of the Project Director and will be assisted by the Lead Engineers of the various specialist disciplines as described below to ensure the requirements of the Project HSE plan are met.

Safety of design will be performed by Loss Prevention Group on the Project, who report to the Project Engineering Manager. Loss Prevention Group will interface with other groups for the ongoing development of safety in the design modifications to the facilities. These interfaces will be achieved by the following means:

- Kick off meetings to establish interface arrangements
- Via the "IDC" Process of inter-discipline checking
- Safety Audits

The Environmental Engineer for the Project, who reports to the Project Engineering Manager, will manage the Environmental Impact Assessment, which will be conducted in parallel to the design of the facilities. The Engineering Manager is responsible for ensuring integration of the HSE input into the design throughout all other Engineering Disciplines.

Other Site Professionals and Staffs such as Resident Construction Manager (RCM), Workers, Medical Staff, and Site Engineers must be defined.

5.3.4.7. Risk Management

It is the strategic objective of CONTRACTOR to manage the risk within ALARP (As low as Reasonably Practicable) level. To this effect it is necessary that all associated hazards are identified, analyzed and preventive barriers are implemented to effectively manage the risk.

However it is the site management responsibility to identify the risk involved for each activity during the job planning, make arrangement to minimize the risk, communicate with all the personnel involved, record it in the permits and ensure effective implementation during the execution of the job. As Low as Reasonably Practicable in this sense implies that further risk reduction would be physically impracticable or that the cost to implement the risk reduction would be grossly disproportionate to the benefit gained. Where dispute arises from CONTRACTOR's evaluation of ALARP requirements, Project Construction Director / Construction Manager (RCM) will resolve in an expedient manner. Detailed Identification and Risk Analysis Procedure shall be prepared & submitted to COMPANY.

Risk Assessment Procedure

The below mentioned four steps are a basic structure but in reality each of the four main steps are overlapping and iterative.

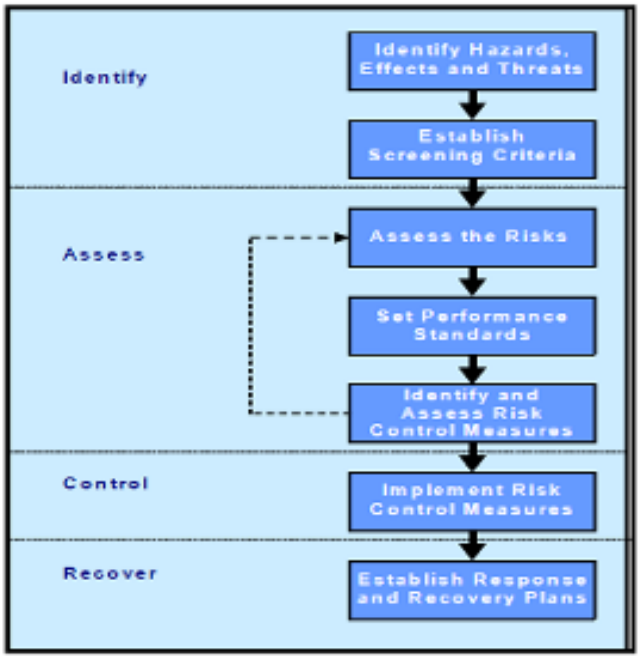


Figure 5.12. Risk Assessment Procedure

Hierarchy of Control

A typical hierarchy of control, from high risk to low risk, is indicated below:

