MINDSET MATTERS

Elevating Workplace Safety Through Behaviour

DR. MANOJ KUMAR RAY

B.Sc. (Hons.), B.E.(Fire), PDIS(RLI), M.Sc. (Env. Sc.), MBA, M. Tech. (HSE), MBEH, NEBOSH, PGD-T&D(ISTD), Ph.D.

BlueRose ONE.com
Stories Matter
NewDelhi • London

BLUEROSE PUBLISHERS
India | U.K.

BlueRoseONE.com
Stories Matter
NewDelhi • London

For permissions requests or inquiries regarding this publication,
please contact:

BLUEROSE PUBLISHERS
www.BlueRoseONE.com
info@bluerosepublishers.com
+91 8882 898 898
+4407342408967

ISBN: 978-93-7139-383-6

Cover design: Yash Singhal
Typesetting: Namrata Saini

First Edition: September 2025

DECLARATION & DISCLAIMER

This book is an original work based on my own research, analysis, and interpretation. More than one hundred standards, manuals, books, articles, and papers were reviewed, and authors whose works have been referenced are acknowledged within the chapters where their contributions are cited. The content is presented in my own words and understanding, with all sources credited in accordance with academic and ethical standards. It is intended for educational and reference purposes only. While every effort has been made to ensure accuracy, no warranty is given regarding completeness, reliability, or applicability. The examples, interpretations, and recommendations reflect my personal understanding and may not be universally applicable. Neither the author nor the publisher shall be held liable for any loss, injury, or damage resulting from the use or misuse of the information provided.

ACKNOWLEDGEMENT

“Everything is possible, if God’s touch is there.”
In my life, this divine touch has come in the form of my **Guru**.

Several people have made immeasurable contributions to the establishment of this study and book. It gives me immense pleasure to express my heartfelt gratitude to all those who have directly or indirectly supported me in this endeavour.

I wish to extend my sincere thanks to **Indian Oil Corporation Limited, Mathura Refinery Management** for granting consent to publish this book. I am deeply grateful to **Dr. H. L. Kaila** for his invaluable guidance on Behaviour-Based Safety, which helped me shape my thoughts in a better way from time to time.

My special thanks are due to **Shri R. L. Kalita** and **Shri D. P. Mishra** for providing the initial inspiration to write this book during my posting at Paradip Refinery Project. I am equally thankful to **Shri Sapin Gopi** for his valuable suggestions and continuous support during the writing process, and to **Shri Ravi Bhushan** and **Shri Ram Raj** for their outstanding encouragement throughout.

I am ever grateful to my wife **Smt. Anita Ray** and my son **Shri Manish Ray** for their constant support, patience, and encouragement, which enabled me to complete this work.

I also wish to thank **BlueRose Publishers** for accepting this book for publication. Finally, I record my gratitude to the numerous writers, editors, and publishers of books and journals whose works were referred to in preparing this manuscript.

(Dr. Manoj Kumar Ray)

This book is dedicated to
Father Late Shri Surendra Kumar Ray &
Mother Late Smt. Sumitra Ray
who have given me the basics of life in the form of Sanskar to produce Noble Thoughts.

PREFACE

Behaviour-Based Safety (BBS) addresses the behavioural aspects of people working in an organisation and is considered one of the most important approaches for improving safety culture in industries. BBS is a key tool to reduce industrial accidents, though unsafe behaviours at the workplace often arise due to factors such as lack of job knowledge, work pressure, unsafe conditions, stress, overconfidence, or unawareness about hazards.

To strengthen safety practices, this book also discusses related areas such as reporting of near-miss incidents, hazard identification and risk assessment, job safety analysis, toolbox talks, work permit system, process safety management, road safety, and overall safety culture. Knowledge of these aspects will make BBS easier to understand and implement in industries.

By implementing BBS, organisations can significantly improve their safety culture. To achieve the goal of zero accidents and incidents, the concept of sustainable BBS has been highlighted. For developing a healthy HSE system, digitization has been given priority, as it helps industries with data analysis, reviews, and better record-keeping.

The book further explains the benefits of Behaviour-Based Safety through different case studies. At the end of each chapter, Questions & Answers are provided to help readers review their understanding. It is hoped that this book will be beneficial for professionals in implementing BBS and sustaining a strong safety culture within their organisations. It will also serve as a valuable resource for students to gain a clearer understanding of industry practices.

Happy Reading!

(Dr. Manoj Kumar Ray)

CONTENTS

Chapter – 1

Introduction

CHAPTER – 1
INTRODUCTION

1.1 Workplace Safety:

Industrialisation has a silver lining in the history of mankind. It has changed the way mankind lives on the planet Earth. It has also changed the way people see, hear, dress, think, and live here. There was a significant improvement in the working conditions in the industries, too. The simple and manpower-oriented shop floors have given way to factories engaging complex machinery. Temperature and pressure of the process were approaching the extremes, and hazardous material started to be produced and used on the shop floors. These technological advancements have brought about their own challenges. Workers and the public started to get exposed to various hazards. The manpower and financial losses related and caused by accidents have led the authorities to think about laws and regulations to protect and compensate the workers, the public, and the environment. The insurance costs related to accidents were rising, and accidents were becoming more and more unacceptable to the industries and the public alike. These lead to the development of workplace safety in industries.

The earlier works in the field of workplace safety came from the insurance agencies. One such study was done by H. W. Heinrich. In his book "*Industrial Accident Prevention: A Scientific Approach*," he stated the relationship between near-miss, lost time, and fatal injury. This is considered as a basis for many of the workplace safety programs of today.

1.2 Why Workplace Safety?

Addressing the monetary costs associated with workplace accidents was the primary goal of the workplace safety program in its early years. The introduction of safety regulations post-formation of the regulatory bodies has made it mandatory for employers to implement a certain workplace safety program. Then this has developed into an industrial norm to put in place the workplace safety management programs along with other management practices.

1.3 Requirement of a Workplace Safety Program:

Any industrial system runs on three elements, namely Man, Machine, and the Environment. It is the interaction between these elements that facilitates the smooth running of the system. ‘Man’ factor is the most important of the above three. It is the real workforce that works in the industrial scenario. ‘Machine’ includes both the machinery and the infrastructure of the industry. ‘Environment’ factor is the wide range of content of the ‘Man’ and the ‘Machine’ elements that are exposed in daily work. All the management systems focus on one or a combination of more than one factors. The workplace safety management system is not different.

Numerous Safety Management Systems exist for ensuring workplace safety. Systems such as Machine Guarding, Process Safety Management, and System Integrity concentrate on the mechanical aspects of the sector. It ensures that the various equipment used in the plant does not compromise safety through various sub-systems. Good ergonomic practices, good workplace design, workplace monitoring, industrial hygiene etc., ensure that the environmental factors are safe. But the most important of these is the ‘Man’ factor. Even after implementing a safety system related to other factors, unless they are followed by the personnel, it is not going to be effective. The response of personnel designated to the worksites is a crucial factor in the effectiveness of any safety management system. Fundamentally, human behaviour determines the effectiveness or ineffectiveness of any safety management system.

1.4 Behaviour Based Safety:

Human behaviour is shown by how they respond to various scenarios. In daily life, people are faced with various scenarios to which different people respond in different ways. The response is mainly administered by the result of the response. The same is the case with the industrial scenario, too. There are many ‘Antecedents’ in the industrial scenario. Response to those antecedents that have an implication on the safety of the man, machine, or environment is a matter of concern in this case.

