



## “A Study on Health, Safety & Environment (HSE) Implementation, Initiatives and Constraints in Pipeline Construction Project”

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### ABSTRACT:

Cross Country Pipelines are a unique mode of transportation of certain types of commodities mainly fluids (liquids and gases like crude and refined petroleum products, Natural Gases and Bio-fuels) over long distances at relatively low cost. The operations are economical, continuous and environmental friendly. Pipelines are also useful for transporting water for drinking or irrigation over long distances when it needs to move over hills, or where canals or channels are poor choices due to considerations of evaporation, pollution, or environmental impact. Pipelines have relieved the increasing pressure on the existing surface transport system (railways and roadways). Due to above reasons, the transportation by pipeline is highly preferred over traditional modes of transport.

Pipelines Construction, by its peculiar nature possesses various specific HSE Risks. Risks during initial studies, survey, routing and construction are less predictable and are different depending on topography, local community and culture, involvement of various stakeholders, weather and climatic conditions, accessibility, socio-political, ecological, technological factors etc.

Pipeline construction activities are hazardous, fast paced, strenuous and are undertaken simultaneously at remote sites, with limited access making it difficult to monitor and control. These increase the Risks which can affect HSE as well as other Performance Parameters / Objectives of the Project.

However a well established, strategic, focused application of Health, Safety & Environment programs, its monitoring and mitigation will significantly improve the HSE Performance, safe execution and on schedule completion of the project.

**Key Words:** Pipeline Construction, HSE Risks, Transportation, HSE

## **1. INTRODUCTION:**

Construction Industry is most unorganized and dangerous places to work where injury, illness or death rates are very high. Statistics of accidents in the construction industry in India are scarce. The construction is the second largest economic activity in India after agriculture, accounting 40% of the development investment during the past 50 years and employing over 35 million people and creates assets worth over Rs.200 billion.

Cross Country Pipeline Construction by its nature is a hazardous, fast paced, strenuous activity and are undertaken simultaneously at remote sites, with limited access making it difficult to monitor and control.

### **Rationale of the Study:**

This Study has been carried out at a pipeline project involving construction of 160 kilometers of 30 inch OD pipeline.

The rationale behind this study is that managing HSE Risks in a Pipeline Construction projects is quite uncommon in nature and required a better understanding of risks involved, people behavior and involvement of a number of stakeholders. These risks need to be duly accounted in overall as well as HSE Risk Management System. Further the boundary of this study also covers the existing HSE Management System in place, various Initiatives taken by company to improve HSE Performance, measures how specific risks are handled, HSE Culture at workplace etc.

### **Objectives and Aims:**

The core objectives of this study are to study the project specific HSE Risks. The Pipeline Project by nature involve many specific risks associated with topography, local people and

communities, people from different cultures, socio-political, security, ecology etc. which are very less common in other construction projects.

***The main objectives of this study are to:***

- To study the existing HSE Management System, it's implementation and monitoring.
- To study the HSE Culture at the Project Site.
- To study the initiatives taken by the Project Management to improve HSE Culture.
- To study the Constraints / Hurdles / Risks associated with pipeline projects.
- To recommend possible controls for risk envisaged during study.

**2. STUDY METHODOLOGY:**

The study methodology for this project work involves following activities:

- ❖ Selection of project for study
- ❖ Obtaining complete detail of the project.
- ❖ Study existing Project HSE Management
- ❖ Study HSE Risk Management in Pipeline Construction Project
- ❖ Identify / Study Significant Risks specific to Pipeline Construction Project
- ❖ Study the HSE Initiatives taken by the Company
- ❖ Description / Analysis of the information obtained
- ❖ Conclusions and Recommendations

### **Selection of Project for Study:**

Cross Country Pipeline Construction by its nature is one of the most hazardous kinds of project involving unpredicted natural, organizational, technological, socio-economical, socio-political, security, ecological hazards and risks in addition to normal work related hazards. This project work is an attempt to study and understand these hazards and risks.

### **Obtaining complete detail of the project:**

The complete details about the project will be obtained from the tender and contract document and the planning package available at the project site. Also a discussion with site execution leaders helps a lot to understand the project scope and clear doubts, if any.