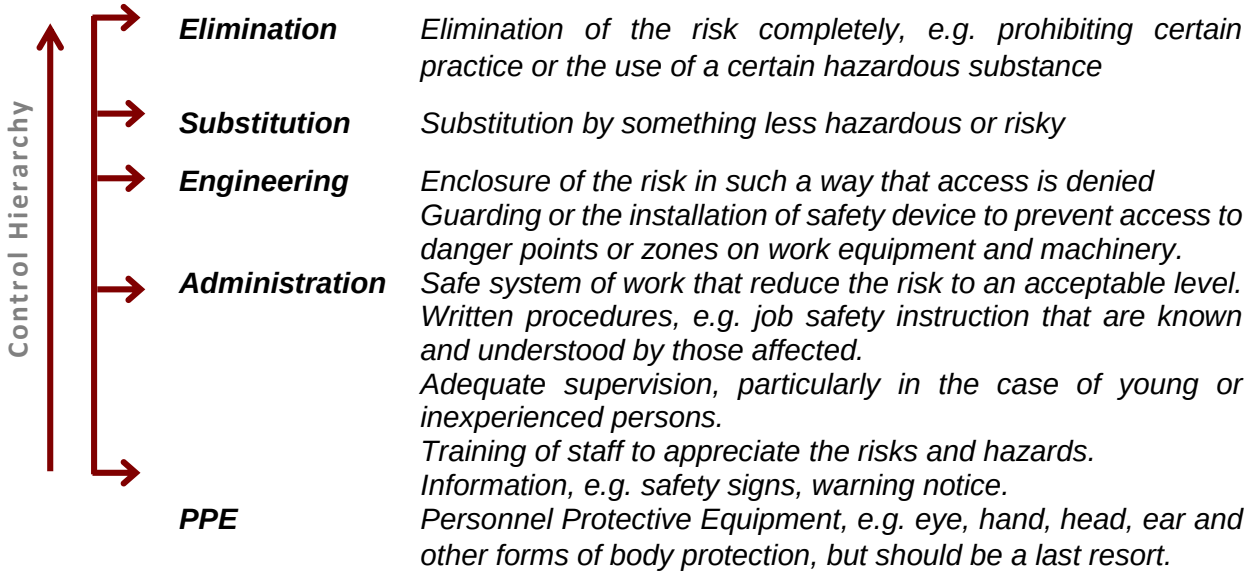


Figure 5.13. Hierarchy of Control

5.3.4.8. Planning, Standards & Procedures

Legal & Other Requirements

CONTRACTOR will not dump, release or otherwise discharge or disposes off any such materials without the express authorization of COMPANY / PMC. CONTRACTOR will comply with all applicable Health, Safety & Environmental legal requirements.

- The Motor Vehicle Act and Central Motor Vehicle Rules
- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules
- The Water (Prevention & Control & Pollution) Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Indian Explosives Act and Rules.
- The Building and Other Construction Workers (Regulation of Employment and Condition of service)Act
- Other statutory acts Like EPF, ESIS, Minimum Wage Act.
- Noise Pollution Regulation Rules
- Atomic Energy Act 1962
- Norms specified by State & Central Pollution Control Board (SPCB)
- OISD norms & guidelines
- Conditions specified in Environmental, Clearance issued by MoEF, Consents & authorizations issued by SPCB, Central Ground Water Board (CGWB).
- Apart from the legal and other applicable international requirements CONTRACTOR will follow the COMPANY’s requirements specific to the project and work location.

Design HSE Approach

The approach used to incorporate HSE into the design modifications of the facilities is defined in this Plan. The design shall identify and assess the significant major hazards and their consequences, which may include the following:-

a) Fire, explosion, toxic release and/or pollution, caused by:

- Blow-out
- Equipment or pipeline failure
- Failure of process fluid containment
- Dropped Objects
- Uncontrolled release of toxic/explosive/flammable substances

b) Events resulting in loss of Containment:

- Vessel impact during installation/work-over
- Severe weather
- Projectile damage, corrosion, etc

c) Consequential threats caused indirectly by:

- Power supply failure
- Communications loss
- ESD, F & G or Control System failure
- Human Error
- Emergency lighting failures

Adopting the following processes:

- **HAZID Studies**

These will be prepared and updated incorporating any design changes from the initial design packages and will identify all major hazards associated with the design.

- **Escape, Evacuation and Emergency Response**

An Escape, Evacuation and Emergency Response report will be prepared and updated against design changes. Alarm signals, measures to ensure safe escape, muster stations, communications, escape procedures and response equipment will be reviewed and will not be allowed to be compromised or jeopardised.

- **HAZOP Studies**

HAZOP reviews will be conducted at agreed times during the course of the Project through approved third party chairman. CONTRACTOR shall ensure that all action points arising from HAZOP are resolved it into design.