Behaviour-Based Safety operates on the premise that positively altering staff behaviour can lead to an enhanced safety culture inside the organisation.

1.5 History of BBS:

BBS has a history of origin with the workplace safety management concept itself. H. W. Heinrich, in these initial studies themselves, has pointed out that 88% of the accidents are caused by Unsafe Acts of the personnel. But this human factor was not given prompt importance in the initial phases of the safety movement, where the importance was given to technological development. But by the end of the 1970s, BBS had gained its importance in the safety management system. Currently, it is said that altering individuals' behaviour is as crucial as other elements in the effective execution of the safety management system.

Dupont asserts that 96% of injuries and illnesses result from risky behaviours. Behaviour Science Technology has indicated that 80% to 95% of all accidents result from dangerous behaviour.

1.6 How is BBS?

BBS aims to alter personnel behaviour to foster a positive safety culture inside the organisation. Understanding this process necessitates a thorough examination of human behaviour. This can be done with the help of the ABC theory of human behaviour. ABC theory says that every Behaviour is always a response to a trigger called 'Antecedent,' and it is based on the outcome of the action that is the 'Consequence.' The behaviour can be positive (like following the safety rules) or negative (like bypassing the safety system). The BBS system adds a positive reinforcement to the positive behaviour and a negative reinforcement to the negative behaviour. For example, if a person is handling some chemicals without wearing hand gloves, that is a negative behaviour from that person. So, the behaviour of that person needs to be negatively reinforced. He must be made to understand that behaviour is not safe, and he needs to change that behaviour.

This behaviour modification is easier said than done. There shall be a scientific approach to properly monitor a person's way of work, compare it with the standard procedures, and provide the required feedback. Behaviour-Based Safety Management System provides the scientific tool for this purpose.

1.7 Safety Observation:

Safety observation is one of the time-tested and proven methodologies to go forward in Behaviour-Based Safety Management System. Safety Observation itself is a very vast topic. In a nutshell, in this process, the person doing the work at the site is observed through a laydown procedure. The person is then given feedback on the way the work is being done. This feedback includes both positive and negative but always starts with a positive one. After providing the feedback, the worker is thanked for his cooperation in the process. Safety observation processes can be modified to address the specific area that needs expert attention.

1.8 Summary:

Behaviour-Based Safety has significantly advanced beyond the mere statistics presented by H. W. Heinrich in his research. Many management firms have researched this area and formulated their proposed methods for the execution of Behaviour-Based Safety Programs. Many organisations have successfully implemented this methodology and achieved good results. But it is to be remembered that BBS is not the one-stop solution to all the safety issues of the organisations. This system is to be supplemented by management commitment and good safety standards. BBS is highly dependent on supporting safety management systems to achieve the intended results.

* * *

Chapter – 2

Behaviour Based Safety – A Thought

CHAPTER – 2

BEHAVIOUR BASED SAFETY – A THOUGHT

2.1 History of BBS:

As the industries started to change post-industrial revolution in the 18^{th} & 19^{th} centuries, the need for improved safety standards also started to rise in the industries. The initial response from the employers was to place responsibility for safety on the workers. These efforts were met with the resilience form of the worker community and the administration. This led the industry and administration to think deeply into the cause of the accident. The main intention of these efforts was to identify an effective method to prevent accidents and reduce the associated costs.

The two main concepts that emerged during this time were:

i) Providing workers with maximum protection to protect them from all possible harms.
ii) Providing workers with comprehensive training is crucial for effective hazard identification and prevention. *(Dominic Cooper et al 2001)*

The first of these is based on implementing engineering control measures at the workplace, such as machine guarding etc. The second one assumes that all the personnel can understand the risk at the work site, if they are given sufficient training on the same.

2.2 Administrative Involvement in Safety:

The need for accident reduction further increased with the increase in industrial activities post the Industrial Revolution. Many laws were put in place to regulate industrial activities regarding safety of the personnel involved in the job. Many inspectors were appointed under these regulations. These inspectors conducted studies and suggested modifications of physical condition at work site to reduce hazards. However, this could not result in any significant reduction in industrial accidents. This led the government to conduct studies with experts. One of the early studies in this regard was done by Greenwood and Woods in 1919 in the UK. Greenwood and Woods conducted their studies on workers in an ammunitions factory. Through their studies, they came up with a concept that "*Some people were consistently more involved in accidents than others*." This concept was supported by later researchers as 'Accident Proneness.' *(Dominic Cooper et al 2001)*

2.3 Studies of H. W. Heinrich:

The concept of "Accident Proneness" gained a lot of importance in later days. Many scholars started conducting their research in the field and came up with their own hypotheses. Herbert William Heinrich released his book "*Industrial Accident Prevention: A Scientific Approach*" in 1931. In his book, he established a correlation between unsafe conditions and unsafe acts in relation to accidents. In his book, he asserted that 88% of accidents are attributable to human factors. This was one of the initial studies that produced quantitative results regarding these parameters. Hence, this book is considered as the starting point of Behaviour- Based Studies.

2.3.1 Heinrich's Pyramid:

In his book "*Industrial Accident Prevention: A Scientific Approach*," Heinrich suggested a ratio between Near-miss, Minor Injury & Major Injury. He suggested that "for every accident that causes 1 major injury, there are 29 accidents that cause minor injuries and 300 accidents that cause no injuries". This ratio is represented in a pyramid, which is known as Heinrich's pyramid.

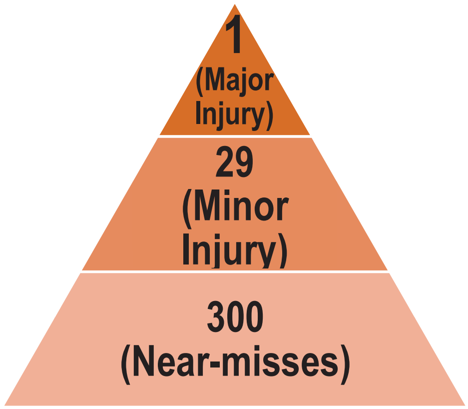


Fig. 2.1: Heinrich's Pyramid

2.4 What is Behaviour?

Behaviour refers to the manner in which an individual acts or conducts themselves, especially in relation to others. This is an observable and quantifiable action. It includes observable actions or auditory expressions, such as a person sitting, standing, speaking, whispering, yelling, or writing, among others. For instance, an individual may express displeasure by facial expressions, vocal outbursts, crossed arms, and an averted gaze from the colleague, among other behaviours.

Employee behaviour can be succinctly defined as an employee's response to specific circumstances within the workplace. It is a primary aspect that fosters a positive work atmosphere. Similar to other skills and abilities, admirable behaviours must be acknowledged to optimize employee performance.

2.5 What is Attitude?

Attitude is an emotional response, belief, or perspective of endorsement or disapproval toward a certain subject. Behaviour is an activity or reaction that transpires in response to an event or internal cues (i.e., cognition). Attitudes can influence an individual's behaviour either favourably or negatively. Positive attitudes are typically reflected in an individual's behaviour; those with a respectable attitude are engaged and industrious, striving to enhance the mood of those in their surroundings.

An attitude is a manner of feeling or behaving towards a person, object, or circumstance. A passion for a sport, aversion to a certain performer, and a general cynicism toward life exemplify attitudes.

