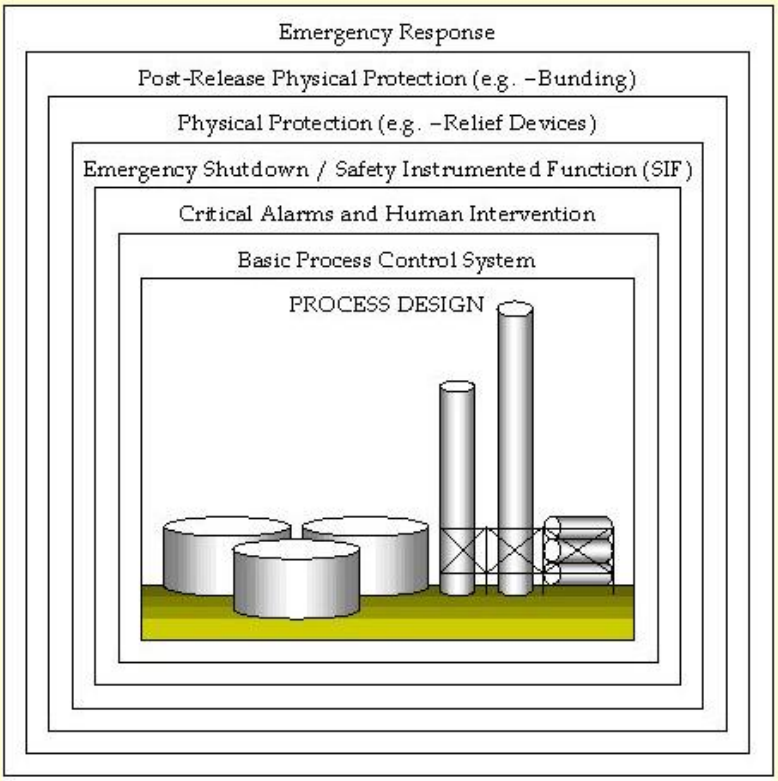
Capability Statement

Process Safety Studies



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1.0 Risk Analysis

Definition

It is a process that consists of a number of sequential steps as follows:

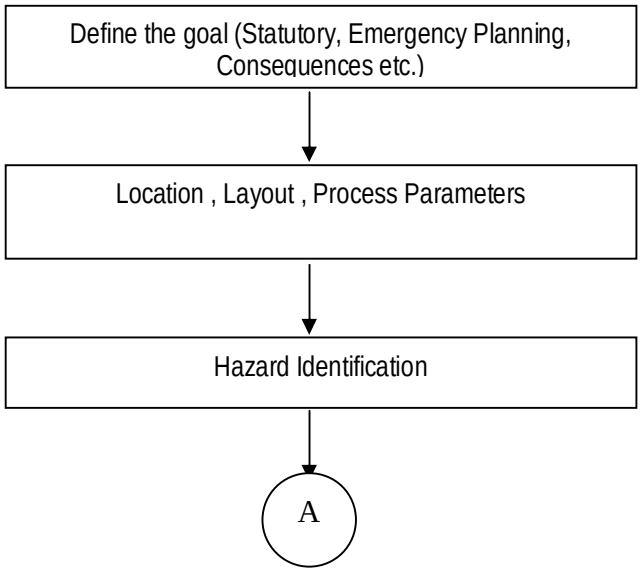
1. Hazard Identification: Identifying sources of process accidents involving release of hazardous material in the atmosphere, and the various ways (i.e. scenarios) they could occur.
2. Consequence Assessment: Estimating the probable zone of impact of accidents as well as the scale and / or probability of damages with respect to human beings and plant equipment and other structures.
3. Accident Frequency Assessment: Computation of the average likelihood of accidents.
4. Risk Estimation: Combining accident consequence and frequency to obtain risk distribution with in and beyond a process plant.

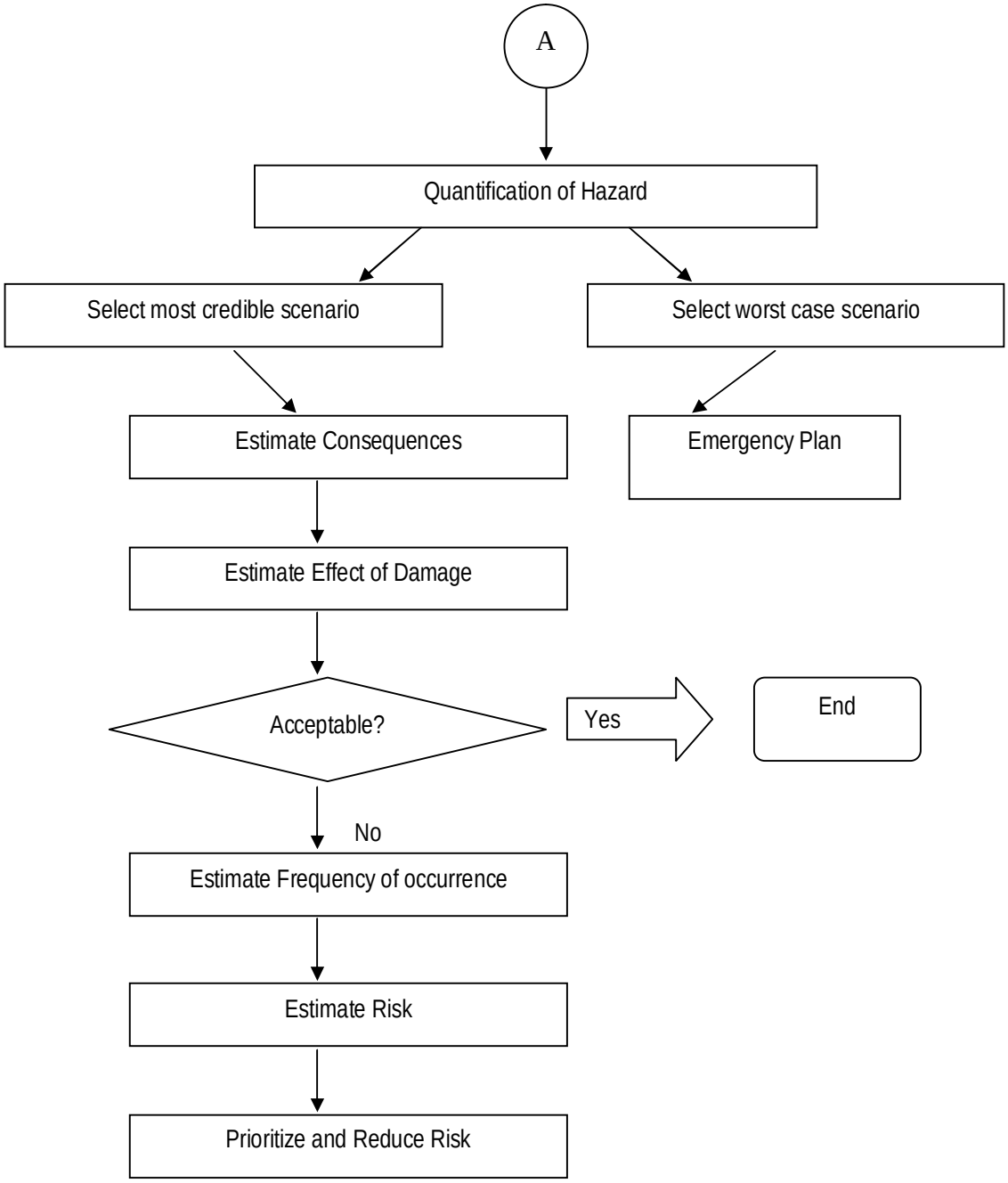
Stages of Risk Analysis

Any plant during its design and construction stages can undergo any of the following hazard identification and hazard analysis techniques:

- ✓ Process Design Check lists
- ✓ HAZOP studies
- ✓ Failure Mode and Effects Analysis
- ✓ What If analysis
- ✓ Fault Tree analysis
- ✓ Event Tree Analysis

Methodology





CMSRSL's Role

CMSRSL will identify hazards associated with the operations and select worst case scenarios for estimation of consequences. Reputed software models will be used for consequence estimation. Based on the estimated frequency of occurrence, risk reduction measures will be suggested to the management for effective implementation.

2.0 Quantitative Risk Assessment

Scope

- Identification of Hazards and credible accidental events
- Calculation of physical effects of accidental scenarios
- Damage limits identification and mapping on the layouts.
- Individual risk quantification and contour mapping.
- Hazard mitigation recommendations.

Methodology and Approach

Approach

- Data collection through data request
- Kick off meeting & Field visit
- Preparation of draft report
- Discussion with client on draft report (if required)
- Preparation of final report and submission

Methodology

The identification and qualitative assessments will be carried out by experienced CMSRSL team members based on the latest risk analysis standard brought out by Bureau of Indian Standards. The quantitative assessment will be done by using reputed software like Safeti, Effects 2.0 or Whazan V 2.0. If necessary, expertise of external experts will also be utilized on case to case basis. The brief write up of software is given below:

SAFETI Micro V 6.51

SAFETI (Software for the Assessment of Flammable, Explosive and Toxic Impact) is the software developed by DNV, UK. This software has been developed based on the various accidents that occurred over 20 years. The software is used to assess the effects of flammable and toxic releases, estimating the distance chemicals may travel given local weather conditions and the number of people who may be injured by these events. The risk contours will be represented graphically on the map.

Specific modules of SAFETI have been included to ensure compliance with the Dutch Yellow Book and UK HSE regulations.

EFFECTS V 2.0 (TNO)

This TNO practical tool is used for calculation of physical effects, which will help in carrying out Quantitative Analysis.

EFFECTS software is developed by the department of industrial safety of The Institute of Environmental Sciences in Netherlands. It enables the user to assess the physical effects of accidental releases of toxic or flammable chemicals. It contains a series of unto date models that allow detailed modeling and quantitative assessment of release rate pool evaporation, atmospheric dispersion, Vapour Cloud Explosion, Combustion, heat radiation effects from fires etc., The software is developed based on the hazard model given in TNO Yellow Book as the basis.

WHAZAN V 2.0 (DNV Technica)

DNV Technica's software, WHAZAN contains a set of consequence model that cover the outflow of chemicals, behaviour immediately after release, dispersion of toxic clouds in the atmosphere, fire and explosion. WHAZAN is a series of models to predict the consequences of accidental releases of toxic & flammable gases or liquids.