- **ENVID Studies**

This study will be performed in order to identify all environmental hazards and issues

- **SIL Study**

Safety Integrity Level (SIL) Reviews shall be carried out by CONTRACTOR for relevant areas and/or systems under the CONTRACT Equipment / Services scope. SIL Reviews shall be carried out in accordance with Project Procedure 3210-8560-PR-0010 (SIL Review Procedure (EPC Phase)).

- **Hazard Register**

CONTRACTOR shall prepare and maintain an overall risk inventory - Hazard and Risk Register, of all work related risks based on frequency and consequence severity. This document will be prepared and will be submitted to client.

- **Noise Study**

CONTRACTOR shall carryout noise mapping for the entire plant and shall implement the noise mitigation measures for the Project across all the areas. Activities shall include but not limited to preparation of equipment noise data sheets for all relevant items of equipment, preparation of procedure and implement necessary action for control of noise/ acoustic fatigue, ensuring vendor compliance with noise requirements, ensuring that the vendor conducts all applicable noise acceptance tests. All equipment shall be specified to meet 85 dB (A) at 1m distance.

- **Plot Plan/ Unit Layout Reviews**

CONTRACTOR shall carry out formal Plot Plan Reviews covering emergency access and escape routes, safety shower/ eyewash locations review. This shall be a team review and shall include CONTRACTOR's Project, Process, Technical Safety, Piping and Commissioning engineers; COMPANY shall also attend.

All HSE actions arising shall be included in the Action Tracking Register.

HSE Approach during Construction and Commissioning Stage

This section details the minimum HSE requirements that shall be implemented at the Project sites by all CONTRACTOR site personnel and subcontractor personnel**.**

- **Permit to work system**

It is a written document specifying the nature of job, hazards, controls and responsibilities. A detailed procedure of Permit to work system shall be developed in line with the PMC/COMPANY procedures. The procedure will clearly outline the types of activities requiring work permit. The procedure shall be duly approved by the COMPANY.

- **Personal Protective Equipment**

CONTRACTOR will evaluate the need of PPE for their employees considering the jobs executed and hazards involved. Risk assessments shall be carried out for all critical jobs and need of specific PPE shall be evaluated. If asked by the COMPANY, CONTRACTOR will submit samples of PPE for COMPANY's approval prior its use at site.

- **Construction Hazards**

CONTRACTOR will ensure identification of all Occupational Health, Safety & Environmental hazards in the type of work he is going to undertake and enlist mitigation measures. CONTRACTOR will carry out Job Safety Analysis (JSA)/Risk Analysis specifically for high risk jobs/critical jobs.

- **Safety Signs, Signals**

Safety signs, signals, barricades appropriate to the type of hazards, cautions, notices and warning/safe guard barriers shall be provided in the construction area.

- **Barricading**

Physical hard barriers will be used as the primary means to barricade hazards and hazardous work area in all cases where the hazard or danger will exists for a period of longer than 8 hours. Barricade tape will be used to wrap around the physical barrier or in conjunction with the physical barrier to provide additional warning of the hazards or dander that exist and / or increase the visibility of the barrier.

- **Working at height**

CONTRACTOR will ensure the adequate norms are complied with whilst working at height. All the employees or workforce have to undergo work at height training programme. The policy of tying the lanyard of the safety harness shall be followed in line with the COMPANY procedure. Ladders & Scaffolding General Requirements are defined.

- **Gas cylinder safety**

CONTRACTOR will ensure adequate control of hazards due to gas cylinders. Gas cylinders shall be stored in a well ventilated area under shade.

Cylinders shall be stored vertically in proper storage racks and chained. All cylinders shall be mounted on trolleys and provided with a closing key.

- **Electrical Installation and Equipment**

All electrical installations shall be approved by the concerned statutory authorities. All temporary electrical installations / facilities shall be regularly checked by the licensed/competent electricians of the Contractor and appropriate records shall be maintained. Such inspection records are to be made available to COMPANY / PMC, whenever asked for.

- **Lock Out & Tag Out System**

CONTRACTOR will ensure the following for control of hazards. Before working on plant or equipment, isolate the machine from the main power supply by locking of the power.

Use a safety lock with one key. Multiple locks / tags are required to put when multiple jobs are planned. Adequate measures must be followed to ensure positive isolation.

- **Occupational Health Management**

CONTRACTOR will identify all operations that can adversely affect the health of its workers and issue & implement mitigation measures.