2.6 What is Behaviour-Based Safety?

Behaviour-Based Safety (BBS) is a systematic method aimed at promoting a safe workplace by changing harmful behavioural patterns. A BBS system emphasizes the examination of work practices, analyses the rationale underlying these practices, and implements intervention strategies to completely eliminate unsafe behaviours.

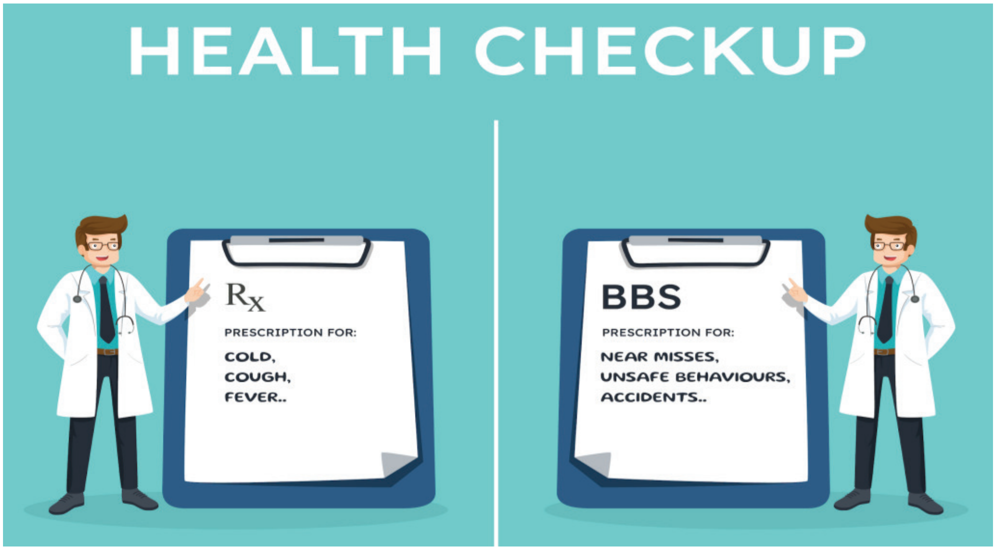


Fig. 2.2: Basics of BBS

BBS looks at the behaviour side of safety performance and focuses on observing and recording safe and unsafe behaviours in a standardized format. BBS attempts to determine the underlying (root) causes of safety behaviours and eliminate the causes of unsafe behaviours. Impartially observing and recording behaviours provides a valuable database on safety performance. This information can be analysed to identify trends and ultimately provide enhancements to make work activities safer.

2.7 Is BBS about Blaming Worker Behaviour for Incidents?

It should not be, but there are negative perceptions associated with the BBS system. This comment from a labour organisation typifies some of the feelings directed towards BBS system:

"…this type of program also encourages workers to spy on their co-workers for working in an unsafe manner. Rather than finding the cause of an accident or injury, the worker is blamed for not working in a safe manner…"

As with any component of a safety system, poor communication, poor design, or poor implementation might do more harm than good. Yet the potential for safety improvement is significant, if one can avoid the "blame game" and other pitfalls that have come to be associated with BBS systems.

2.8 Why is Behaviour-Based Safety Important?

The significance of a behaviour-based safety program lies in its rational strategy for removing the predominant cause of workplace injuries or accidents -"human error."

Although human error is non-deliberate, it results from our inherent behavioural inclination to be satisfied when performing high-risk tasks. Frontline workers are frequently susceptible to human errors due to their tendency to overlook critical safety details during everyday operations. Due to their experience, these personnel often do undetected risky shortcuts that yield faster results. This behavioural change causes a risky pattern that finally results in an accident, inflicting injury on themselves and others around them.

A BBS program involves continuous monitoring of the whole organisation, from management to frontline employees, to identify risky or destructive behavioural patterns. An effective BBS program observes employees throughout standard tasks, providing continuous feedback, motivation, and awareness to reinforce behaviours aligned with safe work practices.

The primary aim of a BBS program is to positively reward safe behaviours by proactively identifying underlying dangerous behavioural patterns in individuals and delivering timely interventions to encourage compliance with safety best practices.

2.9 Safety Pyramid:

A company that operates efficiently and effectively must have satisfied employees and a positive business reputation. However, this is all disrupted when an individual sustains an injury in the workplace. The incident has a much broader impact than just the victim; it also damages the brand image and affects the team morale.

The future of the business is the subject of discussion between employees and outsiders. The safety pyramid is a model that can be used to predict injuries. It functions as follows: for each major accident, including fatality or dismemberment, there are 10 significant incidents, 30 minor incidents, 600 near-miss occurrences, and 300,000 unsafe acts occurring before the injury. The anticipated ratio and the substantial figures in the lower pyramid do not suggest a favourable conclusion for the employees.

Fig. 2.3: Safety Pyramid

It is not too late to mitigate risk before a significant incident occurs at the top level. It can be comprehended through conventional methods of risk management and offers tools aimed at reducing incidents within the safety pyramid.

2.10 ABC Model of BBS:

Psychologists analyse behaviour using the ABC formula: Antecedent, Behaviour, and Consequence. Almost all behaviours, whether beneficial or detrimental, follow this pattern.

Antecedent - The events, actions, or conditions that occur simply prior to a behaviour.

Behaviour - The behaviour in detail.

Consequences - The action(s) or response(s) that immediately follow from the behaviour.

Fig. 2.4: ABC Model of BBS

Example:

We can see an example of speeding of a vehicle by a person and following are the details mentioned in the diagram:

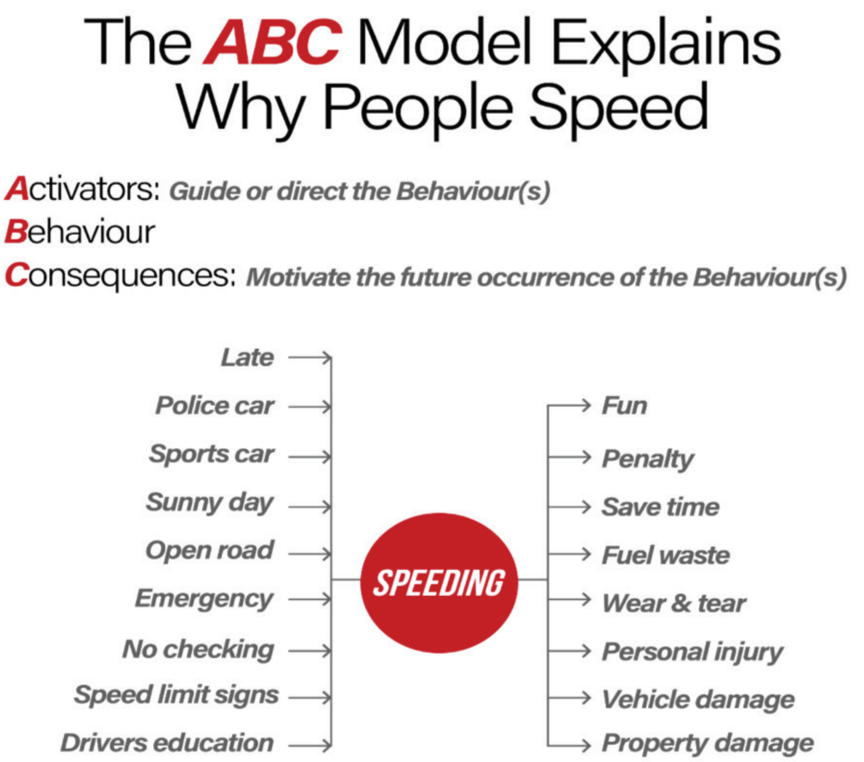


Fig. 2.5: Explanation of ABC Model

2.11 Is BBS an OHSAS/ISO Compliant Practice?

Presently, industries are going for ISO 45001:2018 (a transition phase from OHSAS 18001:2007) as a part of "*Occupational Health and Safety Management System*".

