"Conducting a feasibility study and starting the initial stages of OHSAS-18001 implementation at KOYALI-RATLAM Pipeline project- GAMMON INDIA LIMITED"

A DISSERTATION REPORT

Submitted by

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R070205004

In partial fulfillment for the award of the degree

Of

MASTERS OF TECHNOLOGY
IN

HEALTH, SAFETY AND ENVIRONMENT ENGINEERING

UNDER THE GUIDANCE OF

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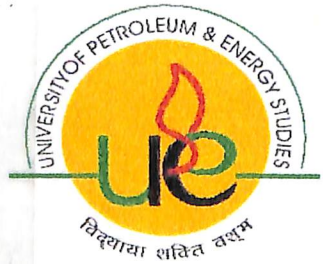

COLLEGE OF ENGINEERING
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
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This is to certify that the dissertation report on "**Conducting a feasibility study and starting the initial stages of OHSAS 18001 implementation at KRPL Project**" completed and submitted to **University of Petroleum and Energy Studies, Dehradun** by **ANJAN BHATTACHARYYA** in partial fulfillment of the requirements for the award of degree of **Master Of Technology (HSE)**, is a bonafide work carried out by him under my supervision and guidance.

To the best of my knowledge and belief the work has been based on investigations made, data collected and analyzed by him and this work has not been submitted anywhere else for any other University or Institution for the award of any degree/ diploma.

DR. N. A. SIDDIQUI

TO WHOMSOVER IT MAY CONCERN

This is to certify that **Mr. Anjan Bhattacharyya,** a student of M.Tech (Health, Safety and Environment Engineering) from University of Petroleum and Energy Studies, Dehradun, completed his project in **Pipelines Department** of our organization from March 05, 2007 to April 25, 2007. He has undertaken his project on **"Conducting a feasibility study and starting the initial stages of OHSAS 18001 implementation in KRPL Project."** He has taken keen interest in his assignment and his performance on evaluation has been found to be **"Good."**

Wishing him all the success,

Sunil Kumar
Construction Manager
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Koyali- Ratlam Pipeline Project, Gujarat

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2. ***Gopal Saha, Engineer***
3. ***Sunil Srivastava, Hydro testing Foreman***

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I am thankful to the management of University Of Petroleum and Energy Studies for making all the needful correspondence with the management of Gammon India Limited to allow us to carry out our project work along with our job at Gammon India Limited.

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CONTENTS

INTRODUCTION TO OHSAS 18001 IN PIPELINE PROJECTS

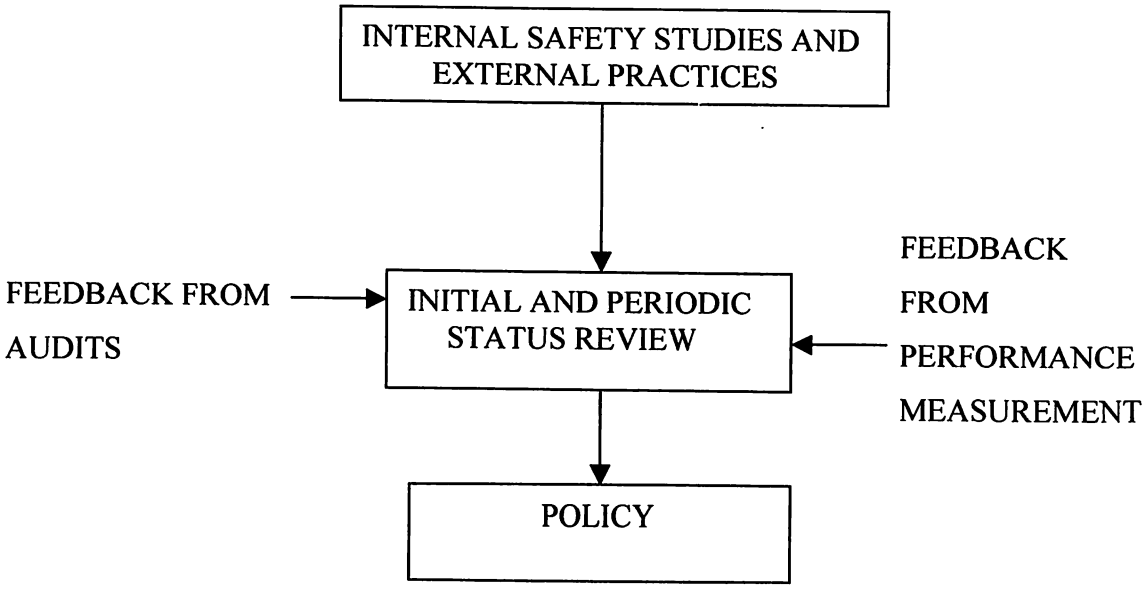
EXECUTIVE SUMMARY

OHSAS 18001 stands for Occupational Health and Safety assessment series. It has been set as a globally acceptable management system for occupational health and safety management system. These management systems are voluntary and may be introduced and practiced by any organization. An organization may introduce and declare that they practice these standards. A formal certification by a certifying agency gives an official acceptance of practice of these standards to any third party.

Scope of these standards-

- Establish an occupational health and safety management system.
- Implement, maintain and continually improve the occupational health and safety management system.
- Assure itself of conformance to the established OH&S policy.
- Demonstrate its conformance to others.
- Seek registration/certification of its conformance by a third party.
- Make a self declaration and self determination of its conformance to the specifications.

The elements of an occupational health and safety assessment series.



How to implement an OH&S policy- Steps of implementation

1 Development of an occupational health and safety policy- The policy should be authorized by the organization's top management which clearly states the overall health and safety policy and includes a commitment to continual improvement

2. Planning for hazard identification, risk assessment and risk control- The Company shall establish and maintain procedures for identification of hazards, assessment of risk and preventive or control measures to contain those risks. These shall include

- All routine and non routine activities
- Activities of all personnel having access to work place (Including sub-contractors and visitors).

- Facilities at work place whether provided by employer or others.

3. Identifying all legal and statutory requirements.

4. Develop occupational health and safety objectives at each relevant function and level within the organization.

5. Development of occupational health and safety management programme to achieve the objectives.

6. Develop a structure and assign responsibilities to personnel- The roles, responsibilities and authorities of personnel who manage, perform and verify activities having an effect on OH&S risks of the organization's activities, facilities and processes shall be defined, documented and communicated in order to facilitate OH&S management.

7. Arranging training programmes to develop awareness and develop competence.

8. Ensuring consultation and communication amongst all levels of employees and all interested parties.

9. Documentation- The organization shall establish and maintain information in a suitable medium such as paper or electronic format.

10. Control and flow of all available data- The organization shall establish and maintain procedure for controlling all documents and data required by the OHSAS Specification.

11. Organize operational control- The organization shall identify those operations and activities that are associated with identified risks where control measures needs to be applied.

12. Organizing emergency preparedness and response

13. Performance measurement and monitoring. The organization shall establish and maintain procedures to monitor and measure OH&S performance on a regular basis.

14. The organization shall establish and maintain procedures for identification, maintenance and disposition of OH&S records, as well as the results of audits and review.

15. Performing audits- The organization shall establish and and maintain procedures and programmes for periodic safety audits to check the compliance to OH&S management.

16. Review by the top management- The organization's top management shall at regular intervals review the OH&S management system to check its suitability at a particular point of time.

This project work is basically focused on the activities to be undertaken for the initial stages of OHSAS 18001 implementation. For this the following work has been undertaken.

1. Lay an occupational health and safety policy.
2. Identify all Hazards and evaluate risks of all activities.
3. Prioritize top scoring 5 hazardous activities
4. Describe 5 operational control procedures to ensure prevention of accidents due to those activities.
5. Suggest some management programmes for capital investment for improvement of Safety- e.g. PPE
6. List all the registers required and manuals to be prepared

CHAPTER 1

INTRODUCTION

SAFETY, HEALTH AND ENVIRONMENT POLICY OF GAMMON INDIA

1. *We at Gammon are committed to provide a safe and healthy working environment for employees by adopting a proactive approach prior to commencement of any project.*

2. *It is a part of our work ethics to ensure that SHE safeguards are in place right from inception to execution stage.*

3. *We accept the need for constant up-gradation of safety and health standards commensurate with rapid changing technology in construction.*

COMPANY PROFILE

Gammon is a major civil and construction engineering company in India. It has an enviable track record of over 75 years both in the design and construction of different types of structures. The numerous projects undertaken over the period effectively demonstrate its capability to embark upon any type of construction activity.

Gammon undertakes the construction of all types of civil engineering projects throughout India and abroad. It is continually expanding its operations and seeking out construction opportunities in newer areas. Throughout, Gammon has established a reputation to meet challenges and to deliver high quality and cost competitive value to the customers. It has successfully integrated and developed all aspects of construction engineering and such as design and detailed engineering, project organization, and management, temporary structures, material and manpower mobilization, construction, plant and machinery, design and fabrication/manufacture and erection, thereby providing the clients with a comprehensive package of services. The company has the capability to take pipeline projects, which can meet client's requirements in terms of quality and resources. The company's reputation for professionalism, innovativeness, reliability, state of art technology to successfully completing challenging assignments is evident from its numerous projects.

Gammon is capable of designing and construction of all types of bridges, tunnels, harbors, jetties and nuclear power stations to horizontal and vertical silos, chimneys and cooling towers, warehouses, dams, reservoirs, aqueducts, industrial complexes, public utility structures. The company in the process of designing and construction has pioneered and established numerous innovations and concepts in the following areas.

- Reinforced and prestressed concrete.
- Long span and cable stayed bridges.
- Under water concreting

- Thin shell roof construction
- Tapered slip form construction
- Parabolic prestressed concrete horizontal silos
- Full face tunnel boring applications
- Controlled demolition techniques
- Lifting techniques from ground level to any height of precast water reservoirs

Gammon takes pride in its innovative skills, intuitive understanding of construction materials and methods and maintaining the process leadership, thereby setting the pace for future needs in civil engineering. It is perhaps a measure of gammon's pioneering expertise that the international federation of Asian and western pacific Contractors Association deemed it fit to award the company two Gold medals for its pioneering work

On the Thane Creek Bridge and the Neyveli Horizontal Parabolic Silo- an honor unequalled by any other Corporate company internationally.
The Mahatma Gandhi setu, Patna, reckoned as the world's longest river bridge which was conceived, designed and constructed by Gammon, was nominated by the American Concrete Institute, Maharashtra Chapter for the Gold medal for the most Outstanding Concrete Structure in India-1988. A certificate of merit was awarded for the Akkar Bridge, SIkkim, India's first concrete cable stayed bridge.

Koyali- Ratlam pipeline will be basically owned by Indian Oil Corporation's Pipeline Division. The construction of the pipeline along with all the associated Civil, Mechanical, Electrical and Instrumentation works has been contracted to M/S Gammon India Limited-Pipelines Division along with a consortium with Limak Constructors, Turkey.

The project will mainly comprise of-

- Installation of pump station at Koyali within the existing Koyali Refinery premises of IOCL.
- Scrapper Station at Dahod, Gujarat.

- 260 Kms long underground pipeline from Koyali to Ratlam (16" diameter initially operating at 2.0 MMTPA capacity) for the transportation of High Speed diesel (HSD), motor spirit (MS), superior kerosene oil and aviation turbine fuel.
- 10 bays Tanker Lorry Filling shed with fully automated tank wagon loading gantry and tank ages of 79.258 Kms.

The pipeline will originate from Koyali refinery in Gujarat and terminate at Ratlam in Madhya Pradesh. The length of the pipeline will be 160 kms in Gujarat and 100 Kms in Madhya Pradesh. The pipeline passes through Vadodara, Panchmahal and Dahod district in Gujarat and through Jhabua and Ratlam Districts in Madhya Pradesh. It is to be noted that no ecologically sensitive area falls enroute the pipeline.

SPECIFIC FEATURES OF THE PIPELINE

- The design, material of construction, assembly, inspection, testing and safety aspects of the operation and maintenance of the pipeline and transporting the products will be as per ASME/ANSI B 31.8/ B 31.4 and OISD standard 141

- The pipeline shall be audited by a third party annually for a period of three years.
- The construction of the pipeline particularly at the river and stream crossing shall be done during dry seasons to avoid disturbance of breeding seasons and soil erosion. The riverbeds, embankments and dykes shall be restored adequately after installation of crossings.
- Pipeline wall thickness and minimum depth of burial at river crossings and casings at rails, major road crossings should be in conformity with ANSI/ASME requirements.
- The project authorities shall plant a minimum of 10 trees for every tree cut along the pipeline route.

- The project authorities shall install a SCADA system with dedicated optical fiber telecommunication link for the safe operation of the pipeline and leak detection system. Additional sectionalizing valves in the residential areas and sensitive installations should be provided to prevent the amount of vapor going into the atmosphere in the event of a pipeline failure. Intelligent pigging facility should be provided for the entire pipeline system for internal corrosion monitoring. Coating and impressed current cathodic protection system should be provided to prevent external corrosion.
- The project authorities shall patrol and inspect the pipeline regularly for detection of faults as per OISD guidelines and continuous monitoring of pipeline operation by adopting non-destructive methods of testing as envisaged in the EMP. Continuous potential survey should be carried out at regular intervals to ensure the adequacy of cathodic protection system.
- The fire water facilities at the terminal must be designed as per OISD-117. However for fighting prolonged fires, the company should firm up a plan for assured water supply from a nearby ground water source. This must be complied before commissioning of the project.
- Green belts of adequate width and density shall be provided to mitigate the effects of fugitive emissions all around the intermediate pumping stations. A minimum of 25% of the total land acquired shall be developed as green belt.

CHAPTER 2

OCCUPATIONAL HEALTH AND SAFETY ASSESSMENT SERIES POLICY CLAUSE 4.2 OHSAS/ BSI

A PROPOSED OH&S POLICY FOR OHSAS 18001 IMPLEMENTATION IN GAMMON INDIA LIMITED (PIPELINES DIVISION)

(Clause 4.2 OHSAS)

Gammon India Limited is a leading multinational infrastructure company specializing in the field of civil construction; and pipeline construction is a specialized part for which this policy is being developed

The management hereby commits itself for continual improvement of occupational health and safety in pipeline construction projects.

The company assures hereby to take all measures through planning, implementation, monitoring, auditing and review of all OH&S hazards to ensure safe working conditions in all pipeline projects.

The company shall also undertake effective training of all employees for potential hazards and prevention.

The company shall also provide and periodically replenish all requisite personnel protective equipments.

The policy shall be communicated to all employees with the intent that they are made aware of all occupational health and safety obligation.

The policy shall be available to all those interested.