- **Management & Handling of Hazardous Chemicals**

Management and handling of hazardous chemicals in India is regulated by the Manufacture Storage and Import of Hazardous Chemical (MSIHC) Rules. CONTRACTOR will identify all hazardous chemicals used or stored by it for the purpose of meeting contractual obligations with client.

- **Leakage / Spillage of Hydrocarbons and Chemicals**

CONTRACTOR will ensure that the implementation of applicable HSE Procedure at storage area and investigate in case if leakage OR spillage & Prepare HSE Alert & circulate

- **Ionizing Radiation**

Ionizing radiation sources are used for radiography. These sources possess high risk at work site. Therefore CONTRACTOR will ensure utmost care to minimize the risks.

- **Demolition Plan**

Before any demolition work is started, a supervisor shall be appointed in writing as the person responsible for all work on site. The man appointed shall be experienced in demolition operations. His duties will include the direct supervision of the work force ensuring that work permit requirement are met.

- **Explosives**

Good Housekeeping means a Good business. It plays a vital role in prevention of accidents at work site. Therefore housekeeping shall be followed at work site like any other operational activity. The CONTRACTOR will be responsible for ensuring that the work Sites are kept clean and tidy and that all scrap materials are removed from the Sites periodically.

- **Road Safety Management**

All road transport operations shall comply with the COMPANY specifications and COMPANY's HSEMS Guidelines for contractors mentioned in CONTRACTOR HSE Requirements.

- **Confined Space Entry**

CONTRACTOR will generate a work permit before entering a confined space. People, who are permitted to enter into confined space, shall be medically examined & certified by registered doctor, confirming their 'medical fitness for working in confined space'. All necessary precautions mentioned therein shall be adhered to.

- **Fire Prevention**

CONTRACTOR will identify all sources of fire hazards and plan controls accordingly. Housekeeping of the work site shall be done on regular basis& mass housekeeping on weekly basis as per COMPANY requirements. Critical works shall be regulated by work permit.

- **Lifting Operations**

The objective of this Part is to ensure that all employees who participate in lifting operations are fully aware of their responsibilities and act in a manner that will ensure safe lifting operations. This is achieved through ensuring lifting appliances, and lifting gear are certified and fit for purpose and ensuring lifting operations are planned and controlled so that a safe system is provided and maintained.

- **Work above Water**

Where work is done over or in close proximity to water & where possibility of drowning exists, provision should be made for preventing workers from falling into water, The rescue of workers in danger of drowning, Safe and sufficient transport. Provisions for the safe performance of work over or in close proximity to water should include, where appropriate, the provision and use of suitable and adequate fencing, safety nets and safety harnesses, lifebuoys, life jackets and manned boats, protection against such hazards as reptiles and other animals.

- **Toolbox Talks**

Tool box talks are quite effective means of communicating the work place hazards and appropriate controls to the workers. It helps in better understanding and ensure proper controls to reduce the risks.

- **Emergency Response and Evacuation Procedures**

CONTRACTOR shall prepare site specific emergency management plan addressing the Emergency Organogram, Role and responsibilities, Communication system, emergency equipment and facilities, telephone numbers of important personnel and resources, medical facilities. Same shall be submitted to client for necessary approval.

- **Environmental Management**

CONTRACTOR shall develop an Environmental Management System (EMS) to control and minimize the environmental impact during the whole duration of the Work.

- **Waste Management Plan**

CONTRACTOR shall develop a Waste Management Plan to control and minimize the impact of different types of wastes during the whole duration of the Work. Suitable Waste Disposal Procedures must be employed in the project site.

5.3.4.9. Implementation and Monitoring

Induction Programs

It is mandatory that the employee must undergo training before starting to work on site. Induction Programs are used to provide such training for new employees in a project site.

Awareness/ Campaign Programs

Either from the corporate office / country office or at site the Site HSE Manager identifies the themes for campaigns like Housekeeping, Road Safety, Health campaigns to create more awareness among the employees on the subject declared. CONTRACTOR will promote and develop awareness on Health, Safety and Environment protection among all personnel working for the CONTRACTOR.