Section 5.4 of this document stipulates the necessity for worker consultation and participation. Organisations must establish, implement, and maintain processes for worker consultation and participation at all pertinent levels and functions, including, when applicable, worker representatives, in the development, planning, implementation, performance evaluation, as well as improvement of the Occupational Health and Safety Management System.

ISO - 45001: 2018, Clause 6.1.2 (Hazard Identification and Assessment of Risks and Opportunities) says that the organisation shall establish, implement, and maintain a process (es) for hazard identification that is ongoing and proactive.

ISO 45001:2018, Clause 7.2 (Competence) stipulates that the organisation must identify the requisite competencies of employees, ensure their competence, implement measures to acquire, and sustain the necessary competencies (when applicable), and retain suitable documented evidence of competence.

It clearly shows ISO 45001: 2018 compliance on human factors in its hazard identification, training, and competence as a part of BBS processes. It helps organisations to implement ISO 45001: 2018 clauses to meet BBS requirements. A BBS method facilitates worker participation in hazard identification, risk assessments, and mitigation strategies, while also enhancing their awareness of both risky and safe behaviours. BBS facilitates the preservation of both safe and risky behaviours, which can be quantified through the documentation of the observation process. This will help to improve from time to time by seeing the progress.

2.12 Impact of BBS on Organisations:

Behaviour-Based Safety (BBS) represents a contemporary and effective methodology for enhancing workplace safety. It does not entail micromanagement at any level; rather, it emphasizes continuous education. BBS involves repeatedly approaching an employee and making random observations until they start safe work.

Behavioural Safety addresses below mentioned ten areas to avoid unsafe and encourage safe behaviour:

1. Personal Protective Equipment (PPE)
2. Housekeeping
3. Using Proper Tools & Equipment
4. Body Positioning and Protection when at Work
5. Material Handling
6. Communication
7. Properly Following Procedures
8. Visual Focusing
9. Use of Mobile Phone when at Work
10. Road Safety

Fig. 2.6: Wheel of BBS

With the help of the BBS Observation Card (mentioned in *Appendix - 10*), BBS-trained observers collect data on these ten parameters. Each observer provides feedback to at least one of their co-workers daily. This makes safety a daily practice and helps to build a safety climate and then safety culture. The frequency of daily inspections can be adjusted based on the observation of risky and safe behaviours by establishing a database.

Employees are the fundamental source of expertise in behavioural modification (observe and rectify). BBS begins with briefing sessions for all operational areas and departments. BBS is a company-wide initiative driven by employees, with minimal enforcement required from upper management. The objective is to recognize safe and hazardous behaviours, as well as potential scenarios that may result in accidents and injuries. These risks are to be communicated to employees, and then solutions. An implementation team will monitor this entire cycle process.

Basically, BBS is an employee-driven approach supported by the management. The safety of employees cannot be left to just the Fire & Safety department in an organisation, and BBS therefore makes sure that every employee in an organisation is made responsible for his or her safety at the workplace.

2.13 Key Insights on Behaviour-Based Safety (BBS):

i) **Safety prospers on visibility and feedback:**
Noticing and discussing both safe and risky behaviours on the job creates a stronger safety culture. Correcting unsafe acts promptly and reinforcing good ones leads to lasting improvement.

ii) **Recognition encourages repetition:**
People are more likely to repeat safe behaviours when they are appreciated. Whether it is praise during meetings, quick verbal recognition, or celebrating milestones, acknowledgement drives consistency.

iii) **Training gets things ready, but habits decide the outcome:**
Skills from the training classroom need reinforcement on the job. Daily observation and constructive guidance ensure that safe habits replace risky ones.

iv) **Mindset drives actions:**
Behaviour is what we see, but it is shaped by attitudes, values, and priorities that are not visible. Addressing both internal and external factors is essential for sustainable safety.

v) **Safety is both personal and social:**
Individual choices matter, but so does the influence of team culture. Effective programs strengthen personal responsibility and collective accountability.

vi) **BBS complements, not replaces, other safety systems:**
Hazard controls, incident investigations, and engineering controls are vital. BBS adds a people-focused layer to address risks that systems alone cannot eliminate.

vii) **Measuring change makes progress visible:**
Surveys, climate assessments, and awareness checks before and after BBS implementation help track its real-world impact.

viii) **One size does not fit all:**
Every workplace has unique hazards, workflows, and cultures. BBS works best when adapted to local needs rather than applied as a generic formula.

ix) **A practical flow for behaviour improvement:**
Identify the behaviour to address → Observe it in action → Intervene with support or correction → Check later if the improvement happened.

x) **Proven benefits go beyond statistics:**
BBS not only lowers accident rates but also boosts teamwork, trust, and engagement among employees.

xi) **Small acts can prevent big losses:**
Safer behaviours reduce injuries, illnesses, and lost time, saving both human and financial resources.

xii) **Data matters:**
Systematically recording, analyzing, and sharing observations ensures trends are spotted early and everyone stays informed.

xiii) **A culture of care:**
BBS promotes looking out for oneself and co-workers, stepping in to prevent harm before it occurs.

xiv) **The aim: prevent harm before it happens:**
Early identification and correction of risky behaviours prevent them from turning into incidents.

xv) **Peer involvement is powerful:**
Co-workers often notice unsafe behaviours faster than supervisors. Peer-to-peer feedback builds trust and encourages change.

xvi) **It is a journey, not a rulebook:**
BBS is about gradually shifting habits through education, reinforcement, and consistent support.

xvii) **Built on trust, not fear:**
The process works best when it is free from blame, focused on solutions, and encourages open dialogue.

xviii) **Bottom-up momentum:**
Employee-driven safety improvements are often more lasting than changes imposed from the top.

xix) **Rooted in behavioural science:**
Drawing from psychology, human factors, and workplace culture research, BBS creates safer habits through evidence-based strategies.

xx) **Consistency turns change into culture:**
Safety behaviours become second nature when they are reinforced consistently across all shifts, teams, and situations. Irregular enforcement sends mixed messages, but steady, fair application builds a shared standard everyone can trust.

2.14 Summary:

The significant outcome of the BBS programmes is that they would make an impact on changing the safety approach. Again, intervention with a positive attitude and feedback measures would produce large-scale enhancement in safety performance. Though, it is a gradual process in foreseeing a progressive outcome but leads to regular reduction in injury incidences. This results in an increase in efficiency, productivity, morale, and profitability of an organisation.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *Behaviour-based safety focuses intervention on observable behaviour.*

□ a) True

□ b) False

2. *Behaviour-based safety looks for internal factors to understand and improve behaviours.*

□ a) True

□ b) False

3. *Behaviour-based safety focuses on _____________ consequences to motivate behaviour.*

4. *Safety in the workplace is a combination of three measurable components:*
i) Environment ii) Accidents iii) Worker iv) Behaviour

□ a) i, ii & iii

□ b) ii, iii & iv

□ c) i, iii & iv

□ d) i, ii & iv

5. *Lack of motivation often centres on attitudinal problems.*

□ a) True

□ b) False

6. *The majority of programmes and processes do not address human behaviours.*

□ a) True

□ b) False

7. *What is the first implementation phase of Behaviour-based safety?*

□ a) Educate and train observers.