The policy shall be reviewed periodically as required.

N.B- this policy has been prepared only as a part of the project report and not for any other purpose related to Gammon India

PURPOSE OF AN OHSAS POLICY AND SPECIFICATION

(Clause 4.2 OHSAS)

The occupational safety and health assessment series policy gives a requirement for an occupational health and safety management system to enable an organization to control its OHS risks and improve its performance.

The OHSAS specification is applicable to any organization that wishes to

- To establish an OHS management system to eliminate or reduce risks to all employees and other interested parties who may be exposed to OHS risks due to the various activities.
- Implement, maintain and continually improve the OHS management system.
- Assure itself of its conformance with the OH&S policy.
- Demonstrate such conformance to others.
- Seek certification/registration of its OH&S management system by an external organization
- Make a self declaration/determination of its conformance with this OH&S standard.

All the OHSAS requirements should actually be implemented in the OHSAS management system. But the extent of its implementation will depend on such factors such as OH&S policy of the organization, the nature of its risks and complexity of its operation.

DEFINITIONS PERTAINING TO OHSAS

1) HAZARD: Source or situation with a potential for harm in terms of injury or ill health, damage to property, damage to workplace environment, or a combination of these.

2) HAZARD IDENTIFICATION: Process of identifying that a hazard exists and defining its characteristics.

3) INCIDENT: Event that leads to an accident or had the potential to cause an accident.

4) INTERESTED PARTIES: Individual or group concerned with or affected by the OH&S performance of an organization.

5) NON-CONFORMANCE: Any deviations from work standards, practices, procedures, regulations, management systems, performance etc that could either directly or indirectly lead to injury, illness, property damage, damage to workplace environment or a combination of these

6) OBJECTIVES: Goals in terms of OH&S performance that a company sets to achieve.

7) OCCUPATIONAL HEALTH AND SAFETY: Conditions and factors that affects the well being of the employees, temporary workers, contractor workers, visitor or any other person present in the work place.

8) OH&S MANAGEMENT SYSTEMS: Part of the overall management system that facilitates the management of the OH&S risks associated with the business of the organization. This includes the organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, maintaining and reviewing the organization's OH&S policy.

9) ORGANIZATION: Company, operation, firm, enterprise, institution or association, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

10) PERFORMANCE: Measurable results of the OH&S management system, related to the organization's control of health and safety risks, based on its OH&S policy and objectives.

11) RISKS: Combination of the likelihood and consequence of a specified hazardous event occurring.

12) RISK MANAGEMENT: Overall process of measuring the magnitude of risk and deciding whether the risk is tolerable or not.

13) SAFETY: Freedom from unacceptable risk or harm.

14) TOLERABLE RISK: Risk that has been reduced to a level that can be endured by the organization having regard to the legal requirements and it's own OH&S policy.

GENERAL REQUIREMENTS TO IMPLEMENT AN OHSAS POLICY (Clause 4.2 OHSAS)

1. OH&S POLICY: The organization should have an OHSAS policy authorized by the organization's top management that clearly states the organization's overall health and safety objectives and a commitment to improve the health and safety performance.

The policy shall:

- Be appropriate to the nature and scale of the organization's OH&S risks.
- Include a commitment for continual improvement.
- Include a commitment to at least comply with the current applicable OH&S legislations and other requirements to which the organization subscribes.
- Be documented, implemented and maintained.
- Be communicated to all employees with the intent that all employees are made aware of their individual OH&S obligations.
- Be available to interested parties.
- Be reviewed periodically to ensure that it remains relevant and appropriate to the organization.

2. Planning for hazard identification, risk assessment and risk control.

The organization shall establish and maintain procedures for the ongoing identification of hazards, the assessment of risk and necessary control measures undertaken. These shall include

- Routine and non-routine activities
- Activities of all personnel having access to work place.
- Facilities at the work place, whether provided by organization or others.

The organization's methodology for hazard identification and risk assessment shall be

- Defined with respect to the scope, nature and timings to ensure that it is proactive rather than reactive.
- Provide for the classification of risks and identification of those that are to be eliminated or controlled.
- Be consistent with operating experience and capability of risk control measures employed.
- Provide input into the determination of facility requirements, identification of training needs or development of operational controls.
- Provide for the monitoring of required actions to ensure effectiveness and timeliness for their implementation

3. Legal and other requirements.

The organization shall establish and maintain a procedure for identifying and accessing the legal and other OH&S requirements that are applicable to it. The organization shall keep this information up to date. It shall communicate all the relevant information on legal and other requirements to its employees and other interested parties.

4. Objectives: The organization shall establish and maintain documented occupational health and safety objectives at each relevant function and level within the organization. When establishing and reviewing its objectives an organization shall consider all the legal and other requirements, its OH&S hazards and risks, its technological options, its financial, operational and business requirements, and the views of interested parties.

5. OH&S management programmes

The organization shall establish and maintain an OH&S management programme to achieve its desired targets. This shall require documentation of-

- Designated authority and responsibility for achievement of desired objectives and functions within the organization.
- The means and time scale by which objectives are to be achieved.

6. Implementation and operation.
7. Structures and responsibility.- The roles and responsibilities of personnel who manage, perform and verify activities having an effect on the organization's OH&S risk in its activities, process and activities.

CHAPTER 3

INITIAL STATUS REVIEW

CLAUSE 4.3- PLANNING
CLAUSE 4.3.1- PLANNING FOR HAZARD IDENTIFICATION
CLAUSE 4.4.4- DOCUMENTATION
CLAUSE 4.4- IMPLEMENTATION AND OPERATION
CLAUSE 4.4.1- STRUCTURE AND RESPONSIBILITY
CLAUSE 4.3.4- OH&S MANAGEMENT PROGRAMME
CLAUSE 4.4.6- OPERATIONAL CONTROL

Clause 4.3 and 4.3.1 OHSAS/ BSI

Safety Management procedure of Limak- Gammon Consortium

1) **INTRODUCTION:** Safety in construction management deserves utmost attention especially in the hydrocarbon industry such as Exploration, Refineries, Pipelines, marketing installations, gas processing units etc. Construction is widely recognized as one of the accident prone activities. Most of the accidents are caused by inadequate planning, failure during the construction process and/or because of design deficiencies. Besides property loss, accidents also result in injuries and fatalities to the personnel; the same needs to be prevented.

   The reasons for accidents during construction activities are related to unique nature of the industry, human behavior, difficult work site conditions, extended odd duty hours, lack of training and awareness and inadequate safety management. Unsafe working methods, equipment failure and improper housekeeping also tend to increase the accident rate in construction.

   Ensuring good quality of materials, equipment and competent supervision along with compliance of standard engineering practices shall go a long way to in built safety into the system.

   The objective of this policy is to-

   a) Prevent accidents and harmful effects on the health of workers arising from employment in construction.
   b) Ensure appropriate safety during implementation of construction.
   c) Provide safety practice guidelines for appropriate measures of planning, control and enforcement.

Clause 4.3 and 4.3.1 OHSAS/ BSI

2) **SCOPE:** The document specifies broad guidelines on safe practices to be adhered to during construction activities in pipelines. Before starting any job, specific hazards and its effects should be assessed and necessary corrective/preventive actions should be taken by all personnel.

3) **DEFINITIONS:**

ACCIDENT

An unplanned, undesired event or condition that results in harm to people or damage to plant equipment.

INCIDENT

Any undesired event or condition that results or could have resulted in harm to people damage to property or the environment or loss.

NEAR MISS

An unexpected, unwanted event not causing loss, or injury or illness but which under slightly altered conditions can leas to an accident.

FATAL

Death resulting from an accident

MAN – HOURS WORKED

The total no. of employee – hours worked by all employees working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contractor labors. Man – hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total no. of work day for a period is the sum of the

no. of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

FIRST AID CASES

First aid cases come under non-reportable cases, where the injured person is given medical treatment and discharge immediately for reporting on duty, without counting any lost time.

LOST TIME INJURY

An injury causing disablement extending beyond the day of shift on which the accident occurred.

MEDICAL CASES

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absents on work and seeks medical treatment.

RESTRICTED DUTY CASES

Days of restricted work activity are those workdays on which 'because of occupational injury or illness' the employee was assigned to another jobs. On a temporary basis worked at a permanent job at less than full time or worked as a permanently assigned job could not perform all duties normally connected with it. The number of lost work days should not include the day of injury or onset illness or any day on which the employee would not have worked even through able to work. This is a recordable case of incident / accident where lost time is not completed.

TYPE OF INCIDENT / ACCIDENT & THEIR REPORTING

The three categories of reportable and non – reportable cases of incident / accident as follows:

Non – Reportable Cases

An accident where the injured person is disabled for less than 48 hours

Reportable Cases

In this case the injured person is disabled for 48 or more and is not able to perform his duty.

Injury Cases

These are covered under the heading of non – reportable cases. In this case the accident caused injury to the person, but he still continues his duty.

LOST MAN – DAYS CASES

Man-Days lost mean the changes in days of disablement of a person. The day on which the injury occurred or the day on which the injured person returned to work, are not to be included as a man – days lost, but all intervening calendar days (including Sundays, days off or days of plant shut down) are to be included.

If after resumption of work, the person injured is again disabled for any period airing out of the injury which caused his earlier disablement, the period of such subsequent disablement is also to be included in the man – days lost.

FREQUENCY RATE

Frequency rate is the no. of reportable injuries per million employees – hours worked mathematically, the formula reads:

$$\frac{\text{NO. Of LOST TIME INJURY}}{\text{TOTAL NUMBER OF MAN-HOUR WORK}} \times 10,00,000$$

SEVERITY RATE

Severity rate is the no. of days lost for injuries per million employees – hours worked. Mathematically, the formula reads:

$$\frac{\text{NO. Of LOST WORK DAYS}}{} \times 10,00,000$$

Clause 4.3 and 4.3.1 OHSAS/ BSI

NUMBER OF EMPLOYEE-HOURS WORKED

INCIDENT RATE

Incidence rate is the ratio of the number of injuries to the number of persons during the period under review. It is expressed as the number of injuries per 1000 persons employed. The incidence rate shall be calculated both for lost time and reportable lost time injuries as follows:

$$\frac{\text{NO. Of REPORTABLE INJURY}}{\text{AVERAGE NO. OF PERSONS EMPLOYED}} \times 1000$$

SAFETY AUDIT

Limak-Gammon consortium has a systematic and independent examination of the Health and Safety management systems and their outcomes to determine the effectiveness of the Health & Safety management system.

EMERGENCY CONTROLLER

Person taking charge of an emergency situation

EMERGENCY COORDINATOR

Limak-Gammon consortium is responsible for co-coordinating site emergency procedures.

HEALTH & SAFETY PLANNED INSPECTION

Physical condition inspection of the work place undertaken by local managers accompanied by Health & Safety advisors as appropriate.

Clause 4.3 and 4.3.1 OHSAS/ BSI

HEALTH & SAFETY REVIEW

A formal recorded management evaluation of the effectiveness of the Construction Health & Safety management systems and identification of actions for continuous improvement.

HEALTH & SAFETY TOUR

A highly visible Health & Safety site visit / walkabout by senior management, to gain feedback from the workforce and demonstrate commitment to Health & Safety.

POSITIVE HEALTH & SAFETY CULTURE

The organization's attitude, values and beliefs with respect to the Health, Safety and Environment is a vital part of the process to achieve the aim of Zero Accident Performance. The creation of a positive culture towards the Health, Safety and Environment requires involvement and participation at all levels. Effective communications and the promotion of competence enable all employees to have a responsible and informed contribution to sustain this positive Environment, Health & Safety culture. Senior Management's visible positive leadership in Health & Safety is vital to the development and maintenance of the positive safety culture.

ZERO ACCIDENT PERFORMANCE

Accident in the term 'Zero Accident Performance is defined as an incident that results in the inability of an individual to attend the next shift as a consequence of that incident.

THE DIFFERENT CONSTRUCTION ACTIVITIES CARRIED OUT IN THIS SITE ARE AS FOLLOWS

- ROW Survey
- ROW Grading and cleaning
- Trenching/ excavation
- Pipes Stringing

Clause 4.3 and 4.3.1 OHSAS/ BSI

- Mainline Welding
- Joint Coating
- Radiography Test
- Clearing of Lowering
- Section backfilling
- Tie-In Joints
- Tie –In Joint Coating and backfilling
- Hydro testing of Section
- Joint of Optical Fiber cable
- Restoration of ROW and ROW Pillar marking, Kilometer post, Flow direction marking post.

EXCAVATION

All excavation work should be carried out considering the following

- The stability of the ground
- The excavation will not affect adjoining buildings, structures or roadways
- Presence of underground pipes, cable conductors etc
- The position of culvert, bridges, temporary roads and spoil heaps should be determined

All excavation work should be planned and supervised properly

Sites of excavations should be supervised thoroughly

Safe angle of repose while excavating trenches exceeding 1.5 mts depth should be maintained

Where there is the possibility of any ingress of water then pumping shall be established with pumps being readily available for use and additional ladders placed for use in the event of the emergency evacuation

No excavation shall commence till the disposal area has been earmarked and is ready to receive the excavated material.

Correct planning of excavations is essential for safety and before digging and precautions against the following shall be taken.

a) collapse of the sides
b) materials falling onto personnel working in the excavations
c) Personnel and vehicle falling into the excavation
d) Undermining nearby structures
e) Contact with underground services
f) Access to the excavation
g) Fumes
h) The necessary equipment needed is available at site
i) The disposal area has been defined, made safe for receiving the excavated material and the manner of disposal is defined.

The following precautions shall be observed

- Prevent the sides and the ends from collapsing by battering them to safe angle or supporting them.
- Entry into unsupported excavations shall be avoided.

LIFTING OPERATIONS

All lifting appliances, mobile cranes, gantry cranes, launching beams and lorry mounted cranes, prior to being allowed to work on site shall have a current certificate of safe operations

All lifting appliances with a lifting capacity of more than one ton shall, where applicable, be fitted with automatic safe load indicators which shall be kept in an operable condition at all times the

lifting appliance is used. Checks shall be made to ensure that the indicator is properly calibrated and is functioning properly.

All lifting appliances shall be maintained in accordance with the manufacturer's instructions and shall be subjected to a regular preventive maintenance programme

The operators of lifting appliances shall conduct daily inspections of their respective lifting appliances with the result of the inspections being recorded and kept available for inspections.

LIFTING GEARS

Lifting gear includes chain slings, wire ropes slings, or similar gear and a ring, link, hook, plate, clamp, shackle, swivel or eye bolt.