WHAZAN (World Bank Hazard Analysis) is developed by Technica in collaboration with the World Bank. WHAZAN provides a facility for the user to explore the consequences of a set of release scenarios. The core of the programme is the set of hazard models. The models cover mainly the areas of outflow of chemical, behavior immediately after release, dispersion in the atmosphere, fires and explosion, indoor gas build up etc. The programme does not make estimates of the frequency of the scenarios or risk.
The various damage scenarios are calculated by using suitable software and based on practical engineering judgments.The determination or estimation of frequency of the events is usually based on industry data, company experience or incident histories. In addition to the above or wherever sufficient data not available the qualitative risk assessment will be carried out by CMSRSL. The likelihood estimation will be in line with the following table:

Likelihood estimation

Likelihood	*Log frequency (/ yr)*
Well probable, frequent	*0-1*
Occasional	*1-2*
Remote	*2-3*
Improbable	*3-4*
Nearly impossible	*4-5*

The evaluation of the risk of a given scenario (frequency and consequence class is based on pre-defined tolerance criteria. In the absence of any statue in India regarding tolerance levels, the limits prescribed by laws of Netherlands will be taken as basis. The criteria for individual risk will be 10-6 per year for new situations and 10 –5 for existing situations. The limits for societal risk are set at f = 10 –3 / N2 as a guideline. For assessing societal risks 100 % fatality rate will be taken as basis. General risk acceptance criteria are given below:

Tolerance criteria

Frequency of consequence (/yr)	Consequence Category				
	1	2	3	4	5
$10^{0} – 10^{-1}$			Not acceptable		
$10^{-1} – 10^{-2}$					
$10^{-2} – 10^{-3}$			Tolerable		
$10^{-3} – 10^{-4}$					
$10^{-4} – 10^{-5}$					
$10^{-5} – 10^{-6}$		Acceptable			
$10^{-6} – 10^{-7}$					

3.0 HAZOP & OPERABILITY STUDY

HAZOP is one of the most effective and widely used hazard identification techniques, employed all over the world, mainly for chemical and petrochemical processes. It involves a systematic analysis of the consequences, of all the possible causes of deviation in a process from the original design intention. The HAZOP team, then, identifies suitable actions required for elimination of the hazard or reduction of its consequences. The multidisciplinary team involved in the study also discovers operability problems and identifies actions to reduce or eliminate them. CMSRSL has conducted HAZOP studies for a number of process industries. The software HAZOP Pro V 2.0

Concept

To identify all possible deviations from the way the design is expected to work and all the hazards associated with these deviations so that the output from the examinations consists of a mixture of decisions and questions for answering at subsequent meetings. Hazards that will be considered include those pertaining to those working in the plant, plant & machinery, product quality, general public and environment

Objectives

- ✓ To check a design
- ✓ To decide whether and where to build
- ✓ To decide whether to buy a piece of equipment
- ✓ To obtain a list of questions to put to a supplier
- ✓ To check running instructions
- ✓ To improve the safety of existing facilities

General HAZOP Methodology

- ✓ Define objectives and scope
- ✓ Select the team
- ✓ Prepare the study
- ✓ Carry out examinations
- ✓ Follow up
- ✓ Record the results

Team Composition (to be deputed from the plant)

- ✓ Design consultant / Project Manager
- ✓ Production Manager
- ✓ Chemical engineer / Chemist
- ✓ Maintenance Manager
- ✓ Electrical Engineer
- ✓ Instrument Engineer
- ✓ Quality Control Engineer

CMSRSL Role

- ✓ To facilitate and lead the team to carry out highly structured and systematic examination sessions by using the standard guide words and suitable simulation tool.
- ✓ To control the discussion so that meaningful results are obtained
- ✓ To record the discussions and submit the report to the management

4.0 Control Hazards and Operability Analysis (CHAZOP)

OBJECTIVE

Control Hazards and Operability Analysis (CHAZOP) is a highly structured hazards identification tool for instrument control and computer systems. The basis of the methodology is very similar to typical HAZOP used in the process industry. It is used to analyze the types of failure modes of new system (independently and in conjunction with other new/existing equipment) and to ensure that sufficient redundancy/fall back arrangement is provided and the introduction of the new system does not result in unsafe plant operation

SCOPE

The scope of the study covers all the Instruments and Control systems like DCS, ESD, Field Instruments, Local Control Panel, UPS, paging system, etc. including new design and revamping of existing facilities.

The study will also undertake a Safety Integrity Level (SIL) assessment for all safety related electrical/ electronic/ programmable electronic systems wherever required.

METHODOLOGY

After the detailed engineering drawings are developed the main CHAZOP process will be started.

This methodology is used to identify potential flaws and weaknesses of instrument control and computer systems by reviewing how the system deviates from design intents. It is commonly used for proposed and existing Safety Critical Software and Instrument Control Systems. It supports the risk analysis requirement in IEC 61508, Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems.

The full CHAZOP involves a detailed analysis of each part of the PES: the computer system / environment, I/O signals and control schemes, safety shutdown system etc. The objective is to build up a view of how the systems are intended to work and what will happen, if they fail. A single point failure shall not lead to any hazardous conditions in the plant. The recommended procedures and guidewords are outlined below:

PROCEDURES AND `GUIDEWORDS' FOR FULL CHAZOP

1. Computer system/environment 1.1 Consider RANDOM failures of: (a) Cabinets, crates, field stations (b) Controller, I/O cards, etc; (c) Highways and communication links; (d) Operator (and other) consoles; (e) Power supplies and filters; (f) Watch-dog timers, etc; (g) Other utilities. 1.2 CONSIDER GROSS failures of a whole machine (DCS or PLC or Gateway, Tank gauging etc.).	IN EACH CASE, ASK: (a) What should happen? (b) Will the operator know? (c) What should he do? (d) Any changes needed? (e) Any Fallback provided? IN EACH CASE, ASK: (a), b), c), d) and e) as above. (f) Can the failure propagate?
2. Input/output signals 2.1 For EACH input signal CONSIDER: • If signal is used for safety-related function. If so: - Review function(s): - Note any back-up, i.e. redundancy; • LOW, HIGH, INVARIANT, DRIFTING, BAD SIGNALS. 2.2 For EACH actuator CONSIDER: • DRIVEN HIGH and/or FAILURE HIGH • DRIVEN LOW and/or FAILURE LOW • FAIL TO MOVE ON DEMAND • DRIFTS	IN EACH CASE, ASK: (a) Does it matter? (b) Will the operator know? (c) Any action needed by the operator/other systems? (d) Any changes needed? (e) Any Fallback provided? IN EACH CASE, ASK: (a), (b), (c), (d) and (e) as above.
3. Control schemes For EACH SCHEME, DESCRIBE AND CONSIDER: (a) Purpose, method of operation; (b) I/O signals used; (c) Points of operator access; (d) Limits applied (set point, output, output rate of change); (e) Synchronisation, timing, interaction with other schemes, operator actions; (f) Controller tuning, wind-up, initialisation; (g) Relationship with trips and alarms; (h) Action in the event of major plant upsets.	IN EACH CASE, ASK: (a) Does it matter? (b) Will the operator know? (c) Any action needed by the operator/other systems? (d) Any changes needed? (e) Any Fallback provided?

4. Centralization of Operation FOR EACH OLD CONTROL ROOMS, DESCRIBE AND CONSIDER (a) Purpose, method of operation; (b) I/O signals used; (c) Points of operator access; (d) Limits applied (set point, output, output rate of change); (e) Synchronisation, timing, interaction with other schemes, operator actions: (f) Controller tuning, wind-up, initialisation; (g) Relationship with trips and alarms; (h) Action in the event of major plant upsets. (i) Emergency Handling (j) Communication between FUP-CCR and field operators	IN EACH CASE, ASK: (a) Does it matter? (b) Will the operator know? (c) Any action needed by the operator/other systems? (d) Any changes needed? (e) Any Fallback provided?

The important features of the study are:

a) Intention: The intention defines how the part is expected to operate.

b) Deviations: These are departures from the intention, which are discovered by systematically applying the guidewords.

c) Cause: These are the reasons for which deviations might occur.

d) Consequences: Theses are the results of the deviations should they occur.

DETAILS OF SOFTWARE

PHA-Pro® version 7 developed by Dyadem will be used for the CHAZOP study. PHA-Pro® 7 is by far the most time-efficient and cost-effective tool for conducting a Process Hazards Analysis. It is the world's #1-selling PHA and HAZOP software, having been adopted as the standard HAZOP tool by thousands of corporations worldwide.

Deliverables

The report will contain all major hazards identified by using the CHAZOP technique and provide recommendations wherever required. The report will have all worksheets used during HAZOP meetings.

5.0 Study on Safety Instrumented System – Assessment of Safety Integrity Levels

Introduction

Process industry is exposed to risks like fire, explosion, injuries and accidents etc causing fatalities and monetary losses. Safety Instrument System (SIS) is one of the most important layer of protection against accidents & hazards, in a chemical process industry. Occupational Safety and Health Administration, USA warrants that the design and implementation of safety system meet good engineering practice. Safety Performance criteria for SIS should be defined by Safety Integrity Levels (SIL). The determination of Safety Integrity Level required for the SIS will help verification of configuration of SIS to meet or exceed the required SIL and in turn the reliability of the system.

Methodology

During the design stage of the project or modification or revamp, the safeguarding systems or emergency shut down systems (mechanical or instrumented) are identified. The requirement for an Instrumented Protective Functions (instrumented systems) is decided based on the design practices which are checked by technical disk HSE review or the HAZOP study.

Consequence of failure in terms of safety, environment and economical losses are assessed along with the probability of occurrence. This risk graph generated helps to assess the risk levels. The SIL assessment can be qualitative and quantitative.

The appropriate SIL is simply selected from the matrix once the demand rate and highest consequence class of all consequence categories have been determined.

The sample chart of SIL determination and instrument selection is depicted as follows:

		Demand Rate Once per ... Year	IPF Safety Integrity Level				
Demand Rate Class	D4	0-0.5	a2	2	3	4	b
	D3	0.5-4	a2	1	2	3	4
	D2	4-20	a1	a2	1	2	3
	D1	>20	-	a1	a2	1	2
Consequence Category	L	Economics (US$)	Slight Damage <10k	Minor Damage 10-100k	Local Damage 0.1-1M	Major Damage 1-10M	Extensive Damage >10M
	S	Health and Safety	Slight Injury	Minor Injury	Major Injury	Single Fatality	Multiple Fatalities
	E	Environment	Sligh Effect	Minor Effect	Localised Effect	Major Effect	Massive Effect
Consequence class			1 (N)	2 (L)	3 (M)	4 (H)	5 (E)

Standards adopted for the study

- IEC 61508
- IEC 61511
- ANSI- ISA 84.01

Documents required for the study

- Process flow schemes
- P & ID diagrams
- Standards adopted for the instrument selection
- Process safety study reports
- Cause and effect matrices

Role of CMSRSL

SIS study will be team exercise and competent personnel responsible for the areas of process technology, process safety, operations and process control should be part of the team. The CMSRS expert will carry out the role of facilitator. The main task of the facilitator is to guide the team through the classification steps and to ensure that every step is recorded to achieve the objective.

Benefits

- Helps improve overall safety of the facility.
- Prevents (or) mitigates consequences which can result in – loss of life, personnel injury, equipment damage, loss of production.
- Helps in complying with present (or) future government directives on Health, Safety and Environment.
- Provides a better corporate image and helps in boosting employee morale.

6.0 Layer of Protection Analysis – An effective tool in PHA

Purpose

LOPA is a simplified risk assessment method. It is applied when a scenario is too complex or the consequence is too severe for the HAZOP team to make a sound judgment based solely upon the qualitative information. On the other hand, it can screen scenarios as a precedent to a QRA. LOPA helps organizations to make consistent decisions on the adequacy of the existing or proposed layer of protection against an accident scenario.

This method utilizes the hazardous events, event severity, initiating causes and initiating likelihood data developed during HAZOP. It evaluates risks by orders of magnitude of the selected accident scenarios and builds on the information developed in qualitative hazard evaluation e.g. PHA.

LOPA Process

LOPA is based on the assessment of single event- consequence scenarios. A scenario consists of an initiating event and a consequence. Though multiple initiating events can lead to same consequence, all these initiating events must be used to develop scenarios for subsequent assessment.

Criteria for evaluation

The crucial step of LOPA is evaluation process for which criteria need to be selected. Three criteria are considered for LOPA study:

- Consequence class characteristics,
- Likelihood estimation and
- Tolerance limits fixed by local legislations.

Standards adopted

1. AIChE CCPS (2001). Layer of Protection Analysis - Simplified Process Risk Assessment.
2. Franks A P (2003). Lines of Defence / Layers of Protection Analysis in the COMAH Context.