□ b) Assess the safety culture.

□ c) Educate and train employees.

8. *The corporate safety culture should ___________ employees to set and achieve their own goals.*

9. *In Behaviour-Based Safety can behaviours be defined in relation to work practices, training, and equipment.*

□ a) True

□ b) False

10. *Behaviour based safety focuses on at-risk behaviours that can lead to ________________.*

: (1.b, 2.b, 3.positive, 4.c, 5.a, 6.b, 7.b, 8.guide, 9.a, 10.injury)

REFERENCES

1. Cooper, D. (2009). *Behavioral Safety: A Framework for Success*. BSMS Publishing.
2. Rodgers, M. D., & Blanchard, R. E. (1993). *Accident Proneness: A Research Review*. Federal Aviation Administration, Civil Aeromedical Institute.
3. Heinrich, H. W. (1941). *Industrial Accident Prevention: A Scientific Approach* (4th edition). McGraw-Hill Book Company Inc.
4. Online Safety Trainer. (2023). *Safety Leadership and the ABC Model for Influencing Behavior*.
5. International Organisation for Standardization (ISO). (2018). *ISO 45001:2018 – Occupational Health and Safety Management Systems – Requirements with Guidance for Use*.
6. Greenwood and Woods (1919) – UK study on workers in an ammunitions factory, introducing the concept of "Accident Proneness."
7. Kaila H. L. Dr. (2017). *Behaviour Based Safety in Organizations Saving Life Before the Accident* (Second Edition). I. K. International Publishing House Pvt. Ltd., New Delhi.
8. ISMS Standard – 1009. *Behaviour Based Safety*. Indian Oil Corporation Limited, Refineries Head Office, Scope Complex, Core – 2, 7-Institutional Area, Lodhi Road, New Delhi – 110 003

* * *

Chapter – 3

Near-miss Reporting System

- An Ideal BBS Tool

CHAPTER – 3

NEAR-MISS REPORTING SYSTEM – AN IDEAL BBS TOOL

3.0 Introduction:

There are many incidents, small & large, that occur in day-to-day work in the industries. These incidents may not always result in injury or even death. There are many close saves. These incidents may have all the components that could have resulted in an accident. But there was no injury because of the time factor (the person was not present at the time), the location factor (the person was not present at that location), some type of protection measures taken (like using PPEs), or mere luck. These incidents are very significant from the point of view of the safety management system. These can give a very good indication of the strengths and weaknesses of the safety management system. Hence, these incidents are categorized as near-miss incidents.

Fig. 3.1: Example of Near-miss

3.1 What is Near-miss?

Occupational Safety and Health Administration (OSHA), USA terms near-miss instances "close calls" where a worker could have been hurt, if the conditions had been different. According to OSHA, reviewing these accidents allows employers and workers to discover operational hazards and safety and health program deficiencies.

3.2 Hi-Potential Near-miss:

Hi-Potential or Hi-Po near-miss is a concept that is gaining popularity in recent times. Hi-Po incidents are those incidents that have the potential to be converted into a major accident. These incidents need proper review.

The Risk Matrix for selection of incidents as Hi-Po is mentioned in below table.

Table - 3.1

Consequences			
Code	**Injury**	**Property Damage (Fire/Explosion/Others)**	**Environmental Loss**
A	Fatality/Permanent Disability	Plant/Unit shutdown/ Loss more than 50 Lacs.	Breach of law.
B	Loss Time Accident 48 hrs. or more	Where loss is more than 5 Lacs. but less than 50 Lacs.	No Breach of law, but media attention.
C	Loss Time Accident less than 48 hrs.	Where loss is more than 2 Lacs. but less than 5 Lacs.	No Breach of law, no media attention, but neighbour complaint.
D	First Aid	Where loss is less than 2 Lacs.	Loss/Complaint within the boundary.

Note: The values in the above table are only examples and may vary across industries.

Table - 3.2

Probability	
1	Incredible (No record of such accident)
2	Unlikely (One cannot rule out)
3	Likely but not frequently (expected)
4	Frequent (Certain to happen no. of times)

Consequence - Probability (Risk) Matrix:

Table - 3.3

A	A1	A2	A3	A4
B	B1	B2	B3	B4
C	C1	C2	C3	C4
D	D1	D2	D3	D4
	1	**2**	**3**	**4**

IDENTIFICATION OF BLOCKS AS PER MATRIX

Incidents falling under A1, A2, A3, A4, B3, B4, C4 & D4 (shaded blocks) shall be considered under High Potential (Hi-Po) Near-miss Incident category.

Examples:

i) We will take an example of a case where consequence is B and probability is 3. Hence, the identification of the matrix will be B3, which will come under the Hi-Po incident.

ii) We will take another example where consequence is D and probability is 1. Hence, the identification of the matrix will be D1, which will come under Non-Hi-Po incident.

The above two examples are mentioned in the below table.

Table - 3.4

Sr. No.	Description	Code	Remarks
1.	Consequences	B	--
	Probability	3	--
	Identification of Matrix blocks	B3	Hi-Po
2.	Consequences	D	--
	Probability	1	--
	Identification of Matrix blocks	D1	Non-Hi-Po

3.3 Unsafe Acts/Practices:

Unsafe acts are those practices that are done in such a manner that can cause an accident or injury. Procedures are laid down for every activity in an industry. They can be general (like the use of PPE) or specific (like following SOP). These include safety embedded into them. They need to be followed in their true sense to complete the job safely. Failing to follow these procedures will jeopardize safety and can cause accidents.

3.4 Unsafe Conditions:

Unsafe conditions are those conditions that are present at a worksite which can create a hazard. In the earlier times, it was considered that unsafe conditions were predominant at the worksite, and they were the major causes of accidents. But studies have shown that unsafe conditions can be further drilled down. Unsafe conditions are created by action or inaction by any personnel and are therefore considered as unsafe acts only.

3.5 The Safety Pyramid:

One of the intensely entrenched legends of the safety profession is Herbert William Heinrich's "Safety Pyramid." Based on Heinrich's research during the 1930s, he suggested that for every 330 accidents, 300 would result in no injuries, 29 would result in minor injuries, and 1 would result in a major injury/fatal injury.

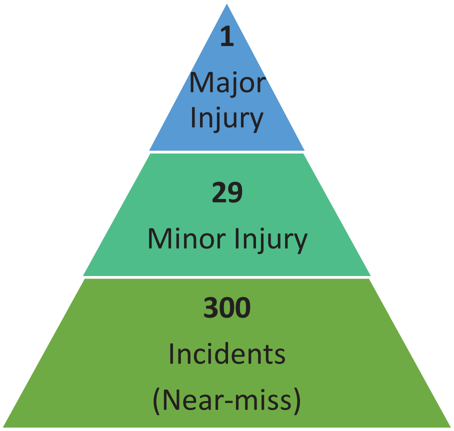


Fig. 3.2: Safety Pyramid

In 1966, Frank Bird contributed to the theory based on his analysis of over 1.7 million accident reports from almost 300 companies. He produced an amended triangle that showed a relationship of 1 serious injury accident to 10 minor accidents, to 30 property damage incidents, to 600 near-misses. These studies have been the basis for the design of a Safety Management System since then.