It shall be ensured that all lifting gears are in good condition, tested and certified every six months, with the safe working load being stamped or clearly displayed upon it. Records of test shall be kept available.

All lifting gear shall be visually inspected before any use and if any defects are found then it shall be removed from site and cut into pieces so that it is not reused again in defective state.

All lifting gears shall be properly stored and not left lying on the ground where it could be damaged or used in an unsafe manner.

WELDING AND CUTTING

It shall be ensured that all welding, cutting and gouging is carried such that risks are kept at minimum. Special care should be taken for

- Welding over areas where others are also working
- Working in areas with increased fire risks or hazardous environment.

All equipments should be in good condition, properly installed and routinely inspected by concerned engineer/ supervisor and the safety officer.

Clause 4.3 and 4.3.1 OHSAS/ BSI

Flexible hoses, cable and connections shall be free from damage or risk of damage in service. Cables and hoses shall have adequate carrying capacity.

Welders shall wear the correct personnel protective equipments which includes the following

- Face and eye protection with the correct grade of shield.
- Safety gloves
- Safety footwear
- The atmosphere in the vicinity of work shall be safe to breathe and free from inflammable gases.

Surface to be heated by the process shall be cleaned of contaminants that may be degraded by heat or give off noxious fumes (e.g. paints, plastics, zinc coating)

Naked flames or high temperature surfaces shall not be allowed in the vicinity of volatile solvents.

All movable inflammable materials shall be removed from the vicinity of work and fire proof covers placed over all materials that cannot be removed.

During welding the work place and any access equipment must be safely secured.

The welding current return cable shall be connected to the work place close to the arc point or to a well electricity conductive support structure in good contact with the workplace.

Contact with water or wet floors shall be avoided when welding

The correct eye and face protection with the appropriate filter glass shall also be used.

Clause 4.3 and 4.3.1 OHSAS/ BSI

MACHINERY

It shall be ensured that all gears, revolving shafts, flywheels, couplings and other dangerous parts of machinery shall be effectively guarded unless they are so constructed, installed or placed as to be safe as if they are guarded.

Fencing of dangerous parts of machinery shall not be removed while the machinery is in use or in motion. If the fencing is required to be removed for maintenance purposes it shall be replaced before the machine is taken into use.

MAINTENANCE

It shall be ensured that all machinery used on site is in safe condition and is properly maintained and repaired by duly authorized, thoroughly trained and experienced persons.

No repair to machinery shall be carried out whilst it is in motion unless it is avoidable.

Maintenance records shall be kept available for inspection by the concerned officials.

WORK ADJACENT TO LIVE ROADWAYS

Whenever working adjacent to any live roadway, the following aspects shall also be considered

Close liaison with the police and metropolitan authorities

Production of an agreed traffic management scheme in accordance with the local traffic laws.

The provision of wearing of high visibility clothing by all personnel engaged in the traffic management.

Clause 4.3 and 4.3.1 OHSAS/ BSI

BLASTING OPERATIONS

The blasting operation will only be permitted following consultation wit relevant authorities and issuing permission to blast. The client's representative must also give his consent in writing before any blasting operation takes place

RISK ASSESSMENT AND METHOD STATEMENTS.

A detailed hazard risk assessment and an in-depth method statement shall be made for the following elements.

- Type of explosive to be used
- Anticipated effects of vibration on nearby structures
- Blasting patterns
- Delivery of explosives
- Transportation and storage of explosives on site
- Drilling and charging of holes
- Warning sirens
- Provision of sentries
- Use of blast screens
- All clear signals
- Ventilation following blasting
- Atmosphere monitoring
- Procedure for miss-fires

HAND TOOLS

Common tools which are used are as follows

A) Pick axes
B) Crow bars
C) Spanners

D) Saws
E) Chisels
F) Hammers
G) Screwdrivers
H) Others

HAZARDS FROM TOOLS

a) Incorrect/ improper use of tools
b) Injuries arising from
   - Human failure
   - Carelessness
   - Lack of common sense
   - Over confidence
   - Improper storage

SAFETY IN USE OF TOOLS

a) Good quality and of sound construction.
b) Right tool for a job
c) Proper training in the use of tools since these are generally used by everyone
d) Position of good quality handles for all tools like files, hammers, screwdrivers etc and frequent checking for weeding out defective ones.
e) Cleanliness and maintenance of tools
f) Cutting edges of all cutting tools shall be kept sharp and used by skilled personnel only.
g) Keeping away from inflammable liquids
h) Heads of hammers shall be firmly and adequately fixed to the handle with appropriate wedge.
i) Hammer heads shall be kept in shape by occasional grinding and shall be discarded if cracks are found
j) Files shall not be used for striking or leverage and shall always be used with handles.
k) All tools like pliers/ screwdrivers etc used for electrical work shall be fully insulated type and of approved quality.
l) All tools shall be inspected prior to use.

Clause 4.3 and 4.3.1 OHSAS/ BSI

HOUSEKEEPING

Good housekeeping is an important component of accident prevention. It shall be of primary concern to all engineers and supervisors. Good housekeeping shall be planned at the beginning of the job and carefully supervised and followed till the final clean-up.
Housekeeping shall be the concern of each supervisor and workman and not left for a particular group. Working will be more efficient when the place is neat and orderly always.

SIMPLE RULES FOR HOUSEKEEPING

Storage areas: all materials shall be maintained in neat stockpiles for ease of access. Aisles and walkways shall be kept clear of loose materials and tools.

Work areas: Loose materials, waste etc shall be cleaned immediately. This shall be especially important in aisles and in the vicinity of ladders, ramps, stairs and machinery. Tools and loose materials shall be removed immediately if a hazard is created.

Areas used by personnel: Empty bottles, containers and papers shall not be allowed to accumulate where lunches are eaten on the jobsite. Waste disposal shall be provided.

Oils and greases: Spills of oil, grease or other liquid shall be removed immediately or sprinkled with sand.

Disposal of waste: An effective means of preventing litter is the provision of suitable receptacles for waste, scrap, etc. Combustible waste such as oily rags, paper etc shall be stored in a safe place such as covered metal container and disposed off regularly.

Protruding nails: It shall either be removed or bent over.

Lighting: Adequate lighting shall be provided in or around all work areas, passageways, stairs, ladders and other areas used by personnel.

Clause 4.3 and 4.3.1 OHSAS/ BSI

ENVIRONMENT PROTECTION

In keeping with the policy on Safety, health and environment we shall ensure that whatever we accomplish, it does not disturb the environment in and around sites, does not affect in anyway the existence of living beings and marine life or other vegetation.

- Adopt and implement environment friendly work practices
- Conserve water, energy and raw materials
- Constantly improve pollution- prevention practices
- Reduce generation of waste at source
- Dispose waste in an environmentally responsible manner

SAND/ SHOT BLASTING/ PAINTING

- Used approval from competent person.
- Air compressor use for sand / shot blasting/ painting should have guard and position
- Keep away from the work place.
- Regular check the hoses in compressed air.
- Operator use PPE with Mask.
- Suitable covered & protected from rain/ moisture.
- Proper ventilation provide in confined places.

SAFETY PERFORMANCE

- Frequency Rate (F.R) = Number of lost time injury (LTI)*1000000/ Man hours worked.

- Severity Rate (S.R) = Man days lost * 1000000/ Man hours worked.
- Incident Rate (I.R) = Number of LTI * 1000/Number of Employees.
- Incidence Rate (Fatal) = Number of fatal injuries * 1000/ Number of Employees.
- Safety Audit:

- Limak-Gammon consortium will carry out systematic and independent examination of the health and safety management system to check its effectiveness and efficiency.

FIRE PREVENTION AND FIRE FIGHTING

- Fires should always be avoided. In case of a fire quick and efficient means to control it quickly should be undertaken. Safe evacuation of personnel should be ensured and immediate information to unit/ fire control room should be undertaken.
- Inflammable material should always be kept away from hazardous areas.
- Suitable fire extinguishing material should always be available and it should be legibly marked to be visible by employees.
- An adequate water supply system meeting the requirements specified in OISD standards should be available.
- Proper training should be provided to each and every person working informing him about all escape routes, safety to be undertaken while at work.
- All measures to be undertaken to avoid spread of fire to adjoining areas.

DOCUMENTATION

Documentation of all types of accidents/ near misses and incidents to be maintained as per factory act 1948.

Clause 4.3 and 4.3.1 OHSAS/ BSI

SAFETY AWARENESS & TRAINING

Awareness programme is basically intended to inform people of safety. Awareness programme consist of

- Talk, Lectures & Conferences: The speakers are required to possess good presentation skills, knowledgeable and should be able to influence the audiences.
- Different safety competitions etc to be organized to increase safety awareness and rewards to be given.
- Training should be imparted to different trades for hazard awareness and safety.

RESPONSIBILITIES

PROJECT MANAGER/ CONSTRUCTION MANAGER

- Shall initiate continuous improvement of Health & Safety and Environment Performance to achieve zero accident performance at site.
- Shall implement detail requirements of the Company Client Health and Safety Policies at project to improve Health, Safety and Environment.
- Shall ensure that all operations are adequately assessed, planned, supervised, monitored and reviewed so as to allow them to be executed safely and without risks to health.
- Shall ensure that all personnel on the project have attended induction training and are adequately informed about foreseeable hazards, preventive or precautionary measures and instructed on the safe system of work to be employed.
- Shall conduct Health and Safety surveillance as he go about his day to day work and take immediate action to correct any unsafe practices or defects observed or reported to him.
- Shall ensure that the attendance at Health and Safety meetings is comprehensive and appropriate. He will also ensure that the minutes of such

meetings assign actions and timings to name the individuals and promptly distribute to all relevant personnel.

HSE OFFICER / ENGINEER

- Shall report administratively to Site In – Charge and functionally to Project Manager.
- Act as a focal point of contact with owner's representative local authorities and subcontractors on safety matters.
- Specifies and maintains the security and emergency services and ensure that the equipment are in proper condition and operated by trained and experienced persons.
- Participates in subcontractor's monthly safety meeting.
- Conducts initial safety induction for all workers.
- Carries out daily tour of construction sites and with supervisors to co-ordinate and maintains constant good state of housekeeping and Safety practices.
- Trains and occasionally assists supervisors to conduct tool box meeting.
- Checks to ensure that specified precaution in work permits are complied with.
- Conduct safety meetings on site with attendance by relevant supervisors and work leaders.

HSE PLAN FOR CONSTRUCTION ACTIVITIES – IMPLEMENTATION, MONITORING & AWARENESS

The Company shall be fully responsible for planning, reporting implementing and monitoring all HSE requirements and compliance of all laws and statutory requirements. It shall also ensure that all HSE requirements are clearly understood & faithfully implemented at all levels at site

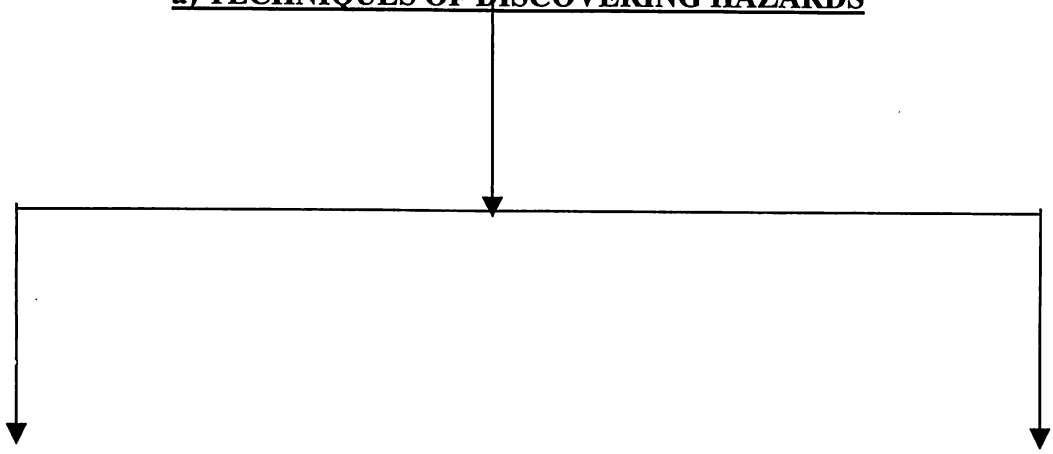
The company shall also evolve a comprehensive planned and documented system for implementation and monitoring of HSE requirements. The monitoring for implementation shall be done by regular and compliance to the observations thereof.

Clause 4.3 and 4.3.1 OHSAS/ BSI

It shall also promote and develop consciousness about health, Safety and Environment among all personnel working. Regular awareness programme and fabrication shop/work site meetings shall be arranged on HSE activities to cover hazards involved in various operations during construction.

INTIAL STATUS REVIEW **(Clause 4.3 and 4.3.1 OHSAS/BSI)**

a) TECHNIQUES OF DISCOVERING HAZARDS



PROACTIVE

Plant Safety Inspections
Safety Survey
Safety Audits
HAZOP, HAZAN, MORT
FMEA, FTA, JSA

REACTIVE

Accident
Investigation

b) Accident/ Incident Reporting/ Investigation (Clause 4.4.4 OHSAS/BSI)

Job: _____

A. Name of the person:
B. Date/ Time of accident/ incident:
C. Age of the injured:
D. Occupation/ Category of the employee:
E. Working since:

F. Part of Body Injured:

G. Date of reporting back on duty:

2. Description of the accident/ Incident:

a) What jobs the individual was doing-

b) What was the unsafe act or working method on the part of the employee?

c) Was there any unsafe condition present at the place of the accident?

d) Were the safety rules followed?

e) Were the required personnel protective equipment provided and used by the employee?

f) Any other facts you would like to highlight?

g) Suggestions for improvement and necessary steps to prevent recurrence.

Signature of the immediate supervisor/ engineer in charge

c) Monthly safety performance report: Clause 4.4.4 OHSAS/BSI

Job: _____

For the month of: _____

Part 1:

1) Number of personnel employed by Company: STAFF-

Local Muster Roll:

Daily Muster Roll:

Sub Contractor or other Employees:

2) Number of near misses:

3) Number of first aid cases:

4) Number of Lost time injuries (more than 48 hrs of disablement)

5) Number of fatal accidents/ permanent disablement injuries:

Part 2:

I confirm that:

a) Requisite personnel protective equipment has been provided to all concerned and usage ensured.
b) Necessary safety training is provided to all concerned:

Signature of Site In charge:

Part 3:

Comments of CMS:

CC: HO SAFETY

d) FOLLOW UP SYSTEMS BY THE MANAGEMENT (CLAUSE 4.4)

It is ensured by the top management that all necessary control measures are adopted at management level to prevent recurrence of any incidents/accidents.