### **Study existing Project HSE Management:**

Study of existing Project HSE Management was done by:

#### **❖ Reference Document Review :**

Following documents were referred to study the existing Project HSE Management:

- Applicable Regulatory Requirements (National, Regional / State Rules)
- Client reference document - HSE Management during Construction (IOCL Contract Document, Procedures)
- Company's Occupational Health, Safety and Environment Procedural Manual
- Project HSE Plan and Job Specific Procedures

#### **❖ Records Review :** Relevant records as requirements identified in above documents

#### **❖ HSE Resources and HSE Organization:** HSE Team deployed at site.

#### **❖ Interview People:** Interviewing randomly selected people from all categories including workforce and staff.

**Study HSE Risk Management in Pipeline Construction Project:**

- ❖ Obtaining information from Literature / Internet
- ❖ Reviewing HSE Studies , Hazard Identification and Risk Assessment Sheet
- ❖ Records from field such as Daily Observations, Risk Log Register
- ❖ Interview of people across all levels including Staff and workforce.

**Identify / Study Significant Risks specific to Pipeline Construction Project:**

- ❖ Identification of specific hazards and risks involved in Pipeline Construction
- ❖ Study of potential consequences and likelihood

**Study the HSE Initiatives taken by the Company:**

- ❖ Study of HSE Initiatives taken by the company to motivate / encourage workforce, understand problems of people, monitor and improve the HSE performance,

**Description / Analysis of the information obtained:**

- ❖ Detailed analysis of the information obtained from the above studies.