Documents required for the study

- Process & Instrumentation Diagram
- Process write up
- Design & Engineering details of the vessels/ equipment and instrument
- Costing of the equipment
- Consequence chart

- Details of existing protective layers
- Statutory compliance requirement

Format

Total risk level can be estimated in terms of severity and probability and can be presented as shown below:

Location: Equipment:

Sl. No.	Initiating event (IE)	Probability Per year f_{IE}	Enabling Event (EE)	Probability Per year f_{EE}	Protective Independent Protective Layers (IPL) Probable Failure on demand (PFD)					Mitigating IPL PFD	Consequence	
											Class	Frequency
		F_1		F_2	P_1	P2	P3	P4	P5	P6		F1XF2XP1xP2xP3xP4XP5X P6

Result: Risk Level acceptable / Not acceptable

Recommendation for risk reduction:

Benefits of using LOPA

- Is a simple risk assessment tool and requires less time and resources than for a QRA but is more rigorous than HAZOP. It can be used a screening tool for QRA.
- Improves scenario identification by pairing of the cause and consequence from PHA studies
- Identifies operations, practices, systems and processes that do not have adequate safeguards and Helps in deciding the layers of protection required for a process operations and thereby focuses on the most critical safety systems. It helps to determine the need for Safety Instrumented Systems (SIS) and Safety Integrity Levels (SIL) for SIS. It provides basis for specification of IPLs as per ANSI/ISA S84.01, IEC 61508 and IEC 61511.
- Can be used as a Cost Benefit Analysis tool while selecting process safety instrumentation
- Is useful for making risk based decisions during stages like design, management of change, preparation of Safety Operating Procedures for operators, incident investigation, emergency response planning, bypassing a safety system etc
- Provides due credit to all protective layers and helps in estimating the specific risk level of the unit/ equipment.

- Can be used as a tool in place of Quantitative Risk Analysis for substances for which standard damage distances or effects are not known. In such cases it helps decide if the risk is As Low As Reasonably Possible (ALARP) for compliance to regulatory requirements or standards.
- It also supports compliance with process safety regulations - including OSHA PSM 1910.119, Seveso II regulations, ANSI/ISA S84.01, IEC 61508 and IEC 61511

7.0 HAZARDOUS AREA CLASSIFICATION REVIEW

HAC Review- Perspective

Industries handling, processing or storing flammable chemicals are exposed to fires & explosion hazards due to their combustible properties. As per the statistics available from Indian oil companies, for a five-year period, 232 major fires took place, out of which 42% were fires. While analyzing the probable causes for fires & explosions, electrical reasons are undoubtedly the top among the 'most probable' causes. Periodic HAC review of hazardous industries is very critical considering the possible process changes /equipment replacements, etc.. The critical design aspect such as temperature classification is seldom considered in pharmaceutical plants. Since HAC is a designer's job, the plant O&M engineers would not be aware about the finer aspects of HAC and they violate the fundamental rules of HAC, resulting in major fire & explosion accidents.

Scope of Work

- To review the Hazardous Area Classification (HAC) in the plant (on a sampling basis) against the existing HAC drawings/documents, based on IS 5572, API 2003
- To review the electrical equipment installed in the plant (on a sampling basis), based on IS 5571((type of protection, Temperature classifications, Gas groups)
- To review the electrical equipment maintenance practices followed in the plant against IS 13346, IS 13408 (part III)

Legend:

IS 5571 –Guide for Selection of Electrical Equipment for Hazardous Areas

IS 5572 –Classification of Hazardous Areas for Electrical Installations

IS 13408 Part III –Code of Maintenance of Electrical Apparatus for Use in Explosive Atmospheres

IS 13346 –General Requirements for Electrical Apparatus for Explosive Gas Atmospheres

NFPA 497-Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous Classified Locations

NFPA 70 E- Hazardous Areas

Methodology

The site study will consist of the following:

- Plant visit (sample review of classified areas, review of equipment installed in the plant and the maintenance of electrical equipment in classified areas)
- Review of design documentation (equipment specifications/HAC drawings) & electrical preventive maintenance documents/test records

- Discussion with plant process and electrical managers

CMSRSL Expertise:

Chola MS Risk Services will utilize competent engineers to carry out HAC Review. The details of the expertise of Chola MS engineers are given below:

- The audit team will consist of 2 engineers (electrical & mechanical), each having more than 16 years of experience in the area of risk management & loss prevention
- Both the engineers are trained at Central Mining research Institute (CMRI), Dhanbad on HAC, flameproof equipment testing, maintenance, etc.
- Both the engineers are exposed to national & international safety regulations
- Both the HAC Review team members are OHSAS 18001 certified lead safety auditors
- Chola MS engineers has carried out electrical risk assessment for pharmaceutical plants, petrochemical refineries, LPG bottling plants, chemical plants, fertilizer plants, oil terminals, etc.
- Both the Chola MS engineers are regular faculty members to Oil Company training institutes (HPCL –Nigdi & CPCL-RESOT) on HAC and Risk Assessment.

8.0 Project Health Safety and Environment Review (PHSER)

Any new project or modification or expansion of industries like Refinery, fertilizer, petrochemical, chemical, pharmaceutical or any industry handling hazardous products etc. involves the review of safety aspects involved in various stages of project viz. preparation of drawings, drawing up specifications, purchase of materials , erection , commissioning of project etc. Though it is safety aspects are considered by the in-house team or by the turn key suppliers/ project consultants, it is always preferred to get it reviewed by the external consultants who are not involved in the erection or commissioning of the projects.

Cholamandalam MS Risk Services (CMSRS) which employs a team of experts with relevant experience and exposure in the area of safety and loss prevention can help you in the review of project safety management by means of Project Health Safety and Environment Review (PHSER).

Purpose

The overall objective of the PHSER process is to assure the Company that HSE-sensitive areas have been identified in a systematic way and that the major projects, engineering and operational systems have been or will be developed to control/ manage the identified risks. The assurance is provided by reviewing proposals at various key stages in their development.

PHSER is a qualitative audit of the project's HSE plans and actions. PHSER shall be conducted at all project stages in accordance with procedures evolved by petroleum giants like British Petroleum, Kuwait Oil Corporation, KNPC etc

Methodology

CMSRSL has a team of experts from the various disciplines of process, maintenance and safety with project experience. The team will develop a detailed, structured and custom-made document to ensure the safety at various stages of the project like Appraise Stage, Select Stage, Pre-sanction Stage, Pre-construction Stage, Construction Stage, Pre-startup Stage (commissioning, prior to introduction of hazardous materials), Operate Stage etc. These can be used by the project & control team. The document will contain the necessary information to achieve the purpose of PHSER. This will be prepared as per the guidelines of BP such as ETP GP48-1, & Procedure for Project HSE Review developed by KOC. The document will be user-friendly and effective to implement.

Benefits

- It gives an understanding of the methodologies employed and acts as basis for participation with the company
- Is a structured approach to examining the HSE risks. It is composed of a number of elements, which are tailored to suit the needs of the organization and/or project
- An audit of project procedures and their implementation to ensure compliance with HSE standards and legislations
- Provides assurance to stakeholders that sensitive areas of HSE risk have been identified and appropriate procedures have been developed to manage these risks

9.0 FIRE RISK ASSESSMENT

Objectives

Fire Risk Assessments are conducted with the following objectives

- To carry out a systematic and critical evaluation of Fire Safety of the occupancy
- To suggest recommendations to improve the fire safety standards

Scope of the study

A broad outline of the scope is given below.

- Identifying potential fire / explosion hazards / risks in the process and storage areas of the premises and suggesting appropriate preventive measures
- Reviewing the existing fire protection systems and suggest modifications wherever necessary as per applicable national and international standards
- Identify deviations with respect to fire safety procedures and suggest action plan to correct deviations
- Advising further scope on the compliance with statutory requirements related to fire safety and explosions
- Providing guidelines for preparation of fire emergency and formation of team for fire fighting, first aid, rescue teams and allocating specific responsibilities. Reviewing the existing On-site emergency plans with respect to Fire risk wherever such plans are available.

Methodology

CMSRS would adopt the methodology of identifying the fire risks at workplace as outlined by Fire Precautions at Workplace Act, UK. After identification of the risks, their evaluation and assessment would be carried out based on two criteria i.e. frequency of occurrence of unwanted event or situations and the harm or extent of damage that unwanted events would cause that were to occur. The magnitudes of these two elements of the risk are indicated by giving each of them a numerical value (X) and (Y) for harm or damage.

Frequency	*Value (X)*
Uncommon / Occasional	*1*
Frequent	*2*
Regular	*3*
Common	*4*

Damage	*Value (Y)*
Negligible / Slight	*1*
Moderate	*2*
Severe	*3*
Very Severe	*4*

For each risk situation, the risk factor is simply defined as the mathematical product of its X and Y values, i.e. Risk Factor is defined by

Risk Factor (R. F.) = XY

Risk Factor for each of the risk situation found in the area is calculated and average risk factor for the entire area is calculated. The average risk factor is the sum of all the individual risk factors (Sigma XY) divided by their number " n "

Average Risk Factor = ($\sum$ XY) / n

This average risk factor is expressed as a percentage of the maximum risk factor and this percentage figure is called the Risk Rating for the area.

In this methodology, 4 x 4 classification table is used. Hence the maximum value of the risk factor will be (4x4 = 16) and therefore a risk factor of 1 would be 100 x 1/ 16 = 6.25 % of the maximum risk factor.

Therefore the risk rating is defined by the equation:

Risk Rating = 6.25 x $\sum$ XY / n

Finally the area being assessed is assigned a risk category of low, normal, high or very high based on the values of risk rating based on the following guideline.

Risk Rating	Risk Category	Ranking
Less than 15 %	Low	Excellent, efforts required to sustain good practices
16% to 50 %	Normal	Scope for improvement exists
51 % to 80 %	High	Attention is required to address the existing hazards
81 % to 100 %	Very High	Immediate attention of management is required

Based on the above risk category, comments on the overall condition of the section and specific risk improvement measures would be suggested for every risk condition while assessing the risk rating

The recommendations suggested for risk improvement would be categorized as High, Medium and Low depending upon the priority for implementation. The criterion for categorization is presented below:

Priority	Criterion
High	Recommendations that require immediate attention
Medium	Recommendations that can be implemented within next six months
Low	Recommendations that can be implemented in the next available opportunity

10.0 Standard Conformance and Performance Evaluation Of Fire Protection System (SCOPE - FP)

Objective :

1. Carry out a fire risk assessment to identify critical areas in the plant based on the fire load calculations
2. Review the existing Fire Prevention and Protection system against national and international standards
3. Carry out a gap analysis of the existing maintenance practices pertaining to fire protection system
4. Evaluate the preparedness (knowledge / training) of the personnel to handle emergency

Scope:

SCOPE - FP would focus on:

- Identification of fire hazards in Plant premises
- Mapping of critical areas(with respect to fire hazard) in the plant based on the fire load
- To evaluate the existing fire protection system based on

We propose to use the following NFPA standards to evaluate your existing fire protection and detection systems.

⇒ NFPA 10: Standard for Portable Fire Extinguishers, 1998

⇒ NFPA 12 - Standard for Carbon dioxide extinguishing System

⇒ NPFA 13-Installation of Sprinkler Systems

⇒ NFPA 14: Standard for the Installation of Standpipe and Hose Systems

⇒ NFPA 15: Standard for Water Spray Fixed Systems for Fire Protection

⇒ NFPA 20: Standard for the Installation of Stationary Fire Pumps for Fire Protection

⇒ NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

⇒ NFPA-101- Life Safety Code

⇒ NFPA 1962: Standard for the Inspection, Care, and Use of Fire Hose, Couplings and Nozzles; and the Service Testing of Fire Hose

KYPIPES 2006 Software for Fire water network analysis

The software is a result of development of full equation set approach for network analysis utilizing the Newton- Raphson linearized approach and enhanced network equations. The calculations and hydraulic analysis is based on standard equations like Hazen – Williams equation, Darcy Weisbach and manning equations for roughness values. The software is based on the principles expressed in relevant standards of National Fire Protection Association, USA.