Gammon India Limited assures that a proactive approach is always adopted for prevention of incidents/accidents.

The accidents shall be reported by the sites in prescribed proforma with a view to prevent recurrence.

The investigation to fulfill the above aim shall be carried out by

a) Immediate engineer/ supervisor.
b) Project Manager/ Site safety committee.
c) Safety Engineer/ Officer.

Photograph/ Rough Sketches of the location shall be made and information of the following shall be collected immediately.

- position of equipment or personnel
- statement of witness
- effectiveness of evacuation/ emergency procedure
- potential severity
- Whether the act of negligence or omission causing the accident was recognized and was tolerated or was not recognized at all until the time of accident
- Conditions for supervision/ Inspection
- Engineering design defects- if any
- Job responsibility
- Adherence to safety procedure

Once deficiencies are identified the analysis process will look into why they were not detected and corrected before the accident occurred, why the system failure was.

Implementation of control measures to prevent recurrence (Clause 4.4 OHSAS/BSI)

- Specific and actionable recommendations shall be identified.
- Directives for implementation shall be issued forthwith
- Time bound compliance programme

- Follow up action of recommendation, which cannot be implemented straight away.
- Case discussed/ presented during safety committee meetings and training at sites.

As per IS 3786 **(CLAUSE 4.3.1 OHSAS/BSI)**

$$\text{Frequency Rate (FR)} = \frac{\text{Number of Lost Time Injuries (LTI) X 10 to the power 6}}{\text{Man Hours worked}}$$

$$\text{Severity Rate (SR)} = \frac{\text{Man days lost X 10 to the power 6}}{\text{Man hours worked}}$$

$$\text{Incidence Rate (IR)} = \frac{\text{Number of Lost Time Injuries X 1000}}{\text{Number of Employees}}$$

$$\text{Incidence Rate (Fatal)} = \frac{\text{Number of Fatal Injuries X 1000}}{\text{Number of Employees}}$$

The delegation of responsibilities is as follows. **(Clause 4.4.1 OHSAS/BSI)**

Deputy MD/ Project Director/ CMS

- Shall review the implementation of spelt out requirements of safety, health and environment at the site in consultation with the project managers at a regular interval not exceeding two months.

- Shall issue specific directives to the site concerning safety, health and environment governing employees.
- Will periodically evaluate the safety performance of the site.

Project Manager/ Site In charges

- Project managers and site in charges that directs and controls the personnel at site are also responsible for the safety and health of personnel under their supervision, direction or control. This responsibility also includes the safe operation and safety of equipments/ machinery at the site.

They will-

a) Familiarize themselves with the basic philosophy of accident prevention and control by acquiring education and training on safety.
b) Enforce, lead, direct and follow up administration/ execution of safety, health and environment process.
c) Set examples by wearing PPE.
d) Ensure regular inspections and surveys.
e) Give weight age to safety performance while appraising performance of employees.
f) Integrate safety and health in all decisions related to purchase of plant/ machinery, materials and PPE.
g) Plan and maintain desired standards of housekeeping.
h) Ensure efficient functioning of safety officer and follow up decisions made to improve existing standards.
i) Ensure implementation of recommendations of the statutory authorities and others.

Concerned Engineer/ supervisor

Concerned engineer on a particular work location will be responsible for safety and health of all employees under their direct and indirect control. His functions will mainly comprise of-

a) To identify all the hazards and ensure control measures on the work spot on day to day basis.
b) Removal of any unsafe condition prevalent or arisen during the previous shift or working activity.
c) Closely monitor the activities of all workmen/ PRW to weed out any unsafe practices adopted by them. He will also be responsible to ensure that all tools/ equipments and other means of working are safe to operate.
d) Usage of helmets/ shoes and other items of personnel protection by one and all, under his span of control.
e) Investigate and report all incidents/ accidents/ near misses on the prescribed pro forma to the site safety officer/ in charge immediately.
f) Take all necessary steps to prevent recurrence of any accident.
g) Will encourage participation of workmen in safety suggestion/ training etc.
h) Will issue instructions to new employees on safety or approach the site safety engineer to ensure the same.
i) Ensure proper investigation of accidents, analyze causes of serious accidents and ensure implementation/ follow up of control measures.

Workmen:-

a) Will comply with necessary rules/regulations, do's and don'ts and other instructions issued by the line supervisor/ engineer from time to time.
b) Report all unsafe conditions/ equipments prevalent in their respective work area to the immediate supervisor.
c) Undergo medical examination and tests as may be prescribed.

d) Report all accidents/ near misses immediately.
e) Maintain work area neat and clean, tidy and orderly.
f) Not remove or make ineffective any protection device or guard provided for their own protection.
g) Co-operate with the site safety committee representative/ officials.
h) Will not willfully endanger their and fellow workmen lives.

Safety Engineer/ Officer

The safety engineer will be responsible for the administration of the company's safety program under directives of the project manager/ site in charge and is authorized to interact with the head office Safety In charge for any matters requiring his attention. A comprehensive note specifying various responsibilities has already been issued for compliance.

His function will include:

a) Assist site engineers/ supervisors/ workmen in implementation of the requirements outlined in the safety manual and periodically review the progress of implementation by visiting the sites on regular basis.
b) Conduct tool box meetings and safety trainings for personnel at site and organize trainings for engineers/ supervisor.
c) Provide up-to-date information of safety requirements commensurate with different types of work at various locations of work.
d) Assist site in charge/engineers in investigation of serious accidents in order to determine contributing causes with a view to prevent their recurrence.
e) Advice the purchase department at site in procurement and usage of PPE.
f) Organize safety trainings for new employees.
g) Compile safety records/ statistics at site and submit bi-monthly report to HO Safety.
h) Organize safety promotional activities like display of safety posters, slogans and other educative materials, competitions and awards, as well as safety day celebrations etc.

i) Interact with clients/ outside agencies/ companies to update information/ documentation of
safety

OPERATIONAL CONTROL PROCEDURES (CLAUSE 4.4.6 OHSAS/ BSI)

CHECK POINTS FOR MAINLINE WELDING

1) Pipe number, heat number, coating number & wall thickness is transferred on top of the pipe coating for proper identification before lining up & alignment of pipes.

2) Visual inspection of pipes, both internally & externally, for maximum permissible depth of dents 2% of pipe OD. If dented area is minor and at least 200 mm away from the pipe end and steel is not stretched, severed or split, the pipe may be straightened with a proper jack.

3) Pipe is properly swabbed to remove any dirt, grease for any other foreign matters.

4) Pipes with damages beyond repair and corroded pipes are removed and replaced by new pipes in the string.

5) Bevel ends from inside & outside for any defects and their proper repairs as specified.

6) Proper slings with rubber padding only are used for lifting of pipe and the pipe is not subjected to over stressing.

7) Strip of soft material is placed in between the wooden skid and the pipe bottom to protect the pipe coating. Minimum two numbers of supports are provided under a pipe during the progress of welding. The maximum distance between an incomplete weld and support is 9% of normal support spacing. Supports under a string are not removed prior to lowering in.

8) Only internal line-up clamp is used for mainline production welding. The maximum offset allowed is 1.6 mm. No backing rings are used for alignment.

9) In case of pipes with longitudinal weld seam, alignment is done in such a way that the seam falls in the upper quadrants of the pipe circumference with offset of at least 20° or 150 mm from each other except for vertical bends.

10) Only specified electrodes as per QWPS are used for different runs in welding operation.

11) Verification of batch certificates by the manufacturer for electrodes.

12) Electrodes are kept in a closed dust proof container at site.

13) The internal line-up clamp is removed only after completion of root pass. The external line-up clamp is removed after completion of at least 50% of root pass.

14) In extreme weather condition of high humidity and low atmospheric temperature for preheating and in case of high velocity winds, proper type of windshields is provided. No welding is carried in dusty winds.

15) No welder is allowed without possessing a valid identity card issue to him after welder qualification test and carried only that portion of job for which he is certified.

16) Marking of identification number of each weld & each welder performing welding without fail. Permanent markers/paint is used for these markings near the weld joints.

17) Partially used electrodes are discarded. Electrode butts should be collected from the welding site and disposed safely.

18) Visual inspections of all production weld & identify joints for radiographic inspection based on visual inspection of joints, which are worst.

19) The defects observed during visual & radiographic inspections are rectified and a proper record is maintained for the same.

20) Tight fit nightcaps are fixed at open ends of the string after completion of day's work.

CHECK POINTS FOR FIELD JOINT COATING

1) Field joints, which are accepted after welding inspection, are only taken up for filed joint coating.
2) The sand blasting is carried out only when relative humidity (RH) is less than 85% and pipe surface temperature is at least 3°C above dew point.

3) The joint, to be coated is sand blasted to shining surface of the pipe metal & inspected for 50-70 micron of surface profile with surface comparator & profile gauge respectively.

4) Only after acceptance of the pipe surface, joint coating operation is taken up.

5) Before application of primer, the pipe surface is preheated to at least 60 ± 10° C. The primer is mixed in appropriate ratio as per manufactures recommendations & applied with applicator pads.

6) When the primer is still wet, heat shrink sleeve is wrapped around the joint in such a way that the longitudinal sleeve joint is positioned at 2 O'clock or 10 O'clock with an overlapping of at least 100 mm. The overlapping of the sleeve on existing coating at both ends should not be less than 100mm. This and subsequent joint coating operations is carried out by two qualified applicators, one on each side of the pipe.

7) In dusty environment, suitable wind shields/protective enclosures are provided during priming/application of sleeve for joint coating & mastic for repair of Joint coating.

8) The temperature is maintained above 125°C during shrinking of sleeve with heating torches.

9) Curved hand Silicon rollers are used from centre to edge of sleeve to remove entrapped air & wrinkles in the joint coating.

10) The extrusion on either ends of the sleeve is uniform.

11) The finished coating thickness is at least 2.0 mm except at the apex of the weld seam where it should be at least 1.7 mm.

12) The visual & holiday testing is performed only after coating has solidified.

13) While in use primer container, mastic container, polyurethane container, sleeves, etc. are kept in dust free environment.

14) Used mixing sticks, cups and other waste materials should not be leftover at site and should be disposed safely elsewhere.

CHECK POINTS FOR COLD FIELD BENDING

1. Before bending of pipe check for the measurements, bending angle, location of bend & orientation of longitudinal weld, condition of bending machine, bending mandrel, pipe coating & thickness of pipe.

2. During bending, check for the marking of start point of bend, step lengths, Number of presses, degree of bend per pull and rotation of pipe (no rotation should take place).

3. All the bend pipes shall be serially numbered in line with pipeline alignment so as to avoid mismatching at the time of welding.

4. After bending operation is complete, check for the wrinkles or buckles, damage to the coating, tangent lengths, longitudinal weld position and thickness of pipe. Check is to be made for wrinkles in the pipe, if found, then the bent pipe is to be rejected and removed from the site.
5. Check for ovality of pipe by passing a calliper disc. The passage should be smooth & free of obstructions. The ovality of bent pipe should not exceed 2.5% of nominal diameter at any point.
6. The maximum deflection and radius of curvature should not exceed the prescribed limits at any point in order to ensure the smooth passage of long pig for Instrumented Pig Survey.

7. Ensure that the ends of each bent pipe length are straight and in no case the end of bend is closer then 2.0 m from the end of pipe or girth weld.

8. The bends, which do not meet the specification, is to be rejected, cut out (if welded) and removed from the site.

9. All the bent pipes should be properly placed on sand bags with proper identification mark.

CHECK POINTS FOR TAKING OVER COATED PIPES, PIPE HANDLING HAULING AND STRINGING

1. Contractor shall fulfil all municipal & other statutory provisions, rules, regulations & applicable orders during hauling, handling & transportation of line pipes.

2. All safety rules & regulations are to be strictly complied with.

3. Pipes are to be properly lashed & secured on the trailer during transportation.

4. The flat straps used for lashing should have proper rubber padding.

5. Suitable equipment and proper staff is to be deployed for handling, hauling, transportation, stacking & stringing work.

6. Before lifting operations, it is to be ensured that pipe surface is free from foreign materials having sharp edges.

7. No rolling, skidding or dragging of pipes is done at any point of time.

8. Pipes are stacked completely clear from the ground.

9. During stringing, pipes are kept at an appropriate height from the ground & properly supported using sand/saw dust (wooden) bags.

10. Minimum of three supports are provided for each pipe length.

11. Separators, used for separating pipe sections in pipe stacks are made of approved materials & specifications.

12. No pipe is lifted without having bevel end protectors.

13. Trailers used for transportation shall have adequate pipe supports having lining of approved rubber material & spaced in a manner so as to support equal load of the pipes. All layers are separated from each other with adequate nos. of separators made of approved material.

14. Top of the stanchions & other positions such as reinforcement of the trailer body, rivets etc. are properly covered with rubber materials to prevent damage to the coating.

15. During stringing operation pipes are not dropped and do not rest on protruding rocks or sharp objects or jagged surfaces.

16. During stringing at cart track/road crossings, pipes are strung in such a manner that the normal traffic is not inconvenienced & also coating of the pipes are not damaged due to movement of vehicular traffic.

17. At crossing appropriate wall thickness & length of pipes are strung as per AFC drawings.

18. Bevel end protector is to be removed only when welding starts.

19. Damaged pipes are not strung and segregated with proper accounting.

CHECK POINTS FOR RADIOGRAPHY

1. The qualified radiographer possess minimum level-II certificate from reputed institute like WRI, Trichy and has minimum of 6 years of relevant experience in the field and a qualification certificate issued by the M/L contractor duly approved by IOCL.

2. Before radiographic inspection procedure qualification, the details of all radiation sources including necessary permission / license obtained from Atomic Energy Commission/BARC, are carefully verified.

3. Procedures for radiographic inspections are approved for commencement of field inspection of welding joints.

4. The percentage of radiographic Inspection of welding joints is in line with the contract requirements.

5. In case radiation source and the film are on outside of the weld and located diametrically opposite, the maximum acceptable length of film for each exposure is not to exceed the value as given in table-5 of API 1104.

6. Each segment of radiographic film of complete weld joint contains film length, date of radiography, and weld number, welder's identification number, length of each segment of film in cm/inch and other field requirements, if any.

7. Each day's production of process radiographs are properly packed separately & identified with the following minimum information:

   a) Date.

   b) Radiographic Unit identification number.

   c) Job location.

   d) Starting & ending progress of survey station

e) Weld number.

f) Original three copies of daily radiographic inspection report

8. All numbers and letters on the radiographic film shall have specified size as per ASTM Std. SE-747

9. Radiographic inspection is allowed using X-Ray radiation only, however, use of Gamma-Rays may be allowed, if it is demonstrated that equivalent quality results are obtained and Iridium 192 is used as Gamma-Ray source.