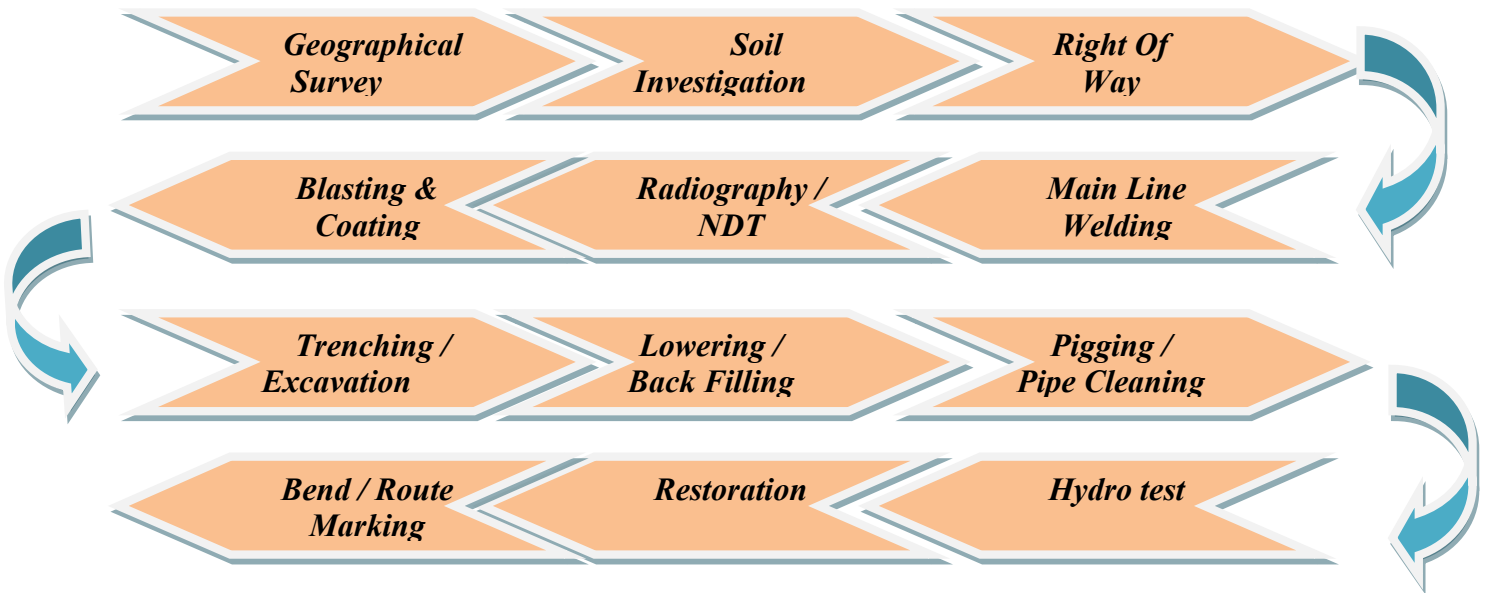
**Conclusions and Recommendations:**

- ❖ Conclusions obtained after analysis of the information and identify recommendations to overcome the gaps and / or improve the HSE Performance.

### 3. RESULTS:

#### 3.1 Typical Pipeline Construction Phases:

The Typical Pipeline Construction Project consists of following Phases.



#### 3.2 HSE Risk Management in Pipeline Construction project:

On the basis of risks identified, A HSE Risk Register is developed as core reference document which is further elaborated in Hazard Identification, Risk Assessment and Control (HIRAC) Sheets. Risk Register covers only Critical Activities whereas HIRA is prepared for all activities involved.

A Review of Risk Register gives insight of the major significant hazards and risk.

**Driving (Shifting People / Materials):** Driving on Highways, Rough Roads and varying terrains shifting Heavy Equipments and Longer Materials through village / soil road etc. involve serious risks to people, public and the organization. A well route planning, Competent Driver, adherence to traffic rules and plan, monitoring and emergency supports are essentials.

***Geographical Survey and Soil Investigation:*** to identify / verify pipeline route and soil strata / strength information which help in design, material selection and planning for construction. It involves hazards like unknown route, location, access, animals, snakes, and types of Land - Marshy, Land Strata, Uneven Land etc., access for vehicle. These require experienced people to be kept on job, proper planning, obtaining information about the locality, people and culture etc. Presence of mind and logical decision making is helpful to handle unexpected situations and risks.

***Right of Way (RoW) / Right of Use (RoU):*** Right of way construction involves using heavy machines like Dozer / Grader and requires all clearance like removal of trees, cutting of hills etc., which requires liasoning with Government and local bodies to obtain permission. Problems raised by local community to hinder the work are very common and need to be handled diplomatically. Sometimes local administration assistance might be required. Sometimes the route might be required to divert slightly considering the public issue like temple, mosque, crimination ground or such things on the RoW.

***Rock Control Blasting:*** The main hazards are Fly Rock generated while blasting, extraneous electricity that might be present and unscheduled initiation. These require Director General of Mines Safety (DGMS) / Petroleum and Safety Organization (PESO) Nagpur Permission, Certification for Blast / Shot Firer. It shall be controlled by proper Pre-planning, Approved Explosive materials / detonator, Study report of impact of explosion on nearby community and buildings etc., Blast Design (Strength of Explosive, Hole Size, and Hole Depth etc.). Also Prior Communication to nearby Public, Safety Signage and Adequate Supervision shall be ensured.

**Main Line Welding / Radiography / Blasting & Coating:** Major hazards are Fire and Explosion (especially while working in an unknown environment), electrocution and working under high voltage power lines. The risk increases during rainy season, wet and humid environment. In village or community area, children or animals can enter inside welded pipes. This can lead to fatality / casualty and also can cause sticking of pigs during pigging. To control such hazards welding booth made of fire blanket, trained / experienced technicians, fire fighting measures, welding away from high voltage power lines etc. shall be ensured and the open ends of welded pipe shall be capped at the end of every shift or break. Proper arrangement for Radiography to warn and keep local people away from location is required.

**Trenching / Excavation:** Trenching / Excavation is one of highly hazardous activity. Cave-ins pose the greatest risk and are much more likely than other excavation related accidents to result in worker fatalities. Other potential hazards include damage to underground services, falls, falling loads, hazardous atmospheres, water egress, and incidents involving mobile equipment. Trench collapses cause dozens of fatalities and hundreds of injuries each year.