Behaviour Based Safety

CONTRACTOR will develop a system to implement Behaviour-Based Safety (BBS) through which work groups can identify, measure and change the behaviours of employees and workers

Safety Observation Program

The basic principle of STOP is that all injuries and occupational illnesses can be prevented. The main objective of the STOP program is to train each member of the line organization to eliminate incidents and injuries by skilfully observing people as they work, talking with them to correct their unsafe acts, and encouraging them to follow safe work practices.

Monthly HSE Performance Monitoring and Measurement

Monthly Activity Plan: Site HSE Manager plans the activity for the month and records in the Monthly Activity Plan. At the end of the month he marks the activities which are achieved & if not mentions the reason.

Incident Investigation

The immediate aim of accident reporting and investigations is to obtain the most accurate and full information about the circumstances and causes of the accidents. The ultimate objectives are to prevent the occurrence of similar accident in the future, uncover new hazards where such exist and devise adequate measures to control them.

All accidents/ incidents shall be reported immediately as per COMPANY/ PMC format No. HSE-CON-IN-024, M02. Thereafter a supplementary accident/ incident investigation report shall be submitted as per Format No. HSE-CON-IN-024, M03. The incident shall be investigated by a team of CONTRACTOR's senior personnel for establishing root cause and recommending corrective and preventive actions. Findings shall be documented and suitable actions' taken to avoid recurrences shall be communicated to PMC/ COMPANY.

Record Keeping

CONTRACTOR shall evolve a comprehensive, planned and documented system for implementation and monitoring of the HSE requirements. CONTRACTOR shall maintain following HSE records, statistics during project execution

- Monthly HSE Checklist cum compliance report
- Accident/ Incident (Near Miss) Report
- HSE Plan
- Supplementary Accident/ Incident Investigation report
- Near Miss Incident Report.
- Monthly HSE Report
- Permit for working at height
- Permit for working in Confined space
- Minutes of various Meetings
- HSE Inspections/ Audits reports
- Work Permits
- Equipment inspection Reports/Certificates
- Medical Examination records

5.3.4.10. Subcontractors Management Plan

CONTRACTOR will interface and manage subcontractors through pre-bid/award and kick-off meetings, weekly progress and performance reviews .This will also be facilitated by establishing a close working relationship between all Subcontractor HSE personnel and CONTRACTOR HSE personnel (Site HSE Committees, weekly meetings, assistance with HSE Toolbox Talk materials, etc.) and through involvement of Subcontractor's in all sites HSE programs, inspections, meetings, and celebrations of success initiated on site.

5.3.4.11. Compliance Assurance

CONTRACTOR ensures Compliance assurance through a comprehensive program that helps organizations and their employees conduct operations and activities ethically; with the highest level of integrity, and in compliance with legal and regulatory requirements. CONTRACTOR performs Compliance Assurance through HSE Inspections and Audits. It ensures that the provisions of its regulations are being met.

HSE Audits

CONTRACTOR will submit an Audit Plan to Owner indicating the type of audits and covering following as minimum.

TYPE	AUDITOR	AUDITEE	FREQUENCY
External	3rd Party (in coordination with Management System Cell, HO)	Head of Corporate office, Country office & Project Site	Once in a year
Internal	SBG/BU Head with a team consisting Senior Staff	Project Manager	Once in a year
Internal	Head of HSE Department	Project Manager	Half yearly
Internal	Project HSE Manager or Site HSE Manager of another project	Project Manager	Quarterly
COMPANY	COMPANY Representative	CONTRACTOR	As per project specific HSE requirements
Internal	Site HSE Manager	Subcontractor	Quarterly

Table 5.9. HSE Audit Program

HSE Inspections

- **Routine Inspection**

Routine inspections refer to inspections performed at a standard interval in time, such as the inspection of plant, equipment, temporary structures, and waste and chemical storages, by a competent person or a person with extensive knowledge and experience that has been appointed by CONTRACTOR Site Management or inspection along with COMPANY team. Daily site walk around by the HSE Engineer can sometimes integrated with HSE routine inspections.

- **Random Inspection**

Random inspections are inspections performed before or during the execution of a construction operation or activity. Random inspections are usually performed through the comparison of a construction operation or activity against established plans, procedures, method statements and/or current legislation, regulations or standards.