10. All films are clearly marked for identification with lead numbers, letters, and/or markers & the image of markers should appear on the film without interfering with the interpretation.

11. All exposed & unexposed films are protected from heat, light, dust & moisture and sufficient shielding should be provided to prevent exposure of film to damaging radiation prior to and following the use of the film for radiographic exposure.

12. In case of unsatisfactory quality of radiograph, it is re-radio graphed for proper interpretation.
13. All repaired weld joints are re-radiographed and repaired weld area is identified with the original identification number plus the letter "R" to indicate the repair.

14. The radiographs are suitably processed for their storage without any discoloration for at least three year's & should be kept in suitable folders for preservation with necessary documentation.
15. Film viewer is equipped with illuminator having sufficient light intensity & suitably controlled to allow viewing of film densities up to 4.0 without damaging the film.

16. All safety precautions to protect the personnel from exposure to radiations are complied with all the rules and regulations set forth by Atomic Energy Commission or any other Govt. Agencies in this regard.

17. Monitoring of exposure to radiation is continuously carried out and dosage does not exceed 0.1 Roentgen per week. Dosimeter should be present at site.

18. Densitometer shall be calibrated for every 90 days in use and all calibration certificates shall be documented.

19. All adequate safety equipments are available with personnel engaged in radiographic inspection.
20. Persons below 18 years shall not be deployed for radiography.

21. All necessary safety provisions are brought to the notice of each and every person engaged in radiographic inspection and also displayed at prominent place at work site.

22. First-Aid facilities are available at each work site where radiographic inspection and related activities are carried out. Names and telephone numbers of agencies providing these services are brought to the knowledge of all concerned personnel and should be displayed prominently at work site.

CHECK POINTS FOR CLEARING AND GRADING OF ROW

1) Clearing & grading to be carried out within the specified width of ROW & as per contract document specifications.

2) All shrines, monuments, border stones, ROW Markers, TP & IP Markers shall be kept intact.

3) Any fencing across the ROW should be removed under intimation/consultation with the landowner & temporary gates of sufficient width shall be installed to allow passage of construction equipment & material.

4) All grubbed stumps, timber, bush, undergrowth & roots etc. cut or removed shall be disposed off properly & should not interfere with the ROW grading & pipeline laying operations.

5) Whenever stumps are grubbed, the cavity should be back filled & compacted to prevent water logging.
6) While passing through forests, cultivated fields, orchards, gardens, lawns, ponds, ditches, roads, rail track etc. care should be taken to minimize the damage. However, the stipulation of the concerned authority (ies) is/are to be adhered to.

7) Public travel shall not be obstructed at any point of time and it is to be ensured that proper detours, lanterns, traffic lights, barricades, signs are maintained wherever necessary.

8) Care should be taken to ensure that no damage to property outside of ROW is done. Contractor to restore all such damages to original condition immediately at his cost.

9) Top agriculture soil should be carefully stripped & stored on one side for reusing it at the top of back filled at the time of restoration.

CHECK POINTS FOR TRENCHING

1. Only approved procedures and methodology is adopted for trenching.

2. Topsoil up to a depth of 30 cm in cultivable areas is carefully removed & stacked separately for restoring the same at the top of the trench at the time of backfilling.

3. Minimum inconvenience is caused to the general public/traffic due to trenching. As per necessity suitable crossovers and or graded diversions are to be provided.

4. Suitable crossovers at reasonable gaps in cultivated land are provided for movement of farmers /machinery /cattle, etc.

5. Wherever field water channels are disrupted, arrangements for temporary water passage with Hume pipes are provided.

6. Soil recovered from trenching is not mixed with debris or foreign materials.

7. Sheet piling, Jacking etc. is carried out in deep trench for protection against its collapse/caving.

8. Trenching is done to the required extra depth to fit the minimum radius of bend at crossing of roads/rails/rivers/ watercourses/other pipelines/sewers/drain pipes/telephone conduits/other underground structures.

9. Suitable trenching machines with drags are used so that digging of as square a bottom of the trench as possible is achieved and minimum hand grading of trench bottom is required.

10. In rocky terrain, the sharp edges of rock at the bottom of the trench are suitably rounded off before sand padding. The sand, which is used for padding is free-from stones, gravels and foreign materials. The thickness of padding is as specified in the contract.

11. Excavated material is cleared and required measurement/levels are recorded before starting of rock trenching.

12. During blasting for rock trenching every possible precaution are taken to prevent injuries & damage to persons and properties. No blasting is allowed without necessary permits for transportation, storage & use of explosives, compliance of all laws, rules & regulations and information to district administration.

13. No blasting is allowed within six meters of any existing pipeline or structure. The ground vibration due to blasting are continuously monitored & at no point of time "peak particle velocities" to exceed 50 mm/sec.

14. Where pipeline crosses any underground utilities/structures, manual excavation is carried out. If any damage to any utility/structure occurs, the concern authority is immediately informed and repair is carried out forthwith as per the advice of that authority.

15. The open trench is inspected to check for the danger of up floating of pipeline. If it is there, suitable measures to prevent up floating should be taken.

CHECK POINTS FOR BLASTING OPERATIONS

1. Before starting the blasting operations:

   a) Availability of Explosive License and its validity and conditions laid down therein. A copy of explosive license shall be available at site with the Supervisor-in-Charge for blasting.

   b) Availability of permission granted by the respective District Authority and in validity & the conditions laid down therein. A copy of permission should be available with the Supervisor-in-Charge of the blasting.

   c) A copy of written intimation to the District Authority & the Fire Stations and landowners, adjacent land owners, property occupants & other interested parties, in whose jurisdiction work is being carried out.

2. Blasting operations are carried out strictly in accordance with the approved detailed procedure and conditions laid down in explosive license, permission granted by District Authorities and all other rules, regulations and statutory obligations in force

3. Muffling arrangement is provided using muffling plates and sand bags to prevent risk to passers by and nearby structures, telephone & power lines and all other public property.

4. The area, where the blasting operation is to be carried out is barricaded and demarcated using red flags.
5. No unauthorized person is allowed to enter the blasting area.

6. Before firing, warning signal/siren is blown & it is ensured that all persons/workmen leave the blasting area and proceed to the shelter. After blasting operation, until all clear siren / signal is given, no person is allowed to enter the blasting areas.

7. It is ensured that magazine and makeup house are located at a isolated place and protected against any ignition source and its round the clock vigil is ensured. Lamb in explosion proof enclosure is used for illumination purpose.

8. The blasting is suspended and area cleared off men & material during thunderstorms.

9. In case of misfire, the shot firer goes to the blasting site after 5 minutes of firing to inspect the nature of misfire and also ensures that no person enters the area until the misfire has been tackled effectively.
10. The blasting operation is carried out during daytime only.

11. Ground vibration during blasting in common ROW and in the vicinity of any existing structures is continuously monitored and the PPV shall not exceed 50 mm/sec. In case PPV exceeds the said limit subsequent blasting is carried out only after corrective action for limiting the vibration level has been taken.

12. Only closed containers are used for carrying explosive from storage to the site and for carrying back the leftover explosive after a day's work. Separate containers are used for carrying explosives, detonators & primers. Explosive are kept at least 50 m away from the blasting site until the site is ready for charging.

13. Explosive & detonators are thoroughly examined for any signs of deterioration in quality before priming and charging. Also lead wire is checked for damage during placing of stemming material in the shot hole.

14. Exploders are tested & maintained to ensure proper firing and they shall not be used above rated capacity. Before firing, the electric connections are checked for continuity to prevent misfiring.
15. The cable are laid out on the ground and not coiled during the firming of shots.

16. The entry of workmen for further activities in danger zone after blasting is allowed only after the dust has settled and smoke has cleared.

CHECK POINTS FOR HDPE DUCT LAYING

1. HDPE pipe should be checked for physical damage and for its dimensions like internal diameter & wall thickness when it is received at site.

2. HDPE pipe to be stored at a safe place where it has less chance of being hit by sharp or heavy objects.
3. While lying, it should be ensured that the HDPE section does not contain any deformity.

4. All works of the PE laying are to be performed in accordance with the approved procedure, drawings specification and stipulations of the contract documents.

CHECK POINTS FOR LOWERING

7.1.0 Ensure that the trench is clear from any stones, debris, loose rock, welding rods, coating waste etc.

7.2.0 Check for proper padding as specified in the contract has been done in the trench before lowering.

7.3.0 Ensure that lowering shall follow immediately after the completion and acceptance of joint coating for a completed section.

7.4.0 Ensure that before lowering-in, holiday detection is carried out through full circle holiday detectors.

7.5.0 Any holiday and/or coating defect detected in the pipe section prior to lowering is repaired by patch repair system or wrap around heat shrink sleeves as per approved procedure.

7.6.0 Ensure that no sling shall be put around field joint coating and coating repaired portion of pipe section.

7.7.0 Ensure that the trench is free from water.

7.8.0 Ensure that rock shield (wherever provided) is wrapped around pipe section being lowered in rocky areas after holiday inspection and such sections are placed over loosely filled sand bags, which are placed at the trench bottom

7.9.0 Lowering operation is avoided during night period.

CHECK POINTS FOR BACKFILLING

1. Acceptance record of the section being backfilled is available at site.

2. Before backfilling the trench is free from debris, construction waste, any foreign matters etc.
3. Before backfilling it is ensured that the pipe and the appurtenances have proper fit and follow the ditch profile.

4. It is ensured that backfilling is immediately carried out upon inspection & acceptance of lowered pipe section. Under no circumstances, the lowered section is left uncovered and at least 200 mm cover is provided immediately.

5. In rocky areas, it is to be ensured that sand padding around and above the pipe surface is at least 150 mm are as provided in the contract before earth filling is allowed.

6. The backfill earth shall not contain any rock, gravels, stones, any piercing matter, lumps, etc.

7. The earth fill is done in such a way that soil is backfilled in gentle manner.

8. In cultivable areas, the back filled soil is compacted in every step of 300 mm by moistening followed by ramming.

9. 300 mm top excavated soil, stacked separately is back filled in the last at the trench top.

10. Backfills for trenches excavated in road crossings are thoroughly compacted after moistening in layers before restoration of its top to its original condition.

11. Road Dykes are graded & back filled to their original profile & condition.

12. Restoration of the banks is done keeping in mind its erosion factor as well as per the requirement of the respect authorities.

13. Back filling crew is within 500 m from lowered-in-pipe section.

14. In steep areas, flow breakers are provided as per requirement.

15. Backfill stabilization is ensured where sand dunes are encountered.

16. After backfilling, temporary markers on the centre of the pipeline are provided to facilitate succeeding mainline construction activities.

17. Requisite entry into pipe book is ensured after completion & acceptance of backfilling.

CHECK POINTS FOR CONCRETE COATING

7.1.0 Before commencement of concrete coating, a trial coating and field as well as laboratory tests is carried out for procedure qualification. Only approved procedure shall be followed for production concrete coating.

7.2.0 Hardened or partially set cement is not used & test certificate from cement manufacturers for each lot is verified before its use.

7.3.0 For concrete coating of pipes to be used in marshy areas and areas where water is saline, sulphate resistant cement is used.

7.4.0 Fine aggregate of 10 mm nominal size graded from course aggregate is used unless otherwise specified.

7.5.0 Sand to be used is clean & free-from salt, alkali, deleterious substances or organic impurities. It is tested for organic impurities before use.

7.6.0 If required, iron or barium ore aggregate are used in place of sand for producing a denser concrete weight coating.

7.7.0 Water to be used, is tested and reports verified. Water is limpid, fresh & clean and does not contain chlorides, sulphates & magnesium salts.

7.8.0 When concrete coating is applied by casting method wire fabric (sheets) are used and in case of application of coating by impingement method ribbon mash (rolls) are used.

7.9.0 Unit weight of concrete is minimum 2400 kg/m^3 & concrete mix is 1: 1½: 3 (1 cement: 1½ course sand: 3 graded stone aggregate). The comprehensive strength of cubes is not less than 210 kg/cm^2 in 28 days & 140 kg/cm^2 in 7 days.

7.10.0 The gap between continuous concrete weighting at the welding joints is suitably filled as per approved method.

7.11.0 A special log book for recording of following data is maintained:

a) Field identification number, mill serial number, length, weight & nominal average outside diameter of each line pipe. Concrete coating on any line pipe is not allowed until and unless this information has been recorded in the logbook.

b) Date of placing of concrete coating, average concrete coating thickness, "wet weight" of concrete coated pipe & date of weighing and "dry weight" of concrete coated pipe, 28 days after placement of coating & date of weighing in respect of each concrete coated pipe.

c) "Unit dry weight", "negative buoyancy" and "unit saturated weight" of each concrete coated pipe.

7.12.0 It is ensured that weight-batcher and water meter is calibrated. The calibration is checked at frequent intervals.

7.13.0 Prior to placing of reinforcement, the protective coating of each pipe is carefully inspected and any damage is repaired before placing the concrete. All foreign matters are removed from the surface of protective coating before placing the concrete.

7.14.0 Pipe supports at the ends are adequately braced with interior struts or rings to prevent undue flexure or ovality during coating and handling.

7.15.0 The reinforcement for concrete coating is terminating at a distance of 37.5 to 40 cm from the end of the pipe.

7.16.0 In case of casting method, the reinforcement rests on synthetic resin spacers forming a "crown" whose number are such as to avoid any contact with the pipe's protective coating. Spacing between to consecutive crowns are minimum 500 to 1000 mm or as specified.

7.17.0 In case of impingement method, placement of reinforcement can start after first layer of concrete has been applied on pipe. It is ensured that steel reinforcement is not in contact with protective coating of pipe.

7.18.0 Concrete mix is placed on pipe within 45 minutes after adding water to mix. Containers used for placing of concrete are continuously cleaned and are free-from hardened or partially hardened concrete.

7.19.0 In case of casting method, concrete is not be poured from a height more than one metre. During pouring, vibrator is run continuously. In case of impingement method, concrete is placed up to specified thickness in one continuous course and is injected at high velocity against the surface of coated pipe.

7.20.0 Casting is not interrupted or passes stopped for more than 45 minutes. If interruption is for more than 45 minutes, before placing fresh concrete, the contact surfaces is carefully cleaned at wetted to ensured good bond between the fresh material and previously placed material.

7.21.0 At the time of casting or placing of concrete, it is ensured that the temperature of coating does not exceed 32° C.

7.22.0 The coating at each end of the pipe is bevelled to a slope of 2: 1 and it is terminated at about 100 mm short of the end of corrosion coating on the pipe surface.