Advantages

- Provides powerful graphical user interface for laying out comprehensive fire system models
- Can input a back ground map and drawings in a variety of vector and raster formats
- Can calculate the actual simulations for pump and valve conditions/ positions
- Provides the necessary data like roughness factor for standard pipes
- Simulation of age based performance of pipes is possible
- Pump characteristics based on electrical load can be developed.
- Pump head and flow will develop the performance curve for the pump depending on the demand.
- Simulation of leaks/ pipe breaks in the network system and developing results
- Options for selection of equations like Hazen- Williams or Darcy Weisbach etc.
- Extended Period Simulation for water reservoir level is possible thereby variation of level is taken appropriately for hydraulic analysis.

11.0 Comprehensive Safety Audit – SAFE Magic Wand

Introduction:

We in Cholamandalam MS Risk Services have developed an audit methodology called SAFE Magic Wand, to focus on the management systems that make sure your risks are properly controlled. This approach can be compared to Total Quality Management (TQM) concept, which is widely recognized as the most effective way to provide high quality.

Objectives of the Safety Audit:

Safety Audits are conducted with the following objectives

- ❖ To carry out a systematic, critical appraisal of all potential hazards involving personnel, plant, services and operation method and
- ❖ To ensure that Occupational Safety and Health system fully satisfy the legal requirements and those of the company's written safety policies, objectives and progress.

Scope of the Audit:

The scope of the safety audit would be based on the Indian Standard 14489 - Code of Practice on Occupational Safety and Health Audit.

A broad outline of the scope is given below.

Safety Management

- ⇒ Review of Safety and Health Policy
- ⇒ Safety Organization
- ⇒ Contractor employee activities and review of contractor Safety Manual
- ⇒ Status of Regulatory Compliance(Various statutes applicable to the factory concerning safety and health)
- ⇒ Statistical information on losses and injuries
- ⇒ Expansion, Modification and Work Permit systems
- ⇒ Auditing of Systems for identifying risks, hazards and counter measures
- ⇒ Review of various safety procedures and manuals
- ⇒ Safety Training
- ⇒ Accident/Incident reporting, investigation and analysis

Fire Prevention and Protection

- ⇒ Fire Protection arrangements
- ⇒ Fire emergency control procedures
- ⇒ Personal Protective equipment

Electrical Installations

- ⇒ Electrical safety issues like earthing, hand tools, protective devices, lightning protection, cables and cable routing etc.
- ⇒ Sample review of hazardous area classification (areas where Acetone, Toluene and solvents are handled)

⇒ Review of Electrostatic hazards
⇒ Detection of electrical hotspots in the permitted plant area using Infrared Hot Spot temperature measurement instrument.

Hazardous Chemicals - Handling and Storage (if applicable)

⇒ Handling / Storage and Transfer procedures for handling hazardous chemicals in the plant

Work Injury Prevention

⇒ Work injury prevention in areas where material handling (Manual handling and mechanical handling) is involved.

Mechanical Equipment

⇒ Testing procedures for Pressure Vessels, Lifting tools and Tackles
⇒ Sample audit of preventive maintenance schedule for the entire system, trips and interlocks.

Emergency Management

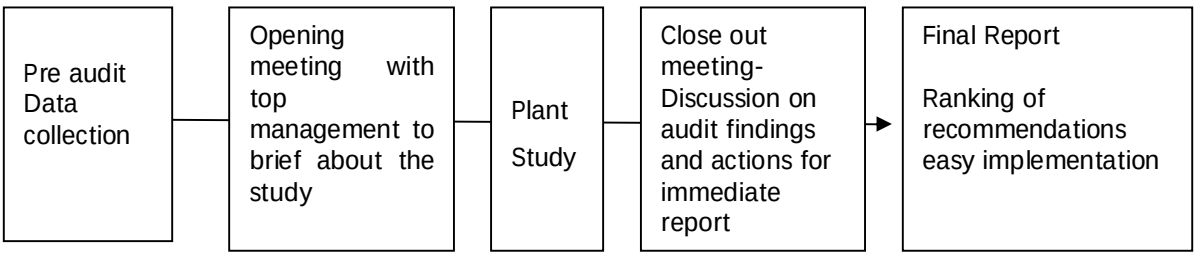
⇒ Review of availability of emergency equipment to handle major emergencies and review of systems associated with managing emergencies (Emergency communication system. Equipment and facilities at Emergency control Center etc)

⇒ Review of Emergency Management Plan

Methodology:
Safety Audit is conducted in four principal phases

- Preparation
- On-site audit
- Reporting
- Follow-up

How we approach an audit?



SAFE Magic Wand – CMSRSL Methodology

12.0 Disaster Management Planning

Good disaster management separates those companies that will survive a disaster from those who will not. Accidents are inherently unpredictable both in its nature and timing. However the impact of a disaster is predictable and can be planned for. Some companies who have managed disasters well have emerged with higher reputation, and increased customer and staff loyalty. Disaster management plan (DMP) addresses both managing immediate crisis and recovering normal production and service.

Following key questions will help you in understanding the importance of disaster management plan:

- Do you feel your premises could be affected by any one of the events, for example - explosion, fire, flood, earthquake, utility failure?
- Do you rely on single dominant supplier, customer or distributor?
- Are there any incidents or business problems that could impact the rest of your business, for example major environmental accident, multiple fatality accident, product safety recall?
- Do you know what your customers need from you as absolute minimum?

CMSRSL helps clients to evolve an effective Disaster Management Plan as per NFPA 1600 – Standard on Emergency / Disaster Management and Business Continuity Programmes. The key steps involved in the preparation of DMP are as shown in the next page. A DMP could be prepared for onsite emergency or offsite situation.

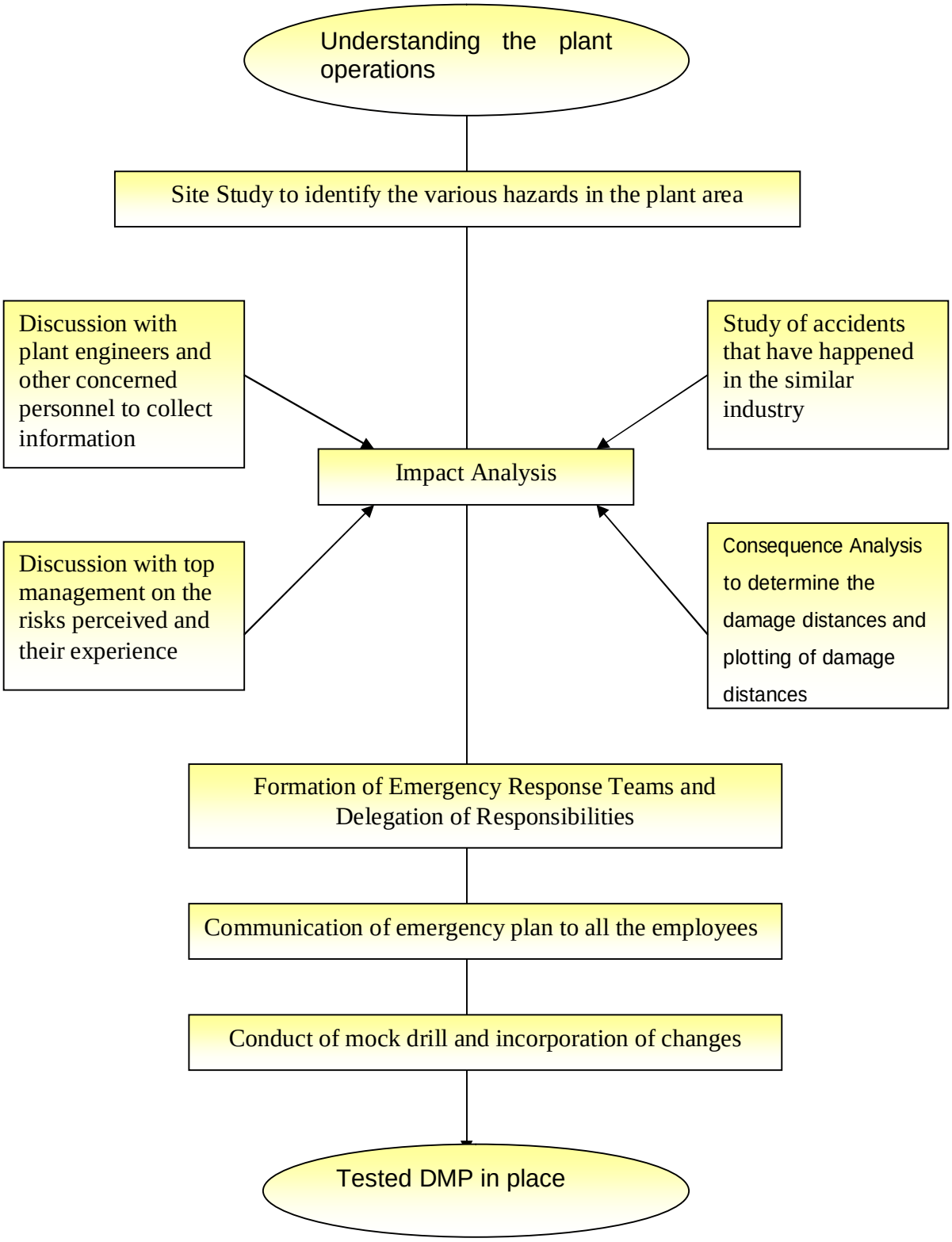
Offsite Emergency Plan:

The purpose of preparing a well defined off site emergency plan is to systematically document and define various types of catastrophic situations where it will be necessary for the company to safeguard its own people and to assist district administration along with other statutory authorities to take control of the situation, rescue and evacuation of people living around the industry. The infrastructure set up required at the time of emergency and the envisaged action by District Administration, Fire Services, Police Dept., Medical Services, Transport Dept. and other voluntary organizations, till normalcy is achieved after the occurrence of the event. This plan takes in to account all emergency scenarios of the various industries of the areas to publish the risk contours in the various industrial zones to prepare industry to meet all potential emergencies.

Onsite Emergency Plan:

Onsite Emergency Plan provides detailed blue print of what needs to be done in case of emergency inside the plant.

Key Steps in Disaster Management Planning:



13.0 Risk Management and Insurance Planning

Introduction

Risk Management and Insurance Planning is required for any organization to review their risk management strategies and to opt for risk transfer measures like availing insurance cover etc. Many a time the coordination between the technical or operational departments and finance department is difficult and an unbiased study on technical risk management measures adopted and insurance practices followed will help the management of the organization to manage the risk effectively and profitably.

Objectives

Broadly the Risk Management studies are conducted with the following objectives

- To carry out a systematic, critical appraisal of all potential risks involving personnel, plant, services and operations (risk identification, assessment and control) and
- To review the insurance coverage and to identify areas of coverage to optimize the risk exposure

Strengths of CMSRSL

CMSRSL has a team of risk management and insurance planning experts with a wide experience of each having over 18 years in the relevant area. The team members have carried out similar studies for organizations belonging to various sectors like fertilizer factories, power plants, mines etc and helped the managements of those organizations to manage their risks effectively and profitably. The suggestions made by the team are technically possible and practically viable.