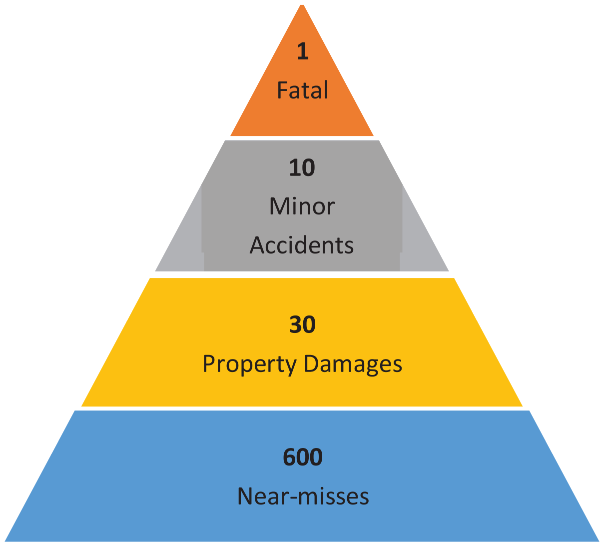


Fig. 3.3: Frank Bird Triangle

3.5.1 Position of Near-miss in Safety Pyramid:

As we have already seen, Heinrich's safety pyramid was one of the earliest works in the field of quantitative representation of safety statistics. The theories derived from this work suggested near-miss incidents as the lowest level of the safety pyramid.

3.6 At-Risk Behaviours:

In 2003, in the ConocoPhillips Company, a similar study was conducted demonstrating a large difference in the ratio of serious accidents and near-misses. The study found that for every single fatality there are at least 300,000 at-risk behaviours, defined as activities that are not consistent with safety programs, training and components on machinery. These behaviours may include bypassing safety components on machinery or eliminating a safety step in the production process that slows down the operator. With effective machine safeguarding and training, at-risk behaviours and near-misses can be diminished. This also reduces the chance of the fatality occurring, since there is a lower frequency of at-risk behaviours. The variation can be explained by time or distance – For example, the injury was missed by one second or by one centimetre.

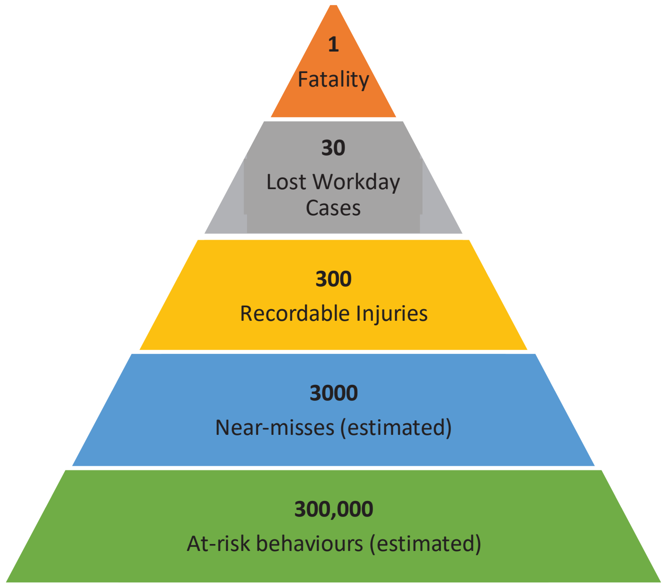


Fig. 3.4: Example of At-Risk Behaviours

As the studies continued, researchers have identified that near-miss incidents are no longer the lowest level of the safety pyramid. Instead, this level represents unsafe acts, conditions, and behaviours that can lead to major incidents. Examples include not using proper PPE, not following SOP, or ignoring safety rules. Thus, at-risk behaviours play a vital role in deciding the cause of major incidents.

3.7 How Many Near-misses Should We Expect?

From the above, it is clear that near-miss incidents need to be obviously identified and analysed. But the near-miss reporting system cannot be limited to only near-miss incidents. If we want to really understand the condition of the safety management system, we need to further drill down and start to capture unsafe conditions and acts before they are converted into near-miss incidents. This creates a very uphill task for the safety managers to capture, analyse and take the inference out of the huge number of unsafe acts and conditions. So, it is important to prioritize the near-miss incidents reported.

3.8 Management of Reports:

In this digital era, near-miss reporting is essentially done in an on-line system. As compared to the pen and paper system, on-line reporting can enable us to manage a large number of incidents and effectively keep records, analyse and come to reasonable inference in a very fast manner.

The main question coming in this context is 'What is a near-miss?' As the system gets opened for all personnel to report, personnel tend to report all the observations made by them at the site in the near-miss reporting software. This will create a nuisance of data in the system. Such a huge number of data will be very difficult for the personnel to review and reach a conclusion. If the system is open for reporting of unsafe acts and conditions, the situation will be more difficult. Users will report all types of observations in the system that they observe at the site. The number of incidents thus reported in the system will be in the number of thousands per month.

The first step in dealing with the situation is to educate users on what to report and what not to. Users are to be trained in understanding what is to be reported as a Near-miss, Hi-Po Near-miss, Unsafe Act/Practice, and Unsafe Condition. The same shall be prominently displayed in the work site so that they are familiar with the requirements. Workers shall be given a simple checklist to understand, if an observation comes into any of the above-mentioned categories.

The second step is to add a self-checklist in the system. The user reporting the incident shall first do a self-check of the observation to decide, if the observation is a Near-miss or Hi-Po Near-miss or Unsafe Act/Practice or Unsafe Condition. This can be done by asking some simple questions on the severity and frequency of the observation. The observation is to be reported only, if it has some type of frequency & severity to be turned into an accident.

In the next step, the user shall select the incident as a Near-miss or Hi-Po Near-miss or Unsafe Act/Practice or Unsafe Condition while reporting in the system. The system shall treat the observation differently based on this selection. If it is reported as a Near-miss or Hi-Po Near-miss, the system shall trigger a notification for proper investigation. Whereas, if the observation is an Unsafe Act/Practice or Unsafe Condition, it shall be investigated by the area in charge and closed the same after taking necessary actions.

The next step is the cross check by the area in charge. Here the area in charge shall review the incidents especially those reported as Near-miss or Hi-Po Near-miss to ensure that these incidents are worth reporting and will take further actions accordingly.

3.9 Feedback to Employees:

Employees must receive feedback on near-misses to promote reporting. Employees should receive feedback on the types of near-misses reported and the measures taken as a result.

Several techniques can achieve this purpose, including the following:

- Displaying statistics of Near-misses at the Main Gate of the Industry (the figures of the number of near-misses reported each month, including type, e.g., Low Priority - 20, Medium - 10, and Hi-Po - 3).
- Displaying on departmental Notice Boards.
- Highlighting in monthly company bulletin, newsletter, etc.
- To discuss in monthly review meetings.
- Analysis of the reported incidents to be shared – In Sectional Safety Committee Meeting (SSCM), Monthly Management Safety Committee Meeting (MSCM) etc.
- Sometimes, if no action can be taken, the same is to be communicated to the employee with a valid reason to encourage the employee to further report. The investigation may show that the incident poses little risk, that further data is needed, or that a refit, layout change, or equipment replacement is needed to remove the hazard.