5.3.4.12. Management Review

The review of contract HSE performance shall be carried out effectively involving senior management as under

Meeting	Members	Periodicity
COMPANY Meeting	CONTRACTOR RCM & Site HSE Manager	As per COMPANY schedule
Project HSE Review meeting	Project Manager – Chairman Project HSE Manager – Convenor All discipline in charge	Monthly
Site HSE Committee meeting	RCM – Chairman Site HSE Manager - Convenor HSE Committee members	Monthly
Sub Contractor HSE Meeting	RCM – Chairman Site HSE Manager - Convenor Contractor site In-charge & Site HSE Officer	Weekly
Toolbox	Workmen	Daily prior to start jobs
HSE Alignment meeting (KOM)	RCM – Chairman Site HSE Manager - Convenor Subcontractors key person	Prior to start of any work and Mobilization

Table 5.10 Management Review

5.4. RISK REGISTER

A risk register describes any major hazards identified at the specific project level which will have high impact on project's time, budget and HSE performance. A combined risk register can easily be adapted to show how existing commercial risks have a HSE impact as well as the interdependency of HSE risks with cost and program issues. It is recommended that an integrated risk register is developed, initially at least.

Depending on the size and complexity of the project, it may be necessary to group risks thereby separating health and safety risks as the register grows. If this is the case then links between the two need to remain strong. Within general risk management, authors on the subject include categories,

- Project management team experience and availability (competence & resources)
- Site-specific safety procedures
- Ground conditions
- Temporary works
- Preventative measures to protect staff, labour and surrounding areas

These categories can be used as a guide; however, the detailed information will come from the project stakeholders, which usually happens during meetings such as hazard ID workshops. Project meetings of any sort will invariably lead to identification of risks followed by agreement on how they will be managed. The risk register merely formalises this process in a tabular form. Therefore any meeting that generates the discussion of a risk should use the Risk Register.

From here the register will be used throughout the project's life. This means it becomes a constantly used tool which is dynamic, changing as uncertainties change through each phase. After initial completion, the risk register becomes a control tool, which can be used to check performance with corrective actions taken, if necessary. The risk register's main benefit is that it formalizes the risk management process and communicates the most important information in a structured manner. Once risk sources, or health and safety hazards are identified, there are other relevant pieces of information required for the risk register. The potential impact of each risk needs to be assessed and recorded. In terms of commercial risk this will relate to size and likelihood of impact on cost and programme. In terms of HSE hazards this will relate to severity and likelihood of accident. Issues considered commercial that affect cost and programme, can

also be assessed for their impact on HSE. Likewise the effect of a health and safety risk on cost and programme may be assessed; although, depending on the level of information that can be obtained, this may be purely indicative. After completion of the risk register it becomes a control tool, which can be used to check that the planned actions are being implemented. Performance can therefore be measured and corrective actions taken, if necessary.

The inputs given by the HSE team to the project risk register which is prepared for IOCL Rath Chakra Project (Polypropylene Project), Paradip Refinery, Odisha. (LSTK-2) is shown below.

	Risk Description		**Assessment**				**Revision : V.0**	
S. No	**Identified Risk**	**Detail**	**S**	**P**	**L**	**Mitigation Plan & Action**	**Target Date**	**Done by**
1	Poor HSE performance	Incident, cost increase, time delay.	High	Medium	Likely	Pre-tender HSE assessment	Date	Project Manager
2	Hazardous material on site	Incident, cost increase, time delay.	High	Low	Most likely	Site Surveys: Soil & HAZMAT	Date	Site Manager
3	Deviations by vendors, Unavailability of resources	Cost increase, time delay.	Low	Low	Less Likely	Monitoring Programs	Date	Project Manager
4	Stringent safety expectations, HSE Coverage (1;50) & the high penalties for safety violations & accidents	Cost Increase, schedule delay	Medium	Low	Likely	Confirming and Analysing Contractor Construction Team.	Date	HSE Manager, Project Manager
5	Site is located in cyclone prone area.	Schedule Delay, Cost increase	Low	Medium	Likely	Proper Procedures developed for Safe Procedures during Cyclone	Date	Project Manager, Project Control Manager, Construction Manager