The risk increases during Horizontal Drilling across the road, rivers, open trenching in river etc. Animals and Children are more prone to fall in the excavation leading to casualty. Proper planning to backfill the excavation on the same day minimizes the risk up to a great extent.

**Lowering / Laying Pipeline in the Trench:** It involves lowering of welded pipeline length in the trench using a number of Pipe Layers and Cradles. Simultaneous use of many Pipe Layers to lower a several hundred long length of welded pipe in trench is a critical task. A well planned Lifting Method, calculated load, positioning & coordinated movement of pipe layers and soil



condition assessment are very essential. The cradle wire rope, rollers etc. shall be thoroughly inspected for any damage, wear & tear.

***Pigging:*** the main risk involve stuck of pig which may require cutting the pipe in extreme cases causing additional risks. The residue contains unknown substances, solid waxes, condensates, gases and high pressure.

***Hydro test:*** Hydro test in pipeline posses serious risk as it takes longer duration for 2- 3 days putting people on Fatigue. Adequate competent manpower and supervisory coverage is important.

***Restoration and Route marking:*** involves backfilling, grading and putting heap over pipeline. Grading or backfilling shall be made with non-toxic, nonflammable, noncombustible and non-putrescible solids. Backfilling shall be by the top excavated soil to restore the land to its original state.

**Environmental / Ecological Risks:** Involve Damage / Disturbance to Wildlife, Damage to Nature / Change in Land Regime. However these are of temporary in nature and can be restored without much impact on environment once pipeline is commissioned. Permission and advice from Forest Department is required.

**Natural Catastrophic Risks:** are those on which there is no control. They are usually the ‘act of God’ and can occur at anytime and anywhere. *Earthquake, floods, hurricanes, landslide, weather conditions* are the common examples of these risks.

However, due to the development of the science and technology these can be predetermined and the information can be helpful to protect life and assets. A topographical study, monitoring environmental conditions, pre-start assessment of the workplace and preparedness to response potential emergencies could be helpful.

**Socio-political Risks:** The effect of *country’s policies and instability of Government* on the project directly impact on project success or failure. Policy and political risks are more concerned in international project risks, such as cross border pipeline projects or in India a pipeline through different states. *Public Safety* is serious concern. A pipeline construction can increase safety risks to the public by increase of traffic on roadways in the vicinity of the pipeline and from potential exposure to construction activities itself. *Community Hindrances and Labor / Worker Disputes* are very common due to several reasons. These need to handle smartly and with the involvement of regulatory / administrative agencies as required.

**Security Risks:** at remote locations is very critical in pipeline construction. It involves problems created by local people, Theft / Violence, Accidents / Mishaps, animal attacks etc. A Security Plan is highly recommended based on potential security risks.

**Organizational Risks:** These are risks related to organization and organizational relationships may appear to be unnecessary but are quite real. Incompetent Manpower, High Employee

Turnover, People from different background increases the risks of people putting themselves in dangers, internal conflicts among themselves based on region, religion, caste, community etc. It increases HSE Costs by training and providing safety items to more people, high monitoring mechanism, increasing the risks of accidents and losses etc. Developing a good HSE Culture can minimize such risks.

**Managing Subcontractors:** In country like India, the construction activities are done by manpower supplied by subcontractors. Where a large number of manpower is required, a number of subcontractors are involved. These supplied manpower are untrained, unskilled, mostly short termed and unaware of HSE Risks. Managing such kind of manpower is quite challenging.

### **3.3 Initiatives taken by The Project Management to improve HSE Culture:**

Many initiatives have been taken by the Company to improve awareness, understand workers concerns, motivate and strengthen HSE Culture among staff and workers. Some of them are as below:

***Skill Validation:*** All workers / technicians are thoroughly assessed for their skill and issued with an Identity card. It prevents deployment of un-skilled or incompetent people on job.

***New Employee Development (NED):*** All new employees are identified by a “NED” Sticker on their helmets. It helps old employees to identify new employees and assist them in case of any need.