3.10 Near-Miss Management Process:

Near-miss incident reporting has a step process. Following are the different steps:

Step 1: The person observing the NM/USA/USC at the site reports the same in the system. This system shall be such that any person such as Employee, Outsourced Workers, Visitors etc. can use the system to report the incident.

Step 2: Once the NM/USA/USC is reported, it shall go to the owner/manager of the area where the incident is reported. This person is responsible for ensuring that incident reported is properly analysed, an action plan is prepared, and the points are complied with at site. So, the area in charge shall analyse the incident and create an action plan accordingly. If the incidents are critical in nature (Hi-Potential), the analysis shall be done by the committee with suitable recommendations/action plans. The committee will be formed by top management with officials from different disciplines/departments.

Step 3: The recommendations/action plans shall then be forwarded to the service departments for implementation at site. The service departments shall do the necessary works at site for compliance of the recommendations/action plans. Upon completion, service departments shall acknowledge the same in the system.

Step 4: Then this will be reviewed by the area in charge and confirmed by closing the near-miss in the system, if work is done.

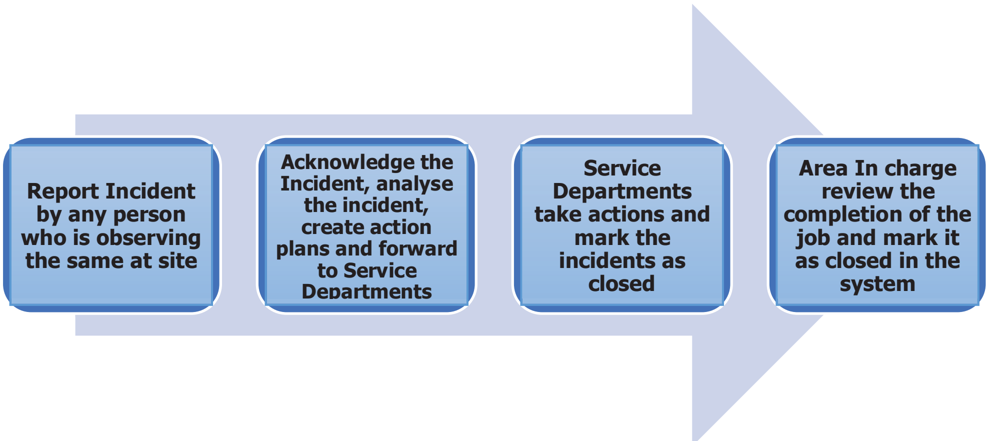


Fig. 3.5: Near-miss Management Process

3.11 Prevention of Future Incidents:

As mentioned, near-misses are incidents that have all the 'recipe' to cause an accident but did not get itself converted into an accident. This is a clear indication of the lapse in the system. If we investigate them and find out the immediate and root causes of these incidents, we can rectify them and prevent future incidents.

It is also a very good practice to include reporting of Unsafe Acts/Practices and Unsafe Conditions in the near-miss reporting system.

3.12 Best Practices in Near-Miss Reporting System:

The best practices to establish a Near-miss reporting system are:

- *Awareness:* The first and foremost factor is awareness of employees for reporting near-miss incidents. It should be very clear to them, "Why" they should report near-miss incidents.
- *Training:* The next step is to impart sufficient training on "How" to report near-miss incidents. If employees are not very conversant with the procedure of reporting, they may lack interest in reporting.
- *Leadership:* Area in charge of plants must take the lead role for encouraging reporting of near-misses. The benefits and status of near-miss reporting must be discussed in daily Zonal meetings to encourage participation.
- *Analysis:* The reported near-misses are to be analysed properly and discussed in monthly management review meetings.
- *Recognition:* The employee who reports the maximum number of near-misses and good quality near-misses is to be identified and awarded in front of other colleagues. In some industries, they are awarded in monthly Management Safety Committee Meeting (MSCM), and in other industries, they are awarded at Monthly Safety Day (MSD) programs held on the first working day of every month etc.

3.13 Beyond Near-miss Reporting System:

The near-miss incident management system is a very important information tool for management. It gives the management a tool for identifying the progress of the safety management system at the shop floor level. Integrating the Unsafe Acts/Practices & Unsafe Conditions reporting with the near-miss system gives the workers an excellent platform to raise concerns over the sub-standard conditions and practices prevailing in their worksite to the management. Similarly, management can use this tool to measure the understanding of their employees of the safety management system.

Nowadays, the near-miss incident reporting system has become an integral part of the safety management system. For many systems like Process Safety Management, Near-miss Reporting & Analysis is a pillar of its implementation. Many national and international certifications require that several near-miss incidents reported are to be reviewed as per the certification program.

3.14 Encouragement to Report Near-miss:

Worker participation is a very important factor in ensuring the success of the near-miss reporting system. Personnel from all the sections shall use this system to report the Near-misses, Unsafe Acts/Practices & Unsafe Conditions to ensure maximum effectiveness of the system. For this to happen, there shall be some types of management system that needs to be in place. Some of the common tools that can be used are:

i) Include near-miss reporting and closing in the HSE part of the performance of the company.

ii) Include near-miss reporting in the performance appraisal of the personnel working in the company.

iii) Periodically review the reported incidents and provide feedback to the personnel reporting the incidents so that there is always an improvement in the system.

iv) Put some incentive schemes in place to reward personnel reporting high numbers and good quality near-miss incidents.

3.15 Significance of Near-miss Reporting:

The reporting of near-miss incidents depends on every employee working in the organisation. To maintain a good safety management system, everybody requires being attentive towards unsafe acts/practices and unsafe conditions which plays a critical role. The safety standards of an organisation can be explained as the “Position on the Bradley Curve” in terms of “how a worker is anticipated to behave” is mentioned below:

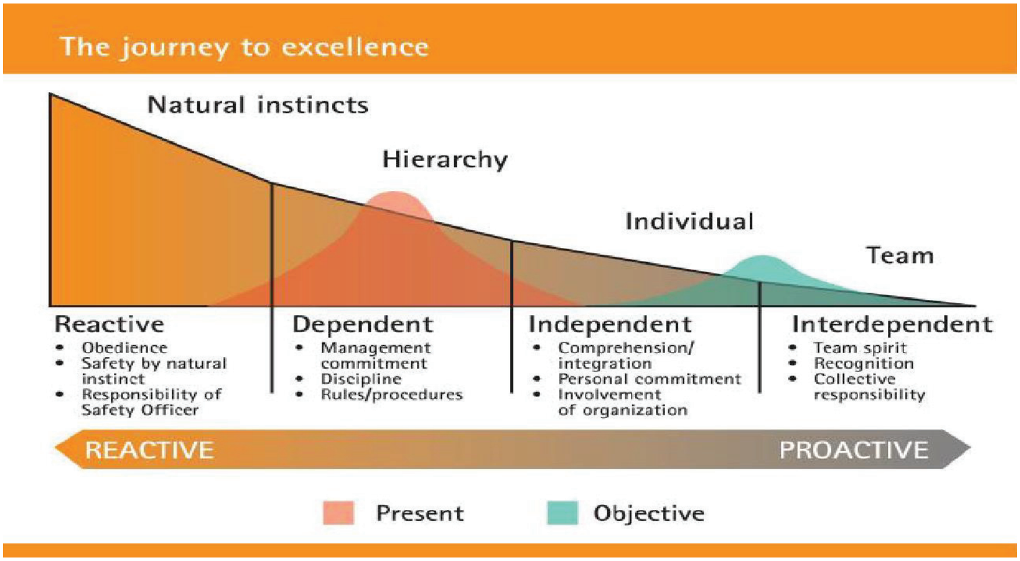


Fig. 3.6: Bradley Curve Model

i) **Reactive:** No one takes responsibility. They believe safety is luck rather than management and that "incidents will happen." And they do it over time.

ii) **Dependent:** People think safety is following others' rules. Incident rates drop, and management feels safety can be managed "if only people would follow the rules".

iii) **Independent:** "Individuals accept responsibility." People believe safety is personal and that their actions matter. This reduces instances further.

iv) **Interdependent:** "Employee teams accept safety and accountability for themselves and others." Low standards and risk-taking are rejected. They communicate to others to comprehend them. They believe zero injuries and meaningful improvement are attainable only together.