Scope of the RM & IP study

The scope of the study will include the following:

- Identification of all major internal and external pure risks including the natural risks and analysis of the impact of above risks
- Review of existing risk control measures and offering comments
- Scrutiny of all existing major insurance policies in respect of:
    * Rationalization of basic rate of premium and widening of covers
    * Applicability / eligibility of discounts in premium
    * Application of suitable clauses, warranties and conditions

- Identification of possible areas for refund of premium and suggestions regarding procedure for the same
- Selection of insurance coverage on the basis of risk analysis
- Providing guidelines for fixation of sum insured and illustrate the same on a selected equipment
- Evaluation of business interruption exposure due to identified risks
- Providing guidelines on documentation requirements, procedures for claims under various policies

The above RM & IP exercise would provide an independent evaluation of the existing risk management system and would help you in prioritizing the risk control measures for implementation.

Study Focus

The study would focus on the following broad elements:

- Risk identification and control measures
- Insurance concept and practice
- Documentation and Procedures

Structure of the Report

The Report would be structured in such a way that the findings are grouped, based on the above broad categories. The report will have the following sections:

- Executive summary
  - Introduction
  - Risk Management - Concept and Practice
  - Risk Identification and risk analysis
  - Review of operational risk control measures
  - Scrutiny of existing insurance policies
  - Fixation of sum insured
  - Insurance coverage based on risk analysis
  - Impact of critical machinery break down
  - Business Interruption Exposures
  - Documentation and Procedures
  - Bibliography

14.0 Project Quantitative Risk Assessment

Objectives

- To assess the impact and likelihood of identified risks and to prioritize risks according to their potential effect on project objectives

- To determine the importance of addressing specific risks and guiding risk responses

Scope and Approach:

Scope:

- To identify the sources of risks like financial, research and development, production, human resources with requisite experience, administrative, strategic, inadequate project definition, lack of communication, improper contract practices, lack of management continuity, failure to identify adverse trends at an early stage, failure to identify and manage site specific difficulties such as infrastructure, logistics, cultural and language requirements, failure to identify problems at early stages, vendor and contractor selection, technical and operation problems etc.
- To analyze numerically the probability of each risk and its consequence on the project objectives as well as the extent of overall project risk

Approach to be adopted:

A detailed step-by-step approach is presented in this section on how the assignment would be executed.

Step 1: Risk Identification

At this stage the inputs for risk identification will be taken from risk management plan, list of prioritized risks from the owner and contractor, project planning and execution document, historical information from the owner and other companies, expert judgments etc. From the above inputs and subsequent activities like record perusal, site visit and discussion with all officials concerned the risks will be identified. The specific risk events will be properly defined and area of impact will be stated clearly. The risk identification will be done as team effort facilitated by consultants.

Step 2: Qualitative Risk Assessment

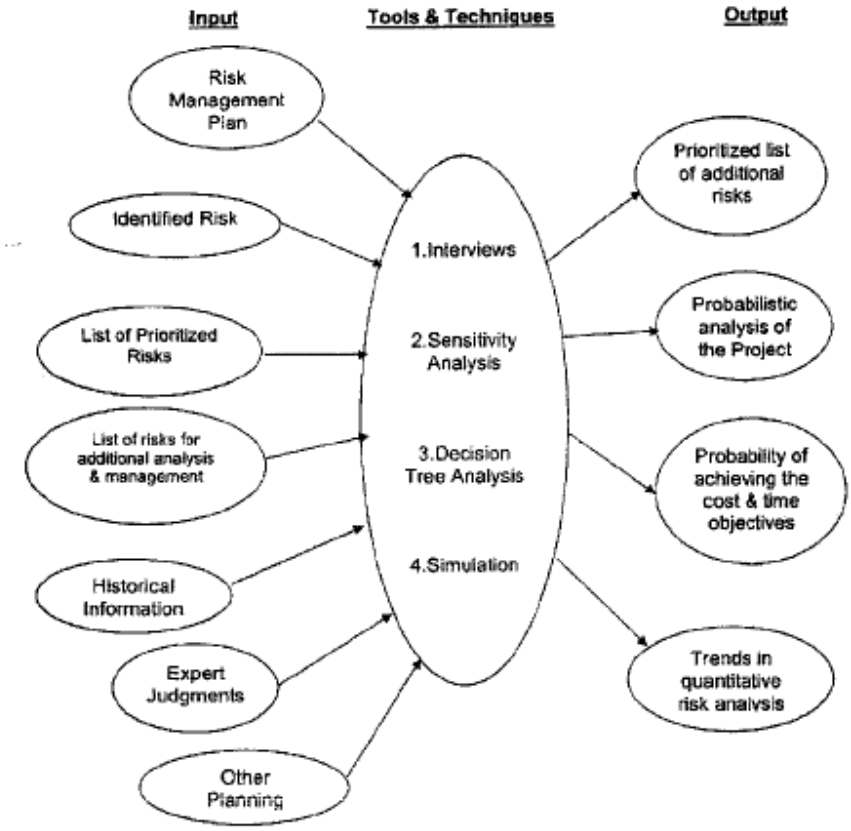
The various risks identified in the step 1 will be assessed qualitatively for their probability of occurrences. They will be rated on the agreed rating scale and rating matrix will be developed. Wherever required data precision and assumptions will be used.

Step 3: Quantitative Risk Assessment

In this step Monte Carlo simulations and decision analysis are used to determine the probability of achieving a specific objective, to quantify the risk exposure of the project and determine the cost and schedule impact, prioritizing the risk based on the attention they require, to identify realistic and achievable cost, schedule and scope triggers. This will be a team exercise as far as

the prioritization is concerned. The risk exposure quantification will be done using Monte carlo simulation models.

The above steps are presented pictographically:



Methodology

The risk assessment exercise can be used to develop risk response plan which may determine actions to enhance opportunities and reduce threats to the project's objectives.

The exercise will be carried out at two stages 50 % of the project engineering completion and during 80 % of project engineering completion.

Software to be used

Crystal Ball developed by DECISIONEERING, INC., USA will be used for the study. It is an analytical tool that helps executives, analysts, and others make decisions by performing simulations on spreadsheet models. The forecasts that result from these simulations help quantify areas of risk so decision-makers can have as much information as possible to support wise decisions. More than 85% of Fortune 1000 companies and over 500 academic institutions throughout the world have implemented Crystal Ball to manage risk, reduce variation and uncertainty, and make optimal decisions.

Deliverables

A report containing the details of identified risks with risk event assessment work sheet and mitigation plans will be submitted at the end of the study.

The Clientele

India

S. No.	*Client*	Project
1.	Mangalore Refinery & Petrochemicals Ltd. (MRPL)., Mangalore	Rapid Safety Audit (RSA) & Hazard Analysis (HA) (for MOEF-Ministry of Environment & Forests)
2.	BPCL LPG Bottling Plant, Mangalore	" "
3.	Nagarjuna Fertilizers and Chemicals, Kakinada, AP	Audit of Fire Protection systems
4.	HPCL POL Terminal, Mangalore	Rapid Safety Audit (RSA) & Hazard Analysis (HA)
5.	HPCL LPG Bottling Plant, Mangalore	" "
6.	BPCL POL Terminal, Coimbatore	" "
7.	ELF LPG Bottling Plant, Mangalore	" "
8.	KONKAN GAS (LPG Bottling), Mangalore	" "
9.	TANFAC Chemical Industries, Cuddalore, Tamil Nadu	" "
10.	IOCL POL Terminal, Coimbatore	" "
11.	IOCL POL Terminal, Mangalore	" "
12.	BPCL LPG Bottling Plant, Irgur, Coimbatore	" "
13.	HPCL LPG Import Facility, Mangalore	" "
14.	BPCL POL Terminal, Mangalore	" "
15.	Tannir Bavi Gas based Power Plant	MoEF Project (Rapid Safety Audit & Hazard analysis)
16.	GMR Power -Tannir Bavi barge mounted Power Plant	Safety Audit
17.	Philips India Limited, Mumbai, India	Safety Audit
18.	EID Parry India Limited, Karaikal, India	Safety Audit
19.	Sterlite Copper, Tuticorin	Safety Audit
20.	Parry Agro Services, Attikurna Tea Factory, India	Safety Audit
21.	Carborundum Universal Limited – Hosur, India	Safety Audit
22.	Carborundum Universal Limited – Edapally, India	Safety Audit
23.	Carborundum Universal Limited – Pallikarnai, India	Safety Audit

S. No.	*Client*	Project
24.	Carborundum Universal Limited – Thiruvottiyur, India	Safety Audit
25.	Carborundum Universal Limited –Palakkad, India	Safety Audit
26.	Hutchison Max , Mumbai, India	Risk Inspection
27.	Cairn Energy, Chennai, India	Safety Survey of Oil and Gas platform-Ravva oil field
28.	ITC – ILTD, Chirala, India	Risk Analysis
29.	Carborundum Universal Limited, Koratty, Kerala, India	Safety Audit
30.	Maniyar Hydro electric power project, India	Safety Audit
31.	Carborundum Universal Limited, Ranipet, India	Safety Audit
32.	ITC Kakatiya Sheraton Towers, Hyderabad, India	Risk Analysis
33.	AXA Business Service, Bangalore, India	EHS Audit
34.	ITC ILTD Division – Anarpathi and Chirala, India	Risk Analysis
35.	ITC ILTD Division – Chirala, India	Risk Analysis
36.	Murugappa Morgan Thermal Ceramics, Tamilnadu, India	Safety Audit
37.	Intel, Delhi, India	Risk Inspection Survey
38.	Software Silicon Systems, Bangalore, India	Risk Inspection Survey
39.	Sterling Cellular, Delhi, India	Risk Inspection
40.	Usha Martin Telecom, Calcutta, India	Risk Inspection
41.	ITC ILTD R&D Lab, Andhra, India	Risk Analysis Study
42.	Murugappa Management Services, Chennai, India	Safety Audit of TIAM House – High Rise Building
43.	Thomson Financials, Bangalore, India	EHS Assessment
44.	BASF Styrenics, Dahej, Gujarat	Safety Audit
45.	Mangalore Chemicals & Fertilizers, Mangalore	MoEF Project (Rapid Safety Audit & Hazard Analysis)
46.	BPCL, Tannibavi, Mangalore	MoEF Project (Rapid Safety Audit & Hazard Analysis)
47.	IFFCO Tokio Marine Insurance, Chennai, India	Risk Inspection Survey of Nellore and Tada works of Nippo Batteries
48.	Chambal Fertilizers and Chemicals, kota, Rajasthan	Safety Audit
49.	Madurai Power	Risk Inspection Survey
50.	Cholamandalam General Insurance Company	Risk Inspection Survey of