7.23.0 The exposed surface of concrete is protected from direct sunshine, drying winds, rain, etc. The curing compound is applied immediately after completion of coating. The membrane curing is not less than 4 days during which period the coated pipe is not disturbed and exposed coating surface is kept wet for seven (7) days.

7.24.0 The stacking and shipment of coated pipe is allowed only after seven days provided the concrete coating surface suffers no damage.

7.25.0 Each concrete coated pipe is weighed as soon as it is feasible to move it for taking wet weight and after 28 days of placement of concrete for dry weight. These values should be marked with paint inside the pipe.

7.26.0 Calibration of weighing devices is checked at regular intervals.

7.27.0 After curing, every concrete coated pipe is non-destructively tested by such means as "ringing" to determine any defects present.

7.28.0 Each concrete coated pipe is visually inspected and also checked for insulation between steel reinforcement and the pipe using a Megger.

7.29.0 Each concrete coated pipe is clearly marked with red or white paint inside the pipe close to bevel end is such a way that the area involved by welding operation is not affected by paint. At one of the ends, the field identification number and the date of concrete placing is marked while at the other end dry as well as wet weight along with the number of days after which the weight was taken, is marked.

CHECK POINTS FOR PIPELINE CROSSINGS

1. Necessary permission for laying pipeline is available from the concerned authority having jurisdiction over it.
2. AFC drawings & conditions laid down by concerned authority are adhered.
3. The carrier pipe section for crossings is hydrostatically pre-tested as specified prior to installation.
4. Suitable barricades, temporary bridges/bye-pass roads with railing, adequate traffic warning signals and/or traffic lights are provided.
5. Ground water table over the length of the crossing is lowered up to at least 0.5 m below the bottom of pipeline & inspected regularly. For stability of bore pit, sheet piling extended over 50% of length of undisturbed soil is provided, if required.
6. The length of boring is in accordance with the width of crossing on either side with minimum 0.6 metre extra.
7. If the boring pit is less than 7 metres deep, use of trench boxes or shoring as well as sheet piling is used as per requirements.
8. For cased crossings and major watercourse crossings, only 3 LPE coated carrier pipes are used.

9. The welding of carrier, casing & vent pipes is carried out in accordance with the approved welding procedure. All weld joints of carrier pipe are 100% radio graphically inspected.

10. Before welding, each length of pipeline is inspected in order to check that there is no out of roundness and dents.

11. Vent pipes are provided on both ends of the casing as per AFC drawing & exhibits.

12. In approaches to roads & railway crossings, unnecessary bending of pipe to confirm to the contour of the trench bottom are eliminated by gradually deepening the ditch. The bottom of the trench and/or the pit is graded for at least 12 metres at the approach to each end of the cased crossing.

13. The backfilling in the boring and exit pits are compacted in 15 cm layers to 90% modified Procter density using mechanical compactors.

14. If the excavated soil is not suitable for compaction, it is replaced or mixed, as appropriate, with imported backfill. Pits are de-watered before backfilling & compaction.

15. The hole for a bored section has a diameter as close as practicable to the outside diameter of the casing pipe.

16. The annular space between the casing pipe and the carrier pipe are packed tightly with jute & bitumen at both ends of the crossing and then end seals are placed.

17. Prior to making tie-in welds and backfilling, electrical resistance between carrier & casing pipe are checked and shorting noticed if any is removed.

18. At cased crossing locations, the earth, up to a distance of minimum 3 m from the end of casing on both sides are properly compacted to ensure that the carrier pipe rests firmly on compacted earthen base.

19. Uncased road/cart track crossing is provided with heavy wall thickness pipe except for crossings where nominal wall thickness pipe is to be provided as per AFC drawings.

20. For minor watercourse crossings, carrier pipe having normal wall thickness is used or as specified.

21. For minor watercourse crossings, the minimum depth of cover over the pipeline is 1.5 metres for the crossings of length less than 100 metres and 2.5 metres for crossings having length more than 100 metres or it is as per AFC drawings.

22. The depth of existing bottom of minor watercourse crossing is determined in relation to the adjacent ground level by taking the average of minimum four measurements.

23. For major watercourse crossings, the minimum depth of cover is 2.5 metres or as specified in the individual AFC drawing. In case rock is encountered in the riverbed, minimum cover of 2.0 metres is provided.

24. For major watercourse crossings, the trench bottom is graded in such a manner so as to give uniform support to the pipeline, when it is lowered or pulled into place. The maximum unsupported span is not exceeding 10 m.

25. In submerged sections, where rock or gravel is encountered, concrete enveloping as specified is provided.

26. The concrete coating/sheathing on the welded joints are provided after pre- hydro testing for continuity with concrete coated pipe.

27. Pipeline sections (carrier pipeline) of all cased crossings, major watercourse crossings and minor watercourse crossings are pre-tested before installation. The anti corrosion joint coating of the welds should be done after pre-test only.

28. Whenever boulders, rock, gravel or other hard objects are encountered, sufficient earth, sand or selected and approved backfill materials are provided around the pipe to provide a protective padding or cushion to a minimum thickness of 50 before backfilling the trench with excavated soil. The backfilling of the trench is continuously checked.

29. All embankments and/or dykes are reinstated to their original condition. Bank protection is provided in accordance with the specified procedure.

30. After laying operations, a gauging pig is run through the pipe. The complete section of major watercourse crossing is hydrostatically tested by holding the test pressure for 24 hours immediately after backfilling of the trench.

31. After completion of land sections, all crossing sections already pre-tested and the major watercourse crossing already undergone hydrostatic test, together with the final land section are retested in order to arrive at a complete tested total pipeline.

32. After laying of the crossing, a post-construction survey of the crossing is conducted and any defects noticed are promptly corrected.

CHECK POINTS FOR TIE-IN OPERATIONS

Ensure that all welders, grinders, helpers are using helmet, spec., shoes etc.
Ensure for shore shuttering, angle of repose for trench pit if it is deep.

1. Ensure that overlapped pipe is cut for proper alignment and should not fall short necessitating addition of a pup piece.

2. Ensure that bevels of pipe ends are properly made.

3. Ensure that lining up the joint with external clamp is proper and joint gap & offset is within specified limits.

4. The tie-in welding is carried out at atmospheric temperature not exceeding 30°C & preferably in the morning hours.

5. Tie-in joint welding is carried out by qualified tie-in welders, one each on both sides of the pipe joint.
6. External clamp is removed only after at least 50% of root pass has been completed.

7. Pup piece be of single length & in no case less than 2.0 m in length. However two pup pieces of 2 meter shall not be welded adjacent to each other minimum separation of 8 meter shall be kept between two-pup pieces.

8. Joint coating is carried out only after weld joint is cleared in visual & 100% radiographic inspection.
9. Joint coating is carried out by qualified joint coaters only.

10. Backfilling is carried out only after joint coating is inspected, tested for holidays & accepted by IOCL.

11. Sand padding, rock shield, etc. are provided, wherever required before backfilling.

12. Cutout pipe pieces are moved to front/site/stock pile depending upon their length & requirement.

13. Material reconciliation of cutout/pup piece & pipe book entry is done with the closing of tie-in site.

g) Criteria for safety man of the month award (Clause 4.3.4 OHSAS/ BSI)

No.	Point	Marks
1.	Reports all unsafe conditions, hazards, accidents, near miss properly	
2.	Always wear PPE	
3	Comply with site safety rules and instructions	
4	Maintains work area neat and clean	
5	Actively participants in safety training program and safety competitions	

h) Criteria for best Site Engineer, supervision, foreman Award (Clause 4.3.4 OHSAS/ BSI)

No	Points	Marks
1.	He does every day safety inspection and takes action on the identified hazard	
2.	Regularly takes 3 question meeting	
3	Always wears PPE	
4	Investigates all accidents, near misses in his area of work.	
5	Carries job safety analysis of every activity in his area of work.	
6	Maintains good house keeping in his work area.	
7	Ensures that workers in his area of control wear PPE and follow safety rules.	

i) Penalty Systems (Clause 4.3.4 OHSAS/ BSI)

Serial Number	Offence	Type of Hazard
1	Not wearing safety shoes	
2	Not wearing safety helmet	
3	Not wearing safety goggles while grinding, using compressed gas, gas cutting, concreting etc.	
4	Not using insulated tools while carrying out electrical work.	
5	Doing job without authority	
6	Unsafe position/ poster	
7	Smoking in fire prone area	
8	Working below lifted load	

9	Doing horse play, working under the influence of alcohol.	
10	Doing job without giving warning.	
11	Not wearing/ anchoring safety belt	
12	Unauthorized tapping of electrical supply	
13	Using wrong defective tools	
14	Unsafe use of tools	
15	Unsafe loading, placing, mixing etc.	

j) Disciplinary Measures (Clause 4.3.4 OHSAS/ BSI)

Classification of Hazard	Consequences	Action
1	Individual or one fellow worker	First: Verbal warning Second: Written warning Third: Written with loss of One day pay Third: Written with loss of one day pay Forth: Written warning with suspension for one week without pay Fifth: Termination
2	More than one worker or whole work place	First: Written warning with loss of one day pay Second: Written warning with suspension for one week without pay
3	Entire construction operation or general public	First: Written warning with suspension for one week without pay Second: Termination

k) JOB SAFETY ANALYSIS (Clause 4.3.4 OHSAS/ BSI)

It is a proactive method of accident prevention. It provides a mechanism by which a supervisor, a safety professional, a contractor may take a detailed looks at how a job or a task is performed and is inherent hazard. It employs the first hand experience and cooperation of the workers and supervisors in the recognition and control of hazard.

Definition: JSA is a procedure of analyzing a job for the specific purpose of finding the hazard in each step in the development of safety precautions to be adopted to avoid or minimize the causative factors. Other names for JSA include method safety analysis, safe work procedure, job hazard analysis, safe performance guide.

Requirement for JSA:

JSA is a combination of Safety Engineering and Method Study. 'Safety Engineering' is also known as engineering revision. It is a method to finding unsafe situation and various methods to counteract them. 'Method Study' is a systematic study of existing method in order to improve the same. All this requires previous experience of similar situations and predictive analysis of possible hazards in existing methods.

Steps to carry out JSA:

1. Select a job (SELECT)
2. Break the job into components in an orderly and chronological sequence of job steps. (RECORD)
3. Critically observe and examine each component part of the job to know the hazard (EXAMINE)
4. Develop control measures to eliminate/ reduce the risk of accident (DEVELOP)
5. Formulate written standard practice of safe system of work and job safety instructions for the job. (INSTALL)
6. Review the safe system of work and job safe practice at regular intervals to ensure their utilization. (MAINTENANCE)

Select

Job is a sequence of separate steps or activities that together accomplish work-goal

Guidelines for selection of a job-

1. Frequency of accident- A job which has repeatedly produced accident is suitable for JSA.
2. Severity potential- Some job may not have a history of accidents but may have potential for severe injury.
3. New job-Any new job or a job created by the changes in equipments or processes will not have a history of accidents but JSA should not be delayed until accident occurs.

Which type of job should not be selected-?

1. Broadly defined jobs such as building a plant, mining iron ore etc.
2. Narrowly defined jobs such as tightening a screw, pushing a button.

Which type of job should be selected?

Jobs suitable for JSA are those which can be assigned to a supervisor such as operating a machine, concreting etc.

Selecting and prioritizing a job.

1. One method is to call a meeting of the supervisor and workers. Ask them to make a list of jobs they perform. Then ask them to prioritize the jobs based on the three guidelines given above.
2. Second method is based on organizational structure and objectives.

Record-

Break the Job- Before searching for hazard; job should be broken down in a sequence of steps. While doing this common errors should be avoided such as

- Making details break down so that unnecessary large number of steps result.
- Making too general break down so that basic steps are not recorded.

While recording steps-

- Each step should be described completely
- Possible deviations from the regular procedure should be recorded. Probably it may be the irregular step causing accidents.
- The wording of each step should begin with action word like remove, open, weld etc.
- Action should be completed by naming items to which the action applied.

Examine-

Identify Hazard- Begin the search for hazards. Purpose is to identify all the hazards those connected with the job procedure and environment.

The following questions are to be asked.

- Is there a danger of injuries when contact with an object such as striking against, being struck by
- Can the employee be caught in or between the jobs
- Is there a potential for slip, trip?
- Can he strain himself by pushing, lifting, bending, twisting?
- Are their any hazard related to environment such as toxic gas, vapor, mist, fume, dust, heat, and radiation?

To get answer to the above questions:

- Repeat the observation as often as necessary until all hazards are observed.
- Record the type of accident that might result and agent involved
- Consult with observed employee or other experienced person
- Thorough observations and discussions will develop a reliable list of hazards and potential accidents

Develop-

Develop solution- The final step in JSA is to develop a recommended safe procedure to prevent recurrence of accident

The principal solutions are-

1. Find a new way to do the job-To do this determine the work goal of the job and then analyze various ways of reaching the goal to see which way is safest. Consider work saving tools and equipment.
2. Change the physical conditions that create the hazard. If new way cannot be found, then it has to be analyzed what change in physical conditions such as tools, materials, equipments, layout, locations etc will eliminate the hazard. Then it can be implemented.

3. To eliminate the hazard still present, the work procedure has to be changed. If none of the procedure works out the change in job procedure has to be investigated.

Install

Installation of the safe method is an important step. The supervisor has to train his workers in the new method. It must be told to the workers the importance of the new method, how it will avoid the accidents. Training should continue till the workers are fully accustomed to the new method.

Maintenance:

After one process has been installed its maintenance is equally important. People have the habit to go back to the old hazardous process. Regular inspections to see whether people are following the safe process or not is important. Regular review of the process is also important.

Benefits of JSA

- It gives individual trainings in safe and efficient procedure.
- New person can be easily trained in the safe procedure.
- Helps in preparing for planned safety observation.
- Helps in giving pre-job instructions on irregular jobs.
- We can review the job procedure if an accident occurs.
- We can study job procedure for possible improvement in method.
- Makes employee safety conscious.

l) **Guidelines for Safety Slogan Competition (Clause 4.3.4 OHSAS/ BSI)**

1. Safety slogans shall be written in Hindi, English or any other vernacular language.
2. Safety slogan shall be short, related to construction safety, health and hygiene, home safety or traffic safety within the site premises.
3. This competition shall be open for all the workers, staff and their family members.