6	Suitable Road for ODC within refinery	Incident due to negligence	Medium	Low	Likely	To be communicated to Client	Date	Construction Manager, PM and PCM for obligations
7	Non-Availability of sufficient and Skilled Construction Workmen	Incident, Delay in Schedule	High	Medium	Likely	Proper Screening process must be developed	Date	Project Manager, HSE Manager
8	Additional piping and instrumentation due to HAZOP recommendation / other special Studies	Cost Increase	Low	Medium	Likely	Suitable provision to be taken	Date	Proposal Manager with inputs from Engg.
9	Soil Investigation Report - Reliability	Incident due to Change in Soil	Medium	Medium	Likely	Verification of Soil investigation report	Date	Project Manager, HSE Taeam
10	Delayed Site hand over by IOCL Roads within refinery and Peripheral drains	Schedule Delay	Low	Medium	Likely	Suitable milestone to be defined in project schedule to ensure project extension by IOCL in such a scenario.	Date	Project Manager
11	Possible Work above Water Scenario in between North and South Refineries	Incident due to mishaps	High	Medium	More Likely	Suitable Procedures must be developed.	Date	Project Manager, HSE Team
S – Severity, P-Probability, L- Likelihood								

Table 5.11.: Project Risk Register

5.5. RESPONSIBILITY CHART

- A responsibility chart is a matrix or chart that indicates the required actions from each individual or organisation for each task. It is used to show who does what during a project and when it is to be done.
- The roles and responsibilities of the client, contractor personnel must be clearly defined in order to execute the work without any obstacles and confusions.
- There is a danger that it may become a superficial document that does not resemble what actually needs to take place. Therefore, everyone who is referred to in the chart needs to be consulted and they must accept the responsibilities allocated. Once the chart is developed it will be easier to maintain and update.
- The greatest benefit of the chart lies in the process of actually developing it. Deciding what should be done at each stage of the project and who should do it is a fundamental part of project planning.
- Further, once the chart is developed it will be easier to maintain and update. A carefully drafted responsibility chart may set up a framework for the distribution of resources, liabilities, roles and responsibilities between the clients, contractors and subcontractors.
- Examples of the chart in use involve senior managers where it relates to strategic issues, however, it is a planning tool and, like networks or bar-charts, can be taken to various levels, from master programme to short-term plan.
- As mentioned above its main value is probably in the development, when tasks and responsibilities are identified, discussed and accepted. Thereafter, it will be used for updating plans and auditing delivery. The responsibility chart is a front end planning tool. It should be developed when setting up the project team. Ideally this will be as early as possible but will depend on the procurement route.
- The roles and responsibilities of those not yet appointed may be assumed but need to be accepted by each party when they join the team.
- Discussion and acceptance will be facilitated if it is prepared during an early project meeting of all the main participants. The chart can be applied to a full project or specific stages.
- A generic chart can be used for repeat projects and would serve as a useful tool when bringing new individuals or organisations into the project team. The chart also sits well with other management tools such as bar charts which list activities in the same way.

The responsibility chart which is prepared for IOCL Rath Chakra Project (Polypropylene Project), Paradip Refinery, Odisha. (LSTK-2) allocating the responsibilities is shown below.

L: Lead & co-ordinate O: Output, receive info A:Advise D:Does the work	**DUTY HOLDER**									
	CLIENT			**CONTRACTOR**				**DESIGNER**	**PMC**	
Activity	Board	Project Manager	HSE Engineer	Senior Management	Project Manager	HSE Engineer	Site Engineer		Planning Co-Ordinator	Site Engineer
Concept Drawings	O	L	A	O				LD	O	
Site Surveys	O	L	D	D	D	D		O	O	O
Project HSE plan	O	O		L	A	D	O			
Incident Investigation		O		O	LD	D	D	O	O	
Hazard Identification and Risk Assessment	L	O	D	A	D	D		O	O	A
Procurement of Equipments	L	A		L	D			A	L	D
Maintenance of equipment		L	A			A	D		A	D
Execution of safety critical Jobs		A	A	O	L	A	D		A	D
Operator Safety Training		O	O		L	D		A	A	O
Toolbox Talks			A		L	D	O			O
Reporting the Accidents		O	O	O	O	O	D	O	O	
Inspections/Audits	O	L	D	O	L	D		A	A	
HSE meetings	O	L	D	O	L	LD		A	A	
Emergency Activities	O	LD	D		LD	D				O
Distribution, Reviewing and Reporting HSE issues		O	LD	O	O	LD	O	A	O	D
Shutdown/Start-up Activities	O	O	A		LD	A	D	A	A	D
Promotion of Safety Awareness	O	L		A	D	D	O		A	O