S. No.	*Client*	Project
	Limited, Chennai	PPN
51.	Cholamandalam General Insurance Company Limited, Chennai	Risk Inspection Survey of CESC
52.	Parrys Confectionery Limited, Nellikuppam	Safety Audit
53.	Shasun Chemicals and Drugs Limited, Cuddalore	Electrical and Process Risk Assessment
54.	EID Parry India – Bio Chemicals Division, Thyagavalli, Cuddalore	Electrical Safety Audit
55.	Vikram Cements (Grasim Industries – Aditya Birla Group), Neemuch, MP	Electrical Safety Audit
56.	Aditya Cements (Grasim Industries – Aditya Birla Group), Shambupura, Rajasthan	Electrical Safety Audit
57.	Accenture, Bangalore	Pre Occupancy Risk Assessment Study
58.	EID Parry – Sugar Division, Nellikuppam	Safety Audit of Monsoon Shed
59.	Hindustan Petroleum Corporation Limited, Vizag Refinery	Comprehensive Safety Audit as per IS14489 and OISD 145
60.	Hindustan Lever Chemicals, Haldia	Lightning Protection Study
61.	Bombay Dyeing Limited - DMT, Patalganga	Lightning Protection Study
62.	Chennai Petroleum Corporation Ltd., Chennai	Safety Perception Survey
63.	Orchid Chemicals Pharmaceuticals R&D Lab, Chennai	Electrical Safety Audit
64.	Transystem Logistics, Bangalore	RM Capacity Building Project
65.	BPCL, Manmad	Electrical Safety Audit
66.	Toyota Kirloskar Auto Parts, Bangalore	Safety Review
67.	ARACO Automotive India, Bangalore	
68.	Matsushita Air Conditioners, Chennai	
69.	Indo-Matushita Appliances Company, Chennai	
70.	Bombay Dyeing Ltd., Patalganga	Risk Inspection
71.	Toyota Kirloskar Motors, Bangalore	Safety Review
72.	Matsushita Washing Machines	
73.	Fenner India Limited, Hyderabad	
74.	Aisin NTTF Limited	
75.	Sharp Software Development, India	Fire and Accident Risk Assessment
76.	East India Petroleum Limited, Vizag	Safety Audit
77.	Ahmedabad Electricity Company	Electrical Safety Audit

S. No.	*Client*	Project
78.	Surat Electricity Company, Surat	Electrical Safety Audit
79.	TI Diamond Chain Limited, Ambattur	Lightning Protection Study
80.	Coramandel Fertilizers Limited, Ennore	Risk Management and Insurance Planning Study
81.	Coramandel Fertilizers Limited, Vizag	Risk Management and Insurance Planning Study
82.	AXA Business Services Pvt. Ltd.	Safety Evaluation
83.	Ruchi Soya Industries Limited, Indore	Safety Audit
84.	ST-CMS Electric Company, Uttangal, Neyveli	Risk Analysis and Onsite Emergency Plan
85.	Andhra Pradesh Paper Mills, Rajahmundry	Life and Fire Safety Study
86.	Andhra Pradesh Paper Mills – Coastal Papers, Kadiam	Life and Fire Safety Study
87.	Rittal India Pvt. Ltd., Bangalore	Risk Management and Insurance Planning Study
88.	Mangalore Refinery and Petrochemicals	Electrical Safety Audit
89.	Fenner India Ltd., Madurai	Safety Review
90.	LG Industries Limited, Noida	Risk Inspection and PML Estimation
91.	LG Industries Limited, Pune	Risk Inspection
92.	IHD Industries Limited, Chennai	Safety Review
93.	Gujarat Paguthan Energy Corporation Limited, Bharuch	Fire Safety Audit
94.	Visaka Cement Industry, Malkapur, AP	Electrical Safety Audit
95.	Safety Review of Toyota Techno Park, Bangalore	Follow up Safety Audit
96.	Hutchison Telecom Limited – Phase 1 & 2	Risk Inspection Surveys of locations in Northern Region
97.	Transystem Logistics, Bangalore	RM Capacity Building Initiative – Phase II
98.	Sharp Business Systems (India) Ltd.,	Pre-Occupancy Warehouse Risk Inspection Survey
99.	National Highway Authority of India	Environmental and Social Screening for NH-47 between Trivandrum and Kanyakumari
100.	Indo Nissin Foods Limited, Bangalore	Safety Review
101.	American Power Conversion (India) Pvt. Ltd.,	Safety Review
102.	Binani Cements, Udaipur	MLOP Study

S. No.	*Client*	Project
103.	EID Parry, Dewas, M.P.	Risk Analysis
104.	Arvind Mills Limited, Ahmedabad	Risk Management and Insurance Planning
105.	Bay Forge Limited, Chennai	Safety Review
106.	Tamilnadu Petroproducts Limited, Chennai	Comprehensive Safety Audit
107.	ABB Limited., Baroda, Gujarat	Electrical Safety Audit
108.	Coromandal Pesticides Limited., Navi Mumbai	Electrical Safety Audit
109.	TVS Motors, Hosur	Electrical Safety Audit
110.	Murugappa Management Services	Safety audit of Dare House
111.	AMM Matriculation HSS, Kotturpuram, Chennai	Risk Management study
112.	TI Matriculation HSS, Ambattur, Chennai	Risk Management study
113.	Sir Ramaswami Mudaliar H.S.S., Ambattur, Chennai	Risk Management study
114.	Vellayan Chettiar Higher Secondary School, Thiruvottiyur, Chennai	Risk Management study
115.	AXA Building, Pune	Risk Inspection
116.	Caltex –Chevron Texaco, Madurai	Safety Audit
117.	Caltex –Chevron Texaco, Tuticorin	Safety Audit
118.	Caltex –Chevron Texaco, Chennai	Safety Audit
119.	Bajaj Hindustan Limited, Meerut	Review of Fire Protection System
120.	Muthoot Ceramics Ltd., Kochi	Insurance Audit
121.	Tata Ceramics Ltd., Kochi	
122.	Primus Gloves Ltd., Kochi	
123.	Cochin Spices Ltd., Kochi	
124.	Time of India Suburban Press, Mumbai	Safety Audit
125.	FEDO for Gujarat Narmada Valley Fertiliser Company Ltd., Bharuch, Gujarat	Risk Assessment study of ammonium nitrate filling station
126.	CEAT tyre manufacturing facility, Pune	Electrical Safety audit
127.	Penta Cables Ltd., Coimbatore	Comprehensive Safety audit & Job Safety Analysis
128.	Penta enterprises, Coimbatore	
129.	Quality Instruments Ltd., Coimbatore	
130.	ABC Engineering Ltd., Coimbatore	
131.	Kovai Industrial Works Ltd., Coimbatore	
132.	Customer Return Analysis Centre, Coimbatore	
133.	Drivewell Products Ltd., Coimbatore	
134.	Popular Instruments Ltd., Coimbatore	
135.	Alpha Instruments Ltd., Coimbatore	
136.	Premier Plating Ltd., Coimbatore	

S. No.	*Client*	Project
137.	Rubber Float Molding unit, Coimbatore	Safety Audit
138.	Hero Honda Motors Ltd., Haryana	Electrical Safety Audit
139.	Mangalore Chemicals & Fertilisers Ltd., Mangalore	Safety Audit
140.	CEAT, Nasik	Electrical Safety Audit
141.	Oswal Chemicals & Fertilisers Ltd., Paradeep	Risk Inspection
142.	TI Cycles of India Ltd., Chennai	FEA inspection
143.	Tube Products of India Ltd., Chennai	Flood loss inspection
144.	Kirloskar Toyoda Textile Machinery, Bangalore	Safety Audit, Risk Analysis and Review of emergency plan
145.	TI Cycles, Mohali, Punjab	Valuation
146.	Pricol Limited, Plant I	Safety Audit & Job Safety Analysis
147.	Pricol Limited, Plant III	
148.	Pricol Limited, Plant IV	
149.	EID Parry India Ltd., Sugar Division, Nellikuppam	Risk Analysis
150.	Paradeep Phosphates Ltd.	HAZOP study
151.	Kene India Ltd., Haryana	Review of fire protection system
152.	Petroaraldite Ltd., Chennai	Hazardous Area Classification
153.	GMR Energy Ltd., Mangalore	Safety Audit
154.	Grasim Chemicals Ltd, Nagda, MadyaPradesh	Safety Audit
155.	GMR Energy Ltd., Mangalore	Electrical Safety Audit
156.	Hyundai Motors Ltd., Irungattukottai	Electrical Safety Audit
157.	Hindustan Insecticides Limited, Kerala	Safety Audit
158.	ACE Glass, Pondy	Safety Audit
159.	Oil and Natural Gas Corporation	EMS Assessment
160.	Welspun – Sivassa	Risk Inspection
161.	Welspun – Palghar	Risk Inspection
162.	Sterlite Copper Limited, Tuticorin	Comprehensive Safety Audit
163.	ST-CMS Electric Company, Uttangal, Neyveli	Thermography Survey (June 2005)
164.	ST-CMS Electric Company, Uttangal, Neyveli	Safety Audit
165.	East India Petroleum Ltd	Safety Audit
166.	National Mineral Development Corp	Risk Assessment study and preparation of safety management plan

S. No.	*Client*	Project
167.	PetroAraldite Pvt Ltd.(PAPL), Chennai	Preparation of Offsite emergency Plan for PAPL
168.	National Fertilizers Ltd, - Nangal	Safety Audit
169.	National Fertilizers Ltd, - Bathinda	Safety Audit
170.	Chennai Petroleum Corporation Ltd – Cauvery Basin Refinery	Safety Perception Survey
171.	Chennai Petroleum Corporation Ltd – Cauvery Basin Refinery	Risk Analysis
172.	Finolex, Ratnagiri	EMS Audit
173.	Minda, - Delhi	Risk Inspection
174.	Minda, - Haryana	
175.	Cheminova, Panoli	
176.	Ozone Pharmaceuticals, Delhi	Risk Inspection
177.	Only Parathas Restaurant, Delhi	
178.	IndoFarm Tractors, Baddi (HP)	
179.	Minda, Gurgaon and Delhi	
180.	Denso, Bangalore	Rapid Safety Audit, Risk Analysis and Preparation of Onsite Emergency Plan
181.	IOCL refinery, Digboi	Petrochemical Rating
182.	Toyota Kirloskar Auto Parts, Bangalore	Risk Analysis and Review of Onsite Emergency Plan
183.	BPL Sanyo, Bangalore	Safety Audit
184.	IOCL - Panipat – Jalandhar LPG pipeline	Risk Analysis Study, Preparation of DMP and EMP
185.	IOCL - Nagapattinam jetty pipeline	Risk Analysis Study, Preparation of DMP and EMP
186.	Taj Hotels, Bangalore	Environmental Impact Assessment
187.	Nhava Sheva International Container Terminal Pvt Ltd	Setting up of Safety Management System for Contractor operations
188.	Mundra International Container Terminal Pvt Ltd	
189.	Chennai Container Terminal Pvt Ltd	
190.	Transystem Logistics International Pvt Ltd, Bangalore	RM Capacity Building Initiative – Phase III
191.	Absolute Logistics Pvt Ltd	Driver Skill Improvement Initiative

S. No.	*Client*	Project
192.	Essar Steel, Hazira	Safety Review/Rapid Environmental Review
193.	INA Bearing Ltd, Pune	Risk Inspection
194.	Machino Basell, Gurgaon	
195.	Apar Industries, Navi Mumbai	
196.	LG Electronics, Greater Noida	Safety Review, Cargo loss minimization and Thermography
197.	Matrix Laboratories, Kazipally, Hyderabad	Risk Analysis and Preparation of Onsite Emergency Plan
198.	EID Parry (I) Limited, Nellikuppam Sugar Factory	Risk Analysis and Preparation of Onsite Emergency Plan
199.	Asian Paints Limited, Cuddalore	Risk Analysis of RM Storage
200.	Godavari Fertilizers and Chemicals Limited, Kakinada	Review of Fire Hydrant System
201.	Matsushita Washing Machines, Pune	FEA Inspection and PML Assessment
202.	Shinrai Toyota, Mumbai	Flood Loss Inspection
203.	Thomson Financials, Mumbai	Flood loss inspection
204.	Toyota Techno Park India, Bangalore	FEA Inspection
205.	Carborundum Universal – Sriperumbudur Project	Project Safety Review
206.	Murugappa Morgan Thermal Ceramics , Ranipet	Fire Investigation
207.	Suzuki Motors, Delhi	FEA inspection
208.	Noida Entertainment Centre	
209.	Park Hotel, Delhi	
210.	National Fertilizers Ltd - Panipat	Safety Audit
211.	National Fertilizers Ltd - Vijaipur	Safety Audit
212.	Murugappa Disaster Recovery Centre, Hyderabad	Fire and Emergency Management
213.	ASB International Pvt Ltd	Safety Review and Thermography survey
214.	Shell India Pvt Ltd	Preparation of Construction Safety Manual for Retail Outlets of Shell