4. The contestant shall submit as many slogans he can. In that case he shall be given only one prize.
5. A good propaganda of the competition shall be made, and people should be motivated to participate.

m) **Guidelines for Safety Poster Competition (Clause 4.3.4 OHSAS/ BSI)**

1. Posters shall highlight safety in construction work.
2. The situation shown in the poster shall convey clear message of safety.
3. This competition shall be open for all the workers, staff and their family members.
4. The contestant shall submit as many slogans he can. In that case he shall be given only one prize.
5. The sheets required shall be supplied by the site management.

HSE- OBJECTIVES AND TARGETS

(Clause 4.3.3 OHSAS/BSI)

S.NO	OBJECTIVE	TARGET
1.	Commitment to provide safe, healthy work Environment to employees	Accident prevention
2	Maintaining safety, health and environment safeguards at worksites	Environment preservation
3.	Continual improvements in HSE standards with rapid change in technology	Progress with safety

e) PROGRAMME TO IMPLEMENT HSE POLICY AND ACHIEVE OBJECTIVES AND TARGETS (**Clause 4.4 OHSAS/BSI**)

1. Talks are conducted for all critical activities like stringing, mainline welding, lowering, boring and tie-ins
2. Training regarding operations and safety instructions, spill preservation and environment protection, activity hazards etc is given to enhance the awareness of HSE.
3. The job safety analysis or hazard analysis of the work activities is made and given to the execution staff before activity is taken up. The execution staff takes care of routine preventive actions as given in the hazard analysis.

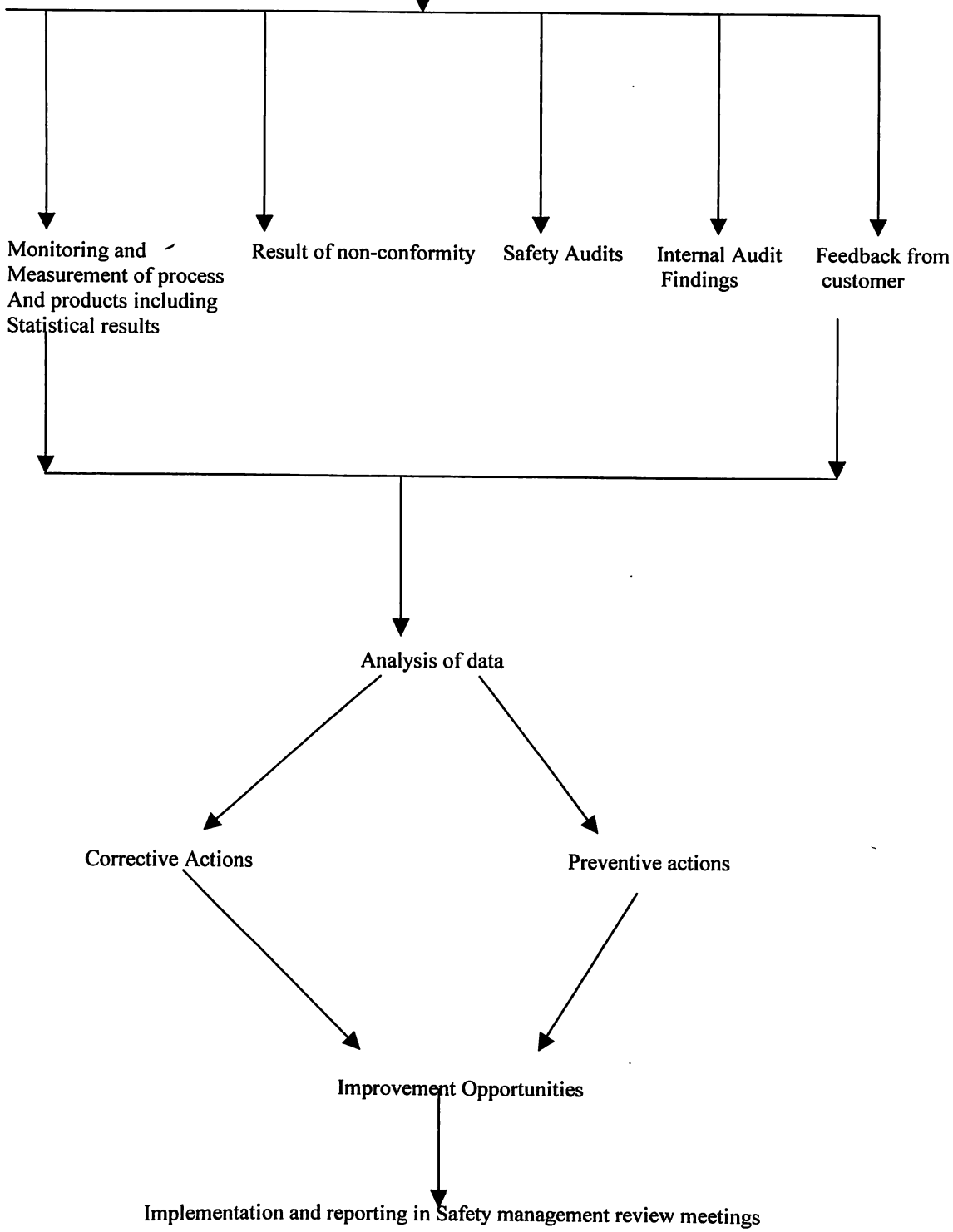
SAFETY AUDITS

Audits are conducted and reports being maintained. Ratings are given for safety performance of the month. From the audit findings, steps to improve the situation can be taken. The findings of the safety audits are reported to the HO Safety in-charge and also to the construction manager and taken up at review meetings.

MONITORING

It is done daily through work place inspections, recording of conformances/ non-conformances and issuing inter office memorandums to rectify the safety related deficiencies. Process parameters of safety are reported monthly basis.

F) **EXECUTION AT KRPL**



CHAPTER 4

PERFORMANCE MEASUREMENT

CLAUSE 4.5.1- PERFORMANCE MEASUREMENT AND MONITORING

Form -1

Table 1.1: IDENTIFICATION OF OHS HAZARDS AND RISKS

Sr. No	Activity	Hazard	Normal/ Abnormal/ Emergency	Direct/ Indirect	Risk		Remarks (Present control & needs)
					Frequency (See Form2, Table 2.1)	Consequence Level (See Form-2, Table 2.1)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Route Survey	Skin Infection Injury	Abnormal	Direct	Very Likely	Harmful	Full body protection to be used
2	ROW Grading Cleaning	Dust	Abnormal	Indirect	Very Likely	Reportable	Use of dust mask
3	Trenching	Dust/ If no barricading then possibility of falling into trench	Emergency	Direct	Likely	Very harmful	Barricading around trench
4	Dust/ If no barricading then possibility of falling into trench	Injury by rock particles	Dust/ If no barricading then possibility of falling into trench	Direct	Likely	Very harmful	No persons to be allowed in immediate vicinity while working

5	Stringing	Breakage of side boom rope. Fall of pipe	Emergency	Direct	Likely	Extremely Harmful	Tension of side boom rope to be checked
6	Grinding	Inhalation of dust may cause silicosis	Emergency	Indirect	Very Likely	Extremely harmful	Compulsory use of dust mask
7	Main Line Welding	Sparks from welding/ UV Rays/ Electric Shocks	Emergency	Direct	Very Likely	Extremely Harmful	Compulsory use of PPE
8	Joint Coating	Chemicals used for coating is highly corrosive. Inhalation or contact can be extremely dangerous	Abnormal	Indirect	Likely	Very harmful	Use of PPE to be ensured
9	Sand Blasting	Injury by sand particles	Abnormal	Direct	Very Likely	Very Harmful	No persons to be allowed in the immediate vicinity

10.	Tie- In joints	Slipping of pipes during tie- ins.	Emergency	Direct	Likely	Very harmful	Proper positioning by side booms
11	Back- Filling	Accident by excavator	Abnormal	Direct	Likely	Extremely harmful	No persons to be present in the swing area of the excavator
12	Hydro testing	High pressure inside the pipe	Emergency	Direct	Unlikely	Extremely harmful	Pressure should always be under check
13	Holiday test	High Voltage electric shock 315-400 V used	Abnormal	Direct	Likely	Extremely harmful	Proper insulation and use of PPE
14	Radiography test	Active radiation hazard	Normal	Indirect	Likely	Extremely harmful	Appropriate PPE to be used.

15	Concrete coating for submerged crossings	High pressure concrete spray	Normal	Direct	Likely	Harmful	Proper spray procedure to be followed

TABLE- 2.1: RISK IDENTIFICATION CRITERIA

Risk Probability of occurrence (Frequency or likelihood) (Time Scale)	Risk Probability of occurrence (Frequency or Likelihood) (Semantic Scale)	Penalty (Weight age)
> Month	Highly Unlikely (HUL)	1
<=Month>Week	Unlikely (UL)	2
<=Week>Day	Likely (L)	3
<=Day	Very Likely (VL)	4

TABLE-2.2: RISK CONSEQUENCE LEVEL DETERMINATION

Sr. No.	Magnitude of Harm in Terms of Mandays Lost	Consequence Level (How Harmful)	Penalty (Weight age)

1	First aid case, No loss of Man days	Slightly Harmful	1
2	Non reportable (Minor) injury- Mandays Lost < 48 hrs	Harmful	2
3	Reportable (Major) injury- Mandays Lost >=48 hrs	Very Harmful	3
4	Fatal/ Permanent disability or number of persons involved	Extremely Harmful	4

TABLE-3.1: RISK SEVEERITY (SV) COMPUTATION

Consequence Level / Risk Likely-Hood	Slightly Harmful	Harmful	Very harmful	Extremely Harmful
Highly Un-Likely	Trivial Task	Tolerable Risk	Moderate Risk	Substantial Risk
Unlikely	Tolerable Risk	Moderate Risk	Substantial Risk	High Risk
Likely	Moderate Risk	Substantial Risk	High Risk	Very High Risk
Very Likely	Substantial Risk	High Risk	Very High Risk	Intolerable Risk

Table – 4.1: EVALUATION OF OHS RISKS Form -2

Risk Identification (Form -1 summary)							Risk Evaluation							
Sr. No.	Activity	Hazard	N/A/E	D/I	Risk Identification		Risk Evaluation							Significance (Yes/No)
					Freq.	Consequence	Concerns			SSD Scores				
							DM	LC	CE	SC	SV	DU	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	Route Survey	Skin Injury	A	D	4	2			●	1	20	2	23	Y
2	ROW Grading	Dust	A	I	4	3			●	2	20	2	24	Y
3	Trenching	Fall	A	D	3	3				2	15	2	19	Y
4	Rock Breaking Blasting	Injury By flying Particles	N	D	3	4			●	1	21	1	23	Y
5	Stringing	Breakage Of Side Boom Rope	E	D	3	4				1	15	2	18	Y
6	Grinding	Dust	N	I	4	4		●	●	1	28	1	30	Y

7	Main Line Welding	Sparks Shock UV Rays	A	D	4	4		●	●	1	32	2	35	Y
8	Joint Coating	Corrosive Chemicals	A	D	4	4			●	1	18	2	21	Y
9	Sand Blasting	Injury By sand Particles	N	D	4	3		●	●		24	1	25	Y
10	Tie-In Joints	Pipe slip	A	D	3	3			●	1	18		19	Y
11	Back fill	Striking By Excavator	A	D	3	4				2	12	2	16	Y
12	Hydro testing	Highly Pressurized Pipe	A	D	2	4		●		2	21	2	25	Y
13	Radiography Test	Radiation Hazard	N	I	4	4	●		●	3	18	2	23	
14	Holiday Test	Electric Shock	A	D	4	4			●	3	32	2	37	
15	Concrete Coating	Spillage of Concrete Mixture	N	D										

Table – 6.1: PRIORITIZATION OF OHS RISKS AND FEASIBILITY ANALYSIS

Sr. No	Activity Product/ Service	Significant Hazard	Associated Risk	Measures Required to				Operational Feasibility	Economic viability	Elimination/ Reduction/ Control	Ref. Document
				Reduce or Eliminate Risk			Measures Required to Control risk				
				Technology	Physical Improvement	Feasibility study	Technique/ Training				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Route Survey	Skin Injury	Severe Infection		☆		Technique			Reduction	
2	ROW Grading	Dust	Lung Infection		☆		Training			Control	
3	Trenching	Fall	Major Injury		☆		Technique			Control	
4	Rock Breaking Blasting	Injury By rock Particles	Eye Injury		☆		Technique			Control	
5	Stringing	Breakage Of Rope	Injury by striking of	☆	☆		Technique Training			Reduction	

			Pipe								
6	Grinding	Wheel Dust	Lung Infection		☆		Technique Training			Control	
7	Main Line Welding	Sparks Shocks UV Rays	Burns Shocks Vision Loss	☆			Techniques Training			Control	
8	Joint Coating	Corrosive Chemicals	Skin Infection	☆			Techniques Training			Control	
9	Sand Blasting	Sand Particles	Eye Injury	☆							
10	Tie-In Joints	Slippage of Joints	Injury by Pipe	☆			Technique Training			Control	
11	Back Filling	Striking by excavator	Injury				Technique Training			Control	
12	Hydro testing	Bursting of Pipe	Immediate injury to surrounding Persons	☆			Technique			Control	
13	Radiography Test	Active radiation hazard	Long term Cancerous effects	☆			Technique Training			Control	
14	Holiday Test	Electric Shocks	Shock Injury		☆		Technique			Control	

15	Concrete Coating	Spillage of Concrete mixture	Physical Injury				Technique			Reduction	

CHAPTER 5

CHECKING AND CORRECTIVE ACTIONS

CLAUSE 4.5 OHSAS/ BSI

IDENTIFICATION OF TOP SCORING FIVE HAZARDOUS ACTIVITIES

As per the careful analysis and quantification of all the hazardous activities at the KRPL site the scores secured by the activities were as follows. It was based on scale, severity and duration (As per OHSAS/ BSI)

1	Route survey	23
2	ROW Grading	24
3	Trenching	19
4	Rock Breaking/ Blasting	23
5	Stringing	18
6	Grinding	30
7	Main line welding	35
8	Joint Coating	21
9	Sand Blasting	25
10	Tie In Joints	19
11	Back Fill	16
12	Hydro-Testing	25
13	Radiography test	23
14	Holiday Test	37

The Top scoring five hazardous activities are as follows-

1. **Holiday test which has a score of 37.**
2. **Main Line welding which has a score of 35.**
3. **Grinding which has a score of 30.**
4. **Hydro testing/ Sand blasting- 25**
5. **ROW grading- 24**

SUGGESTING OPERATIONAL PROCEDURES FOR ELIMINATION/ REDUCTION OF HAZARDS

Hazards are an inherent part of any activity or process. Hazards cannot be eliminated but can only be controlled so that it does not materialize into a risk. Operational procedures can be reviewed and modified but the most important factor which comes into picture whenever any safety study is carried out is the human resource management factor.