Table 5.12.: Responsibility Chart

CHAPTER 6

RESULTS AND DISCUSSIONS

- Consultations with experts in the field of HSE and extensive review of journal articles as well as conference proceedings had been conducted to shortlist the HSE activities done by the contractor during the tendering stage.
- The HSE measures must be portrayed by the contractor through the Preliminary HSE plan, Risk Register and the Responsibility Chart to the client for the complete understanding of the project HSE risks.
- The preliminary HSE plan developed by the contractor will be used in tender evaluation to provide assurance of the effective working of the contractor's corporate HSE-MS at a project specific level.
- It provides the client, a simple, methodical and auditable reference document containing all information relevant to the protection of people, the environment, the assets/infrastructure and the reputations of all parties, including that of third parties.
- It serves as a system for the identification of major hazards and the assessment of risks to the project.
- A combined responsibility chart and risk register have clear overlaps and similarities that could become the overall planning document, which allows the development of a single tool for the identification and management of risks, including HSE risks.
- These can potentially provide continuity for the risk management process, from conception to completion. It can operate at a strategic level initially but drill down to specific operational levels as the project develops.
- This could make it the control document for risk management, in many aspects replacing several sections of the HSE Plan, as a more user-friendly, practical tool.
- These HSE documents submitted by the contractor along with the tender should demonstrate that the contractors have the necessary procedures (e.g., Permit to Work, Hazard and Risk Assessment, Operating Instructions, Contingency Plans) and controls undertaken to complete the project without compromising HSE performance.
- These documents should be harmonized as early as possible to minimize the potential for misunderstanding. If there is a considerable amount of time between prequalification and the tender proposal, contractors should be asked to provide evidence documentation of their current HSE systems and performance.

CHAPTER 7

RECOMMENDATIONS

Recommendations for the contractor to match the client's project HSE requirements during tendering process:

- Answering the client's questions with project specific answers
- Making sure the response is structured so that answers are easy to find for specific questions from the ITT.
- Including case studies and examples of your organization's good HSE management practices to ensure good portrayal of Contractor's HSE-MS.
- Including a project risk assessment and Preliminary HSE Plan that is directly relevant to the specific project
- Demonstrating HSE leadership in the company and how this will apply on the project
- Addressing the responsibility issues through the Responsibility Chart
- Including CVs of HSE specialists; certificates (egg. BS OHSAS 18001; ISO 14001; Man hours without Lost Time Injury awards on previous projects).
- Providing mitigation plans and actions for the HSE issues addressed in Risk Register
- Including company health and safety performance statistics
- Demonstrating that you have a good understanding of and controls on the key causes of accidents (unsafe incident, situation etc.) as applicable to the client's requirements

CHAPTER 8

CONCLUSION

Major hydrocarbon projects may ultimately involve hundreds or thousands of people in engineering, procurement, and construction, followed by commissioning and start up. Early planning and application of HSE principles during engineering are essential to minimize risks to personnel and the environment throughout the life cycle of the project. This report sought to investigate how best to promote the effective integration of HSE aspects into the early stage of a project i.e., tendering process, in order to achieve improvements in both HSE management and project management. HSE is an important factor in winning tenders in the Engineering Procurement and Construction sector. Many small companies does not realize the importance of HSE. Large companies (clients) expect contractors to operate good or best HSE practice – whatever the project's size. The capturing of client's requirements is essential to winning the tender. It will be captured and met through the development of tender HSE proposal by the contractor, leading to the client's satisfaction. Tender HSE proposals should not be simply a 'dump' of all the contractor's HSE materials. It should be carefully thought through to match the client's requirements and be tailored to the specific project. Demonstrating a high standard of HSE during a project tender won't guarantee more work. But, having a poor HSE standard will guarantee no more work.

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