S. No.	*Client*	Project
215.	ST – CMS Electric Company Pvt Ltd, Uthangal, Neyveli	Thermography survey (Oct 2005)
216.	TI Cycles India Ltd., Chennai	Fire Risk Assessment
217.	TI Cycles India Ltd., Nasik	
218.	TI Cycles India Ltd., Noida	
219.	Tube Products India Ltd.(TPI), Chennai	
220.	Tube Products India Ltd., Shirwal	
221.	Tube Products India Ltd., Mohali	
222.	TI Metal Forming Ltd., Chennai	
223.	TI Metal Forming Ltd., Bawal	
224.	TI Metal Forming Ltd., Hallol	
225.	TI Diamond Chains Ltd.(TIDC), Chennai	
226.	TI Diamond Chains Ltd., Roller Chains Division, Hyderabad	
227.	TIDC, Kit Packing Unit, Hyderabad	
228.	TPI Warehouse, Chennai	
229.	TPI Warehouse, Pune	
230.	TICI Warehouse, Durgapur	
231.	TPI Warehouse, Manesar	
232.	TPI Warehouse, Hosur	
233.	TPI Warehouse, Faridabad	
234.	TPI, IBD Division, Chennai	
235.	TIMF, Tiruninravur	
236.	Mangalore Refinery and Petrochemicals Ltd	Lightning and Surge Protection Study
237.	Tata Consultancy Services, Banyan Park, Andheri	EIA
238.	Tata Consultancy Services, Yantra Park, Thane	EIA
239.	Hyatt Regency, Mumbai	Safety Review and Thermography Survey
240.	Hyatt Regency, New Delhi	Safety Review and Thermography Survey
241.	Essar Steel, Hazira	Electrical Safety Audit
242.	Lanson Toyota, Chennai	Risk Audit
243.	Denso Kirloskar Industries Ltd, Bangalore	Study of Fire Protection system
244.	India Glycol, Kashipur	Thermography survey
245.	Cidade de Goa	Safety Review
246.	Guru Hargobind Thermal plant, Lehra Mohabbat, Punjab	FEA inspection
247.	Printers Mysore, Bangalore	Safety review

S. No.	*Client*	Project
248.	Nippon Toyota, Kochi	Risk Audit
249.	FACT Engg and Design Organisation, Kochi	Risk Assessment for SPM system of Kochi Refineries Ltd
250.	Pricol Limited, Coimbatore	Incident investigation
251.	Hutchison Essar Limited, Ongole	Fire Investigation for Cell site
252.	Park Hotel, Hyderabad	EIA
253.	Ahluwalia Contracts India Ltd	ISO 14001 and OHSAS 18001 upgradation
254.	Zuari Industries Ltd, Goa	Electrical safety audit and Thermography survey for CMSGICL
255.	Panasonic Home Appliances, Chennai	Electrical Safety audit for CMSGICL
256.	Siyaram Silk Mills and Balkrishna Industries Ltd, Silvassa	Risk Inspection
257.	Marico Industries, Goa	Safety Review
258.	IHD Industries, Irungattukottai	Safety Audit
259.	IB Thermal Power Station (OPGC), Bhubaneswar	Safety Review
260.	Yokogawa India Ltd, Bangalore	Risk Analysis
261.	Tata Chemicals Ltd, Babrala	Thermography Survey
262.	Vardhman Spinning & General Mills Ltd, Ludhiana	Thermography Survey
263.	Vardhman Polytex Ltd (Unit of Oswal Group), Bathinda	Thermography Survey
264.	MALCO India Ltd, Salem	Thermography Survey
265.	Hikal Ltd, Bangalore	Safety Review
266.	Gates India, Chandigarh	Thermography Survey
267.	Rainbow Denim, Chandigarh	Thermography Survey
268.	Winsom Yarns, Chandigarh	Thermography Survey
269.	Vinayak Textile Mills Ltd, Ludhiana	Thermography Survey
270.	Anshupathy Mills Ltd, Ludhiana	Thermography Survey
271.	Alpha Drugs Ltd, Chandigarh	Thermography Survey
272.	Grasim Chemicals, Nagda	Thermography Survey
273.	Toyota Kirloskar Motors, Bangalore	Thermography Survey

S. No.	*Client*	Project
274.	GMR Energy, Mangalore	Safety Audit
275.	Hindustan Organic Chemicals Ltd, Kochi	Safety Audit
276.	Zuari Oil India Tanking, Goa	Electrical Safety Audit
277.	Yamaha Motors India Ltd, New Delhi	Safety Review
278.	Modern Group, - Sanand	Safety Review
279.	Modern Group, - Moraiya	Safety Review
280.	Shinan Plasto India Ltd, Sri Perumbubur	Thermography Survey
281.	JSW Power Plant, Salem	Risk Analysis and Preparation of Onsite emergency plan
282.	Fact Engg and Design Organisation, Kochi	EIA and EMP for IREL – Orissa
283.	Marico Limited, Goa	Thermography Survey
284.	Yamaha Motors India Ltd, New Delhi	Thermography Survey
285.	Pricol Limited, Pune	Safety Audit
286.	Gujarat Industries Power Company ltd, Surat	Safety Review
287.	Park Hotel, New Delhi	Development of Integrated Environment and OHS Management System (as per ISO 14001 and OHSAS 18001)
288.	Indian Oil Corporation Ltd (Pipelines Division) – WRPL, Koyali	Risk Assessment and HAZOP study
289.	Tube Products of India, Avadi, Chennai	HAZOP study
290.	Taj Hotel, Coimbatore	Rapid EIA
291.	Sri Kaliswari Metal Powders Pvt Ltd, Sivakasi	Safety Audit
292.	LG Electronics, Pune	FEA Inspection & Thermography
293.	Hindustan Petroleum Corp Limited, LPG plant, Chakan	Risk Analysis
294.	Jindal Stainless steel Limited, Hissar	Safety Audit, Risk Analysis and Fire Safety Audit
295.	Punjab Alkalies and Chemicals Limited, Nangal	Thermography survey
296.	Indian Yarn Limited, Nalru	Thermography survey
297.	Prime Focus Ltd, Mumbai	Safety Review
298.	DBS Cholamandalam Office, Mumbai	Safety Audit

S. No.	*Client*	Project
299.	India Cements, Dalavoi Works	Flood Risk Assessment
300.	Standard Chartered, SCOPE International	Implementation of Health and Safety Management system
301.	SAMCOR Glass, Kota, Rajasthan	Thermography survey
302.	Hindustan Petroleum Corporation Ltd, Mumbai refinery, Mahul	HAZOP and Risk Analysis study
303.	Hanil Lear India Pvt Ltd, Sriperumbudur	Risk Inspection
304.	Aparant Iron and Steel Pvt Ltd, Goa	Electrical Safety Audit & Thermography survey
305.	L S Mills, Theni, Tamil Nadu	Thermography survey
306.	Kanoria Chemicals & Industries Ltd, Bharuch	Safety Audit
307.	Thomson Financials India Ltd, Bangalore	Business Continuity Planning
308.	Mahavir Spinning Mills Ltd , Hoshiarpur	Thermography survey
309.	Arihant Spinning Mills, Malerkotla	Thermography survey
310.	Vardhman Special Steels, Ludhiana	Thermography survey
311.	Auro Spinning Mills, Baddi	Thermography survey
312.	Auro Dyeing, Baddi	Thermography survey
313.	Auro Weaving Mills, Baddi	Thermography survey
314.	Auro Textiles, Baddi	Thermography survey
315.	Vardhman Spinning & General Mills, Baddi	Thermography survey
316.	Mahavir Spinning Mills Ltd (Textiles division), Baddi	Thermography survey
317.	Arisht Spinning Mills, Baddi	Thermography survey
318.	VMT Spinning Co Ltd, Baddi	Thermography survey
319.	Vardhman Threads Ltd, Baddi	Thermography survey
320.	Mahavir Spinning Mills Ltd – Sewing Thread – Unit II, Ludhiana	Thermography survey
321.	Mahavir Spinning Mills Ltd – Dyeing and Finishing Unit III, Perundurai	Thermography survey
322.	Anand Spinning Mills Ltd, Mandideep	Thermography survey
323.	Vardhman Polytex Ltd, Bharuch	Thermography survey
324.	Hyundai Motors India Ltd, Irungattukottai	Probable Maximum Loss (PML) Survey
325.	Tube Products of India, Shirwal	Lightning Protection Risk Assessment

S. No.	*Client*	Project
326.	Akash Jewels, Mumbai	Fire Incident Analysis
327.	Jayaswals Neco Limited, Raipur	Risk Inspection
328.	SAB Mall, Chandigarh	Electrical safety audit & Thermography survey
329.	GE BE Pvt Limited, Bangalore	Electrical safety audit
330.	Indian Oil Corporation Ltd, Viramgam	Thermography survey
331.	Madras Cements Limited, Dalavoi	Thermography survey
332.	GE Medical Systems, Bangalore	Electrical safety audit
333.	KLA Tencor, Chennai	Thermography survey
334.	Petronet MHB Limited - Mangalore	Safety review
335.	Petronet MHB Limited - Neriya	Safety review
336.	Petronet MHB Limited - Hassan	Safety review
337.	Petronet MHB Limited - Devangonthi	Safety review
338.	TI Cycles India Ltd., Chennai	Risk Management and Insurance Planning Study
339.	TI Cycles India Ltd., Nasik	
340.	TI Cycles India Ltd., Noida	
341.	Tube Products India Ltd.(TPI), Chennai	
342.	Tube Products India Ltd., Shirwal	
343.	Tube Products India Ltd., Mohali	
344.	TI Metal Forming Ltd., Bawal	
345.	TI Metal Forming Ltd., Hallol	
346.	TI Diamond Chains Ltd.(TIDC), Chennai	
347.	TI Diamond Chains Ltd., Roller Chains Division, Hyderabad	
348.	TIDC, Kit Packing Unit, Hyderabad	
349.	TPI Warehouse, Manesar	
350.	TIMF Warehouse, Manesar	
351.	TPI, IBD Division, Chennai	
352.	TIMF, Tiruninravur	
353.	United Phosphorus India Limited, - Ankleshwar	FEA Inspection
354.	United Phosphorus India Limited, - Vapi	FEA Inspection
355.	LG Electronics, Kolkatta	Flood Loss Inspection
356.	Grasim Cements, Raipur	Safety Review
357.	Ultratech Cement, Raipur	Safety Review
358.	Pricol Limited, Coimbatore	Fire Incident Investigation
359.	Bay Forge Limited, Chengelpet	Safety Audit