***HSE Score and Creditability System:*** A qualitative procedure to measure Daily HSE performance of individual Engineers, Total score of all engineers under each Work Breakdown Structure (WBS) In-charge forming the score of WBS. The whole concept of HSE Credible system is based on integrating HSE into job planning, communicating in one day advance, identifying and scoring risks in activities, ensuring the efforts to minimize risk and finally evaluating HSE Performance Score. It gives negative score for non-compliances and positive score for compliances, initiatives, involvement of execution personnel in HSE Activities.

***One to One Communication*** - Each staff interact with his worker in friendly to improve the relationship and he ask any problem facing at project. It is found useful to identify people problems which are not discovered by formal communication channels.

***Gang Safety Leader (GSL)*** is based on the concept where the worker himself is empowered to take up the safety responsibility of his working team. A member in the team is chosen as “Gang Safety Leader” to look after HSE in addition to his job responsibilities. People are encouraged to take responsibilities and come in frontline by motivational / appreciation programs.

***Concept of Safety Mentor, Coach, Champions and Gang Safety Leader:*** This concept requires mentoring to immediate sub-ordinates at each level in HSE Matters. It involves day to day interaction, obtaining feed backs and passing information with sub-ordinates. Safety Mentor, Coach, Champions and Gang Safety Leader are the terms used for peoples at various levels.

**Mass Housekeeping Drive** conducted at all location on a weekly basis, where participation achieved through safety representatives and management staffs to emphasis and demonstrate that everyone involved to some degree by inputting into and getting involved in HSE best practices.

**HSE Campaign:** through Celebration of Safety Month, National Safety, Monthly Safety Motivational Program, HSE Tabloid, Skit Play etc.

**Stop Job System:** All staff members are empowered to raise “STOP JOB” message through company provided mobiles which flashes all concerned, in case they observe any serious non-compliances. The work can be resumed only after proper compliance and communication to Message Raiser.

**Wall of Fame / Shame:** The details of achievers and violators are displayed on “Wall of Fame / Shame” Board on monthly basis. The understanding behind it is that Good Performers should be appreciated and vice versa.

**Other Efforts:** include HSE Induction, Medical Fitness Certification, Skill Assessment and Screening, HSE Passport System (to record and track individual HSE Performances, Training Records), HSE Exhibition Centre (To raise awareness among people), On-Site and Off-Site HSE Trainings, Safety Task Analysis (Similar to Tool Box Talk), Just A Minute (JAM, to check any new hazards before start of the work), Permit To Work System (PTW) for Critical / High Risk Activities etc.

#### **4. DISCUSSION AND CONCLUSION:**

From the descriptions in previous sections it is obvious that Pipeline Construction is unique in its own nature. It involves several HSE Risks other than normal construction activities due to

- Scattered over a longer geographical area
- Involvement of various stakeholders like local community, land owners, Non-governmental Organizations (NGOs), government and local governing bodies, Province and Federal Regulators, Municipality etc.
- Unforeseen hazards
- Varying and unknown topology
- Untrained, Unskilled and mostly short term manpower
- Other / Interfering Infrastructures, Roads, Cities / Towns etc.

In spite of such hindrances, a systematic study involving identification, evaluation and control of risks can improve the HSE Performance and minimize the risks of any casualty / injury, damage to asset or any adverse impact on environment. Strategic, focused application of Health, Safety and Environment programs and its monitoring and mitigation will significantly control the hazards involved in pipeline construction.

Various initiatives taken by the management to keep people motivated, aware of hazards & precautions to be taken and consequences of non-compliances, retain them for longer time in the project, harmonize people from different cultures will help to minimize the Risks and

## 5. REFERECES:

- Applicable Regulatory Requirements (National, Regional / State Rules)
- Indian Standard Codes and International Standards on HSE
- HSE Management during Construction (IOCL Contractual Document) IOCL-MBPL-01-04-3512-R0.
- OHSAS 18001 : 2007 (IND 14.6417U / HS/3)
- ISO 14001 : 2004 (IND 14.6417U/E/4)
- Company's Occupational Health, Safety and Environment Procedural Manual
- Project HSE Plan and Job Specific Procedures.
- Project Emergency & Disaster Response Management Plan
- Transport and Journey Management Plan

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