A review of the operational procedures could be as follows. We cover the top scoring hazardous activities here.

HOLIDAY TESTING- It is extremely important that the person doing the holiday test knows the correct procedure and the hazards associated with the instrument. Although it is itself a safe procedure, but the insulation of the wire supplying current should be intact. Before every usage the operator can himself check it visually and report if any fault is noticed. The concerned activity head can take necessary actions. Appropriate shoes should always be worn during testing

MAIN LINE WELDING- No welder should be allowed without possessing a valid identity card issued to him after welder qualification test and allowed to carry only that part of job for which he is certified. In extreme weather conditions of high humidity and low atmospheric temperature for preheating and in case of high wind velocity, proper type of wind shields are provided. No welding should be carried out in dusty winds. Partially used electrodes should be discarded. Electrode butts should be collected from the welding site and disposed safely. The defects observed during visual and radiographic inspections are rectified and a proper record is maintained for the same. Tight fit nightcaps are fixed at open ends of the string after completion of the day's work. The most important point to be maintained during welding is using the appropriate personnel protective equipments.

GRINDING- Here the hazard which is associated with the activity is the grinding wheel dust which comes out as a result of contact with the pipe .This dust is responsible for occupational diseases in the long run as well as in short span. The hazard cannot be reduced or eliminated but the only protection which can be taken by the person concerned is the use of dust masks. This will give protection against the dust. But it has been observed that in spite of the use of dust mask certain workers were suffering the ill effects of the dust. On a careful analysis it was found that the masks required certain modifications. An ergonomic study was suggested for this activity.

HYDRO TESTING- This is an extremely critical activity in pipeline construction. Here testing is done by pressurizing the pipe with water at 1.5 times the design pressure usually for a duration of 2-4 hours. Since pipe is pressurized, utmost care should be taken to ensure that no bursting of pipe occurs. Pressure gauges should be properly calibrated and used for this activity. The entire operation should be handled by an experienced hydro test engineer. He should keep an eye for the entire duration of test. In consultation with the safety engineer a meeting should be arranged with the entire hydro- test crew before work begins. Barricading around the region is important for the test duration. Although GIL has always carried out this test successfully in all instances but the hazard associated with this activity is significantly high.

SAND BLASTING- This activity is carried out just before field joint coating to clean the area to be coated. Since a substantially high pressure is utilized to scrub the sand against the joint, it has to be ensured that no person is standing very near to the area to be sand blasted. In case any person is injured during the process it can be extremely harmful. It is useful to barricade the area to be sand blasted and carry out the work. Use of adequate PPE and good knowledge of the process by the operator is useful.

ROW GRADING: Here the procedure involves Generation of a lot of dust during cleaning and grading of the rights of way. The hazards associated with this process cannot be completely reduced because it would not be feasible. But use of proper

Protective equipment by the operators and supervisor can be a useful method to control the hazard.

CHAPTER 6

MANAGEMENT REVIEW

CLAUSE 4.6 OHSAS/ BSI

MANAGEMENT REVIEW (CLAUSE 4.6/ OHSAS BSI)

Suggesting certain management review programme where there could be capital investment for reducing/ eliminating hazards thereby preventing accidents/ incidents.

As it has been seen hazards cannot be eliminated completely but can only be reduced/ controlled. Several measures can be undertaken like operational feasibility review, economic viability analysis etc. But an important factor which has always come into picture while undertaking any safety study and which has not gained much importance in safety engineering is the human attitude factor.

When we talk about this factor it is to be understood how a person undertakes his assigned task. How he approaches a work/ activity. Is he skilled enough to undertake the task? Is he properly utilizing the capital investment done on him in the form of trainings, protective equipments etc by the company.

Accident investigations/ analysis have always given the result that most of the accidents are due to substandard actions. So we require a careful review of the human resource factor. Certain activities where capital investment requires utmost attention is as follows

- Organizing training programmes to make the employees skilled for a particular job.
- Organizing training programmes to make employees understand the hazards associated with a particular activity and how it may materialize into a risk
- Making employees develop a culture of safety.
- Safety budgets specially to be allotted by the company.
- Develop a good incident/ accident reporting programme which has to be regularly reviewed by the company.
- A computer supported safety reporting/ analysis format which can be viewed by all employees of the company.
- A feedback system in the means of forms to be distributed amongst employees where they can provide their viewpoints related to activity hazards which have not been

noticed by senior level managers. In addition means to control those hazards can be obtained from those employees only. This will create motivation amongst employees. They can also be rewarded for providing such ideas.

- Several technological advances have been made in safety for identifying/ controlling hazards. To adopt such technologies requires capital investment. Management can look forward to invest in the same. This may also require specialized trainings to a section of employees which also requires some investment by the company. But in the long run it is helpful in terms of productivity.
- Behavior based safety which is an upcoming field in the safety management is becoming a promising concept for improving the safety culture. This could be given a focus but again the involvement of the top management is utmost necessary.
- Rather than punishing an employee for unsafe acts the focus should be more on understanding what exactly made him do the job unsafely. Immediate action should then be undertaken to remove the gap.
- A few employees can visit a model OHSAS 18001 certified plant to understand how to take necessary measures in their own plant based on their knowledge gathered there. After implementing the necessary steps and obtaining certification we can also welcome visits by other groups to our own plant/ site.

RECOMMENDATIONS FOR CONTINUAL IMPROVEMENT

Safety is basically the responsibility of the top management. The willingness of the top management with regards to adopting safety reflects the corporate safety culture. The flow of this culture should be from the top to the bottom level.

For doing this a corporate safety policy should be framed.

- It should be assessed where the company stands at that point of time in terms of that safety policy.
- A team should be formed which has to be headed by a top level executive for carrying out a gap analysis.
- A strategy has to be formulated how to carry out the gap analysis, delegate roles and responsibilities and fix a time duration to conclude the results.
- A brain-storming session is to be organized to analyze the results.
- View points of all the members including feedback from other employees has to be utilized to come to a conclusion to remove those deficiencies.
- This has to be followed up by framing a plan to implement corrective actions. This plan has to be authorized by the head of the organization or else it would be difficult to implement.
- As per OHSAS continual improvement should be the main objective to gain perfection. So it is necessary that the internal audit team of the organization carries out the internal audit of the entire site frequently and systematically.
- The internal audit team could be rotated amongst different groups except in case of a few members heading the team.
- All documentation related to OHSAS should always be kept up to date. The documents required have been listed in the later stages.
- Regular updating of knowledge in safety engineering by the employees is necessary. Different resources could be utilized for this based on the budget/ scope allotted by the management.

CONCLUSION

Occupational Health and Safety Assessment series 18001 is a formal certification for health and safety management. This certification is nowadays an extremely necessary requirement for gaining a good market reputation by any company.

Gammon India Limited has presently reviewed its health and safety management systems for implementing OHSAS 18001. Accordingly each site has started its implementation guided by the site management representative.

- OHSAS 18001 requires a carefully framed policy which is the guiding force behind its implementation. In case this policy is not specific it may lead the organization towards wrong objectives and targets. The mission and vision of the organization should be understood thoroughly before the OHSAS policy is framed.
- The company has to evaluate where it stands in terms of that policy.
- An expert team has to be formed to carry out the gap analysis. This has to be supported by a carefully formulated strategy.
- Resource utilization has to be done to identify hazards, evaluate risks and take corrective actions.
- Immediate management review is required to authorize the future plans to take corrective actions.
- The most important factor for OHSAS implementation is continual improvement. This requires an extensive and systematic status review frequently and regularly.
- It is beneficial to rotate the internal audit team at intervals except a few members heading the team.
- It is beneficial to fix time bound targets to achieve the objectives. But the time limit selected should be realistic and objectives achievable. This planning is to be done very carefully.
- Job safety analysis/ method study is quite beneficial to identify even the minute hazards.

- Ideas of each employee can be utilized for hazard identification/ risk assessment.
- Brain storming sessions/ meetings/ educative tours should be regularly organized to develop a positive health and safety culture.
- OHSAS certification and implementation requires a commitment of each and every employee without which it would not be a successful objective.

REFERENCES

- HEALTH, SAFETY AND ENVIRONMENT MANUAL, GAMMON INDIA LIMITED
- OHSAS 18001 IMPLEMENTATION STANDARDS, BRITISH STANDARDS INSTITUTION.
- BRITISH SAFETY COUNCIL WEBSITE, www.bsc.org
- NATIONAL SAFETY COUNCIL WEBSITE
- INDIAN OIL CORPORATION LIMITED- SAFETY MANUAL.

APPENDICES

LIST OF ABBREVIATIONS USED

- ASME- American Society of Mechanical Engineers
- ANSI- American National Standards Institute.
- API- American Petroleum Institute
- AFC-
- ATF- Aviation Turbine Fuel
- BS- British Standards
- BSI- British Standards Institute
- BARC- Bhaba Atomic Research Centre
- CP- Corrosion Protection
- CE- Chronic Effects
- DC- Domino Concern
- FR- Frequency Rate
- GIL- Gammon India Limited
- HSD- High Speed Diesel
- HDPE- High Density Polyethylene
- IOCL- Indian Oil Corporation Limited
- ID- Internal Diameter
- IR- Incidence Rate
- IS- Indian Standards
- JSA- Job Safety Analysis
- KRPL- Koyali-Ratlam Pipeline
- LC- Legal Concern
- MS- Motor Spirit
- OISD- Oil Industries Safety Directorate
- OHSAS- Occupational Health and Safety Assessment Series
- OD- Outer Diameter
- OFC- Optical Fiber Cable

- PPV-
- PPE- Personnel Protective Equipments
- QWPS-
- ROW- Rights Of way
- RH- Relative Humidity
- SKO- Superior Kerosene Oil
- SR- Severity Rate
- SSD- Scale- Severity- Duration
- SHE- Safety, health and Environment
- WRI- Welding Research Institute

Form-1

Table-1.1: IDENTIFICATION OF OHS HAZARDS AND RISKS

Sr. No.	Activity	Hazard	Normal/ Abnormal/ Emergency	Direct/ Indirect	Risk		Remarks (Present control & needs)
					Frequency (See Form-2, Table-2.1)	Consequence Level (See Form-2 Table-2.2)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Form-2

Table-4.1: EVALUATION OF OHS RISKS

Risk Identification (Form-1 summary)							Risk Evaluation							
Sr. No.	Activity	Hazard	N/A/E	D/I	Risk Identification		Risk Evaluation							Significance (Yes/No)
					Freq.	Conseq.	Concerns			SSD Scores				
							DM	LC	CE	SC	SV	DU	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)

Help on Form-2

Concerns		SSD (Scale, Severity, Duration)	
DM	Domino Concern (Multiplier effect)	SC	Scale (See Table-5.1)
LC	Legal Concern (Controlled by Law)	SV	Severity (See Table-3.1)
CE	Chronic Effect concern (Slow long term cumulative harm)	DU	Duration (See Table-5.1)

Table-2.1: RISK IDENTIFICATION CRITERIA

Risk Probability of occurrence (Frequency or Likelihood) (Time Scale)	Risk Probability of occurrence (Frequency or Likelihood) (Semantic scale)	Penalty (Weightage)
>Month	Highly Unlikely (HUL)	1
<=Month>Week	Unlikely (UL)	2
<=Week>Day	Likely (L)	3
<=Day	Very Likely (VL)	4

Table-2.2: RISK CONSEQUENCE LEVEL DETERMINATION

Sr. No.	Magnitude of Harm in terms of Mandays Lost	Consequence Level (How Harmful)	Penalty (Weightage)
1.	First aid case, No loss of Man days	Slightly Harmful	1
2.	Non Reportable (Minor) injury - Mandays Lost<48 hrs	Harmful	2
3.	Reportable (Major) injury - Mandays Lost >=48 hrs.	Very Harmful	3
4.	Fatal / Permanent disability or Number of persons involved	Extremely Harmful	4

Form-3

Table-6.1: PRIORITIZATION OF OHS RISKS AND FEASIBILITY ANALYSIS

Sr. No	Activity/ Product/ Service	Significant Hazard	Associated Risk	Measures Required to Reduce or Eliminate Risk			Measures required to Control Risk	Operational Feasibility	Economic viability	Elimination/ Reduction/ Control	Ref. Document
				Technology	Physical Improvement	Feasibility study	Technique/ Training				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

Help on Form-3

5. Technology	Does the Risk Elimination/Reduction requires a new Technology?	9. Operational Feasibility	Does the Risk elimination/reduction requires an operational feasibility study to be undertaken?
6. Physical Improvement	Does the Risk Elimination/Reduction requires some physical improvement?	10. Economic viability	Does the Risk elimination/reduction requires an economic viability study to be undertaken?
7. Feasibility	Does the Risk elimination/reduction requires a feasibility study to be undertaken?	11. Elimination/ Reduction/ Control	Does the method selected results in Elimination or Reduction or Control the significant OHS Risk?
8. Technique /Training	Does the Risk elimination/reduction possible by some new technique or by training?	12. Ref. Document	Reference of Document for Operational Control Procedure (OCP) or Management Programme (MP)

Table-3.1: RISK SEVEERITY (SV) COMPUTATION

Consequence Level / Risk Likely-hood	Slightly Harmful (1)	Harmful (2)	Very Harmful (3)	Extremely Harmful (4)
Highly Un-Likely (1)	Trivial Risk (2)	Tolerable Risk (3)	Moderate Risk (4)	Substantial Risk (5)
Unlikely (2)	Tolerable Risk (3)	Moderate Risk (4)	Substantial Risk (5)	High Risk (6)
Likely (3)	Moderate Risk (4)	Substantial Risk (5)	High Risk (6)	Very High Risk (7)
Very Likely (4)	Substantial Risk (5)	High Risk (6)	Very High Risk (7)	Intolerable Risk (8)

Table-5.1: SSD EVALUATION CRITERIA FOR OHS RISK EVALUATION

Scale (SC)	Scale Penalty or Weightage	Duration	Duration Penalty or Weightage
Spot	1	<Minute	1
Section	2	>=Minute <Hour	2
Plant	3	>=Hour <8 Hours	3
Beyond Plant	4	>=8 Hours	4

Scale is the spread of the Hazardous event e.g. 1. a cut injury is spot, 2. Noise/radiation is section, 3. A fire can be section or plant, 4. A gas leak can go beyond the plant.

Duration is how long the Hazardous event lasts e.g. 1. A cut injury lasts only a second (injury may heal over time), 2. Noise /radiation lasts as long as the machine runs, 3. A fire can last over an hour, 4. A gas leak may last for 15-20 mins or more depending on the situation.