S. No.	*Client*	Project
360.	Coromandel Fertilizers Limited, Ennore	Layer of Protection Analysis and Thermography survey
361.	Standard Chartered Bank – 83 locations across India	Health and safety audit
362.	Chennai Petroleum Corporation Ltd – CBR, Nagapattinam	Electrical Safety Audit
363.	Narmada Chematur Petrochemicals Ltd, Bharuch	Fire Risk Assessment and Consequence Analysis
364.	Gujarat Paguthan Energy Corporation, Bharuch	Solid waste management study
365.	JK Lakshmi Cement, New Delhi	Loss Prevention study for Transit Operation, Railway Siding
366.	Pricol Limited, Coimbatore	HAZOP study of Heat Treatment Furnaces in Plant III
367.	Asian PPG Industries, SriPerumbudur	HAZOP and Quantitative Risk Assessment
368.	Neyveli Lignite Corporation MINES I	Risk Inspection and Safety Review
369.	Neyveli Lignite Corporation MINES II	Risk Inspection and Safety Review
370.	Indian Oil Corporation, Tikri Kalan	Risk Analysis
371.	Bharat Petroleum Corporation Ltd (BPCL), Devangonthi	Safety audit
372.	IPCL, Nagothane	Lightning Protection Study
373.	Reliance Industries, Mumbai	Fire & Electrical Safety Audit and Thermography
374.	Kirloskar Toyota Textile Machinery, Bangalore	Safety Audit
375.	TG Kirloskar Automotive Private Ltd, Bangalore	Safety Audit
376.	Shoppers Stop (9 stores), Mumbai & Pune	Safety Audit
377.	Sterlite Industries India Ltd., Silvassa	Comprehensive Safety Audit
378.	Kesar Enterprises, Kandla	Quantitative Risk Assessment
379.	Hitachi Home & Life Solutions	Safety Audit
380.	Park Hotel, Chennai	Development of Integrated Environment & OHS Management System (as per ISO 14001 & OHSAS 18001)
381.	Park Hotel, Bangalore	
382.	BPCL - Kochi Refinery	Fire Network Analysis
383.	Rajratan Global wire – Indore	Electrical Safety Audit
384.	Steel Strips - Chandigarh	Electrical Safety Audit & Thermography
385.	Areva T&D, Perungudi, Chennai	Electrical Safety Audit
386.	Kandagiri Spinning Mill – Salem	Thermography Survey

S. No.	*Client*	Project
387.	Sambandam Spinning Mill	Thermography Survey
388.	Mallur Sideswara Spinning Mill	Thermography Survey
389.	Bannari Amman Sugar & Power plant - Nanjankode	Thermography Survey
390.	Sangeeth Textiles- Annur	Thermography Survey
391.	Jupiter Textile - Tirupur	Thermography Survey
392.	Dabur India - Baddi	Thermography Survey
393.	Denso India - Gurgoan	Thermography Survey
394.	Havells India – Alwar	Thermography Survey
395.	JK Tyres – Gwalior	Thermography Survey
396.	Seshasayee Paper Boards	Thermography Survey
397.	Ruchi Strips – Indore	Lightning protection study & Thermography
398.	National Steel, Indore	Thermography study
399.	AVTEC, Indore	Thermography study
400.	Grasim - Nagda	Comprehensive Safety Audit
401.	Castrol – Chennai	Design & Review of Fire Alarm System
402.	Castrol – Silvassa	Design & Review of Fire Alarm System
403.	Castrol – Patalganga	Design & Review of Fire Alarm System
404.	Kemrock Industries, Halol	Safety Review
405.	Hindustan Petroleum Corporation Ltd, Mumbai Refinery	Quantitative risk assessment for Laboratory
406.	Samsonite Asia – Nasik	Safety Review
407.	TCS – Pune	Implementation of ISO - 14001
408.	TCS –Delhi	
409.	Hindustan Zinc Ltd, Chittorgarh	Construction safety audit
410.	Asahi Glass, Chennai	Thermography study
411.	Honda Siel Cars India Ltd	Loss minimization in CBU handling
412.	IOCL POL Terminal, Korukkupet	Rapid Safety Audit & Hazard Analysis on behalf of Ministry of Environment & Forests
413.	BPCL POL Terminal, Tondiarpet	
414.	Tirumalai Chemicals, Royapuram	
415.	IOCL POL Terminal, Tondiarpet	
416.	Basin Bridge Gas turbine power station	
417.	Kundanmal Mukanmal Traders (P) Ltd, Jaipur	Driver training and evaluation

S. No.	*Client*	Project
418.	Honda Scooters International Event, New Delhi	Risk assessment study
419.	Pantaloons Stores, Delhi & Ghaziabad	Risk Inspection
420.	Super Spinning Mills, Kovai	Thermography study
421.	Mani Spinning Mills, Kovai	Thermography study
422.	Eveready Spinning Mills, Kovai	Thermography study
423.	Servall Engineering Company, Kovai	Thermography study
424.	LG Home Appliances, Greater Noida	Thermography study
425.	Asahi Glass, Rourkee & Bawal	Thermography study
426.	ETA Star's IT Park, Chennai	Construction safety review
427.	LG Warehouses, North and West	Safety Review
428.	Biocon, Bangalore	Fire Hydrant System Study
429.	Sangeeth Group of Companies, Nagercoil & Coimbatore	Machinery breakdown study for Windmills
430.	ST CMS Energy, Neyveli	Thermography study
431.	Honda Scooters, New Delhi	Event Risk assessment study
432.	Shapoorji Paloonji, Mumbai	Impact Risk assessment of TCS site
433.	Parryware Roca Pvt Ltd, Alwar	Thermography Survey
434.	Crossword Stores – Mumbai (14 stores) & Shoppers Stop Distribution Centres – Mumbai	Safety Audit
435.	Sundram Fasteners Ltd, Padi, Chennai	Fire Investigation
436.	Honda Motors	Event Risk Management Project
437.	Heidelberg Cements - Damoh, Imlai, Jhansi, Ammasandra Plant & Cochin Plants	Safety Audit
438.	Thomson Financials, Bangalore	Safety Review and Thermography survey
439.	Park Hotels, Chennai	Implementation of OHSAS 18001/ISO 14001
440.	Oman Chemicals, Sharjah	Environment Impact Assessment, Risk analysis and preparation of disaster management plan
441.	TCS, Siruseri	Construction safety audits
442.	TCS, Noida	ISO 14001 training programme
443.	TUV Middle East-Helliu Petrochemicals, Qatar.	Environment Impact Assessment

S. No.	*Client*	Project
444.	PRCL	Logistic Management studies
445.	Transystem Logistics	Hazard Mapping Study
446.	Taj, Coimbatore	Environment Impact Assessment
447.	Green Dome Petrochemicals	Environment Impact Assessment
448.	Shapoorji Paloonji , Mumbai	Environment Impact Assessment
449.	Parry ware Roca	Thermography survey
450.	Honda Siel Cars	Thermography survey & Event Risk management
451.	Crossword Stores , Mumbai	Safety Audit
452.	Persistent System Pvt. Ltd, Pune	Safety review
453.	Asahi India Glass Limited, Maharastra	Thermography survey
454.	Asahi India, Taloja plants	Thermography survey
455.	LG, Noida	Thermography survey
456.	Sony India Pvt. Ltd	Safety Review
457.	Honda Siel Cars India Ltd	Logistics Risk Management
458.	Hyundai Workshop	Safety Review
459.	Anchor Electricals, Bhuj	Safety Audit
460.	Sterlite Opticals	Safety Review
461.	STTI, Bangalore	Safety Audit
462.	Drive India	Feasibility Studysiis
463.	Reliance Gas Transportation Infrastructure Ltd.	Risk Analysis and Preparation of disaster management plan(DMP) for compressor station 5 in East-West pipeline
464.	Lubrizol India Pvt. Ltd., Mumbai	Hazardous Area Classification
465.	HPCL Retail Outlets in Chennai	Safety Audit

ASIA & AFRICA

S. No.	*Client*	Project
1	PT Tripatra Engineers and Contractors, Duri Oil Field, Indonesia	Safety Survey
2	Lanka Cellular Services, Colombo, Sri Lanka	Risk Inspection Survey
3	AXA Insurance, Singapore	Business Continuity Planning
4	Watson Stores	Risk Inspection Survey, Taiwan
5	Hong Kong Power, Lama Island, HK	Risk Inspection Survey
6	Nestle, Thailand	Risk Inspection Survey
7	Thai Acrylic Fibre Company Ltd	Safety Audit, Electrical Safety Audit and HAZOP study
8	P&O Ports Pvt Ltd – SAGT, Colombo	Setting up Contractor Safety Management System
9	TUV, Middle East	HSE Audit for Hamriya Free Zone, Abu Dhabi
10	TUV, Middle East	EIA for Oman Chemicals and Pharmaceuticals
11	TUV, Middle East	EIA for Bhuwalka Steel Industries (UAE)
12	NAPESCO, Kuwait	HAZOP, QRA and PHSER for Kuwait Oil Company – GC 25
13	NAPESCO, Kuwait	HAZOP, QRA and EIA for Kuwait Oil Company – GC 3,6,8,19
14	Eleme Petrochemicals Co Ltd, Port Harcourt, Nigeria	Safety Audit
15.	NAPESCO, Kuwait	Hazop & QRA for RFP-1027 Project, Strategic Crude Oil Supply Pipeline from KNPC Metering Skid to Shuaiba And Mina Abdulla Refineries
16.	NAPESCO, Kuwait	Hazop for RFP-1096 Project , New 16” HP gas line from GC-22 to “F” manifold
17.	Qassim Cement Co. , Kingdom of Saudi Arabia	Fire Risk Assessment, Review of fire protection system, Review of Hazardous Area Classification and lightning protection systems
18	Dome International LLC	Risk Analysis for Taiba and

		Fancy Rose buildings, Duba
19	NAPESCO, Kuwait	HAZOP & QRA for new air assisted flares at GC-17, 27, 28 and BS-170, Installation of liquid separator on 24" WK Export Line for Kuwait Oil Company (Contractor GULF SPIC)
20	NAPESCO, Kuwait	HAZOP, QRA, PHSER & HSE Plan for new 12" HP Gas pipeline from FM-7 to MAB Fence, Kuwait (Contractor FINESCO)
21	ATSCO, Kuwait	Project QRA for MOIP Phase I at MAA Refinery, Kuwait

TRAINING PROGRAMMES

S. No.	*Client*	Training Focus
1	TI Diamond Chain, Chennai (2004)	Industrial Safety Management
2	Public Training Programme (2002), Chennai	Hazardous Area Classification, selection, Installation & Maintenance of Electrical Equipment
3	CP Aquaculture, Chennai (2004)	Electrical Safety
4	Eagle Risk Management, Sri Lanka (2004)	Two-day residential workshop on Risk Management
5	ABB Limited, Baroda (2004)	Electrical Safety
6	GMR, Basin Bridge, Chennai	• Chlorine Safety • Power Plant Safety
7	ST-CMS Electric Company, Uttangal, Neyveli	Chlorine Safety
8	Monsanto	Electrical Safety
9	ABB Limited, Baroda	• Electrical Safety • Construction Safety

10	Ranbaxy Laboratories Ltd	• Process Safety • Electrical Safety
11	Oilco Services India Pvt Ltd	Construction Safety
12	Oilco Services India Pvt Ltd	• Safety management • Chemical safety • Fire fighting and emergency response
13	Shell India Marketing Pvt Ltd	Construction Safety
14	Zuari Fertilizers Ltd, Goa	Electrical Safety
15	GMR Energy Limited, Mangalore	Hazard and Operability (HAZOP) studies
16	GE India Technology Centre, Bangalore	HAZOP studies
17	Hindustan Organic Chemicals Ltd, Kochi	Chemical Safety
18	Gujarat Paguthan Energy Corporation	Green Procurement
19	Hindustan Zinc Ltd, Udaipur	Construction Safety
20	Shoppers Stop, Mumbai	General Safety