Most of the organisations are covered by the reactive/dependent type of practice and thus the exclusivity of success in applying approach differences must be noted. Irrespective of the behaviour and safety practice of workers, the responsibility is of management to force the preferred one.

The managers of organisations have a very significant role to play in near-miss reporting as they generate the surroundings where the job will be executed, and their activities will set an example. Hence, top administration must be seen as visibly dedicated to the procedure and in addition keenly support and promote reporting.

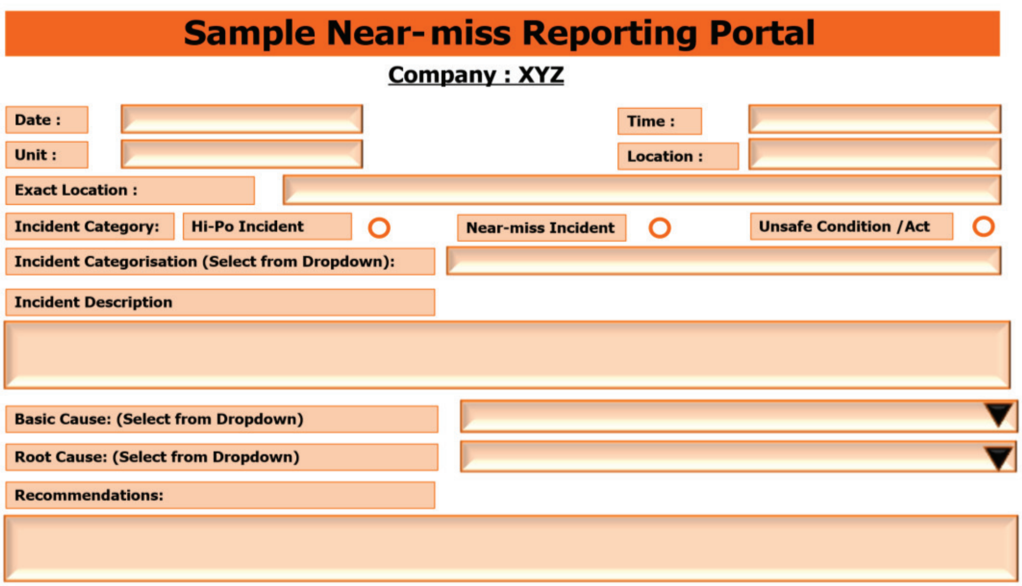
It is also significant to see that only being dedicated to practice is not sufficient, but to see all aspects.

3.16 Best Practices from Award-Winning Industries:

Different organisations have different types of near-misses reporting management systems. We will discuss here one sample near-miss reporting system of an Oil & Gas Industry for better understanding:

3.16.1 Near-miss reporting Procedure for Employee:

Almost all industries have now-a-days moved to an on-line near-miss reporting system. There is an internal near-miss reporting portal in the company, where the employees can report the incidents. They can login using their personal login credential to report any incident.


Sample Near-miss Reporting Portal

Company : XYZ

Date :

Time :

Unit :

Location :

Exact Location :

Incident Category: Hi-Po Incident

Near-miss Incident

Unsafe Condition /Act

Incident Categorisation (Select from Dropdown):

Incident Description

Basic Cause: (Select from Dropdown)

Root Cause: (Select from Dropdown)

Recommendations:

Fig. 3.7: Sample Near-miss Portal

There are many terms associated with the reporting of near-miss incidents on-line:

1. **Person Reporting:** He is the person who is reporting the near-miss incident in the system. He can be an employee, contractor worker or visitor. Many companies have different systems for different groups. For example, the company employees can report the near-miss through the on-line near-miss

reporting system in the portal. They are given unique login credentials so that the person reporting is easily identifiable. If required, the details of the person reporting the near-miss will not be disclosed.

Many companies follow separate procedures for reporting near-miss incidents by contract workers and visitors. In some places, a modified version of the on-line system is used where they can report the incidents. Whereas, in some places, the old pen and paper reporting is still used for near-miss reporting by contract personnel and visitors. They report the near-miss by writing down the incident details in the prescribed format provided (Sample format is attached as *Appendix – 1*). These formats are then handed over to respective areas in charge or put in collection boxes kept at strategic locations. As a matter of fact, the role of a person reporting the incident is much more than mere reporting. Actually, what he is doing is submitting an FIR of the incident. Here, he does an analysis of the incident and provides possible causes and preventive actions also. This acts as a guide for the people who further process the incidents.

2. **Area in charge:** The Person responsible for closing of near-miss is decided based on the ownership concept. The person in charge of the operation department is normally considered as the owner of that plant. This is used not only for near-miss reporting systems, but also for other safety management systems i.e. work permit system, BBS reporting system, Safety Observation Visit (SOV), etc. He is the one responsible for analysing the incident and identifying the basic and root causes. He reviews the incident reported and suggests the corrective actions required and forwards the same to concerned service departments.

3. **Hi-Po Reviewing Authority:** As already mentioned, Hi-Potential near-miss incidents need to be further reviewed. This incident is reviewed by a person who is in a higher grade of the plant in charge. This person will review the incident and decide to further progress on investigation or not. In general, Head of the Department (HOD) of the concerned area are assigned for this job.

4. **Investigation Committee:** Whenever a Hi-Po incident is reported and confirmed by HOD, it is investigated by a committee. The committee will consist of members from various departments. Sometimes, the committee is predefined on an area-wise basis with due approval from top management.

3.16.2 Near-miss Reporting System:

1) **Reporting Procedure:**

Near-miss reporting is started by any person observing the same at site. He immediately reports it on an on-line portal within the stipulated time frame (normally 24 to 48 Hours). While reporting, he normally has to mention the following:

i) Area: Area where the incident occurred.
ii) Exact Location: The precise location of the incident.
iii) Date & Time
iv) Category of the Incident: USA/USC/NM/Hi-Po NM
v) Incident Description: Brief description of the incident.
vi) Classification of the Incident: To enable easy analysis of the incident, USA/USC is further subdivided into different categories. The common classifications used are:

a) **Unsafe Acts (USA):**

i) Non-Adherence to SOPs
ii) Use of Defective Equipment
iii) Violation of Safety Norms
iv) Unauthorized Activity
v) Non-use/Improper use of PPEs
vi) Lack of Knowledge
vii) Failure to Warn/Secure
viii) Slip/Trip/Fall
ix) Improper Material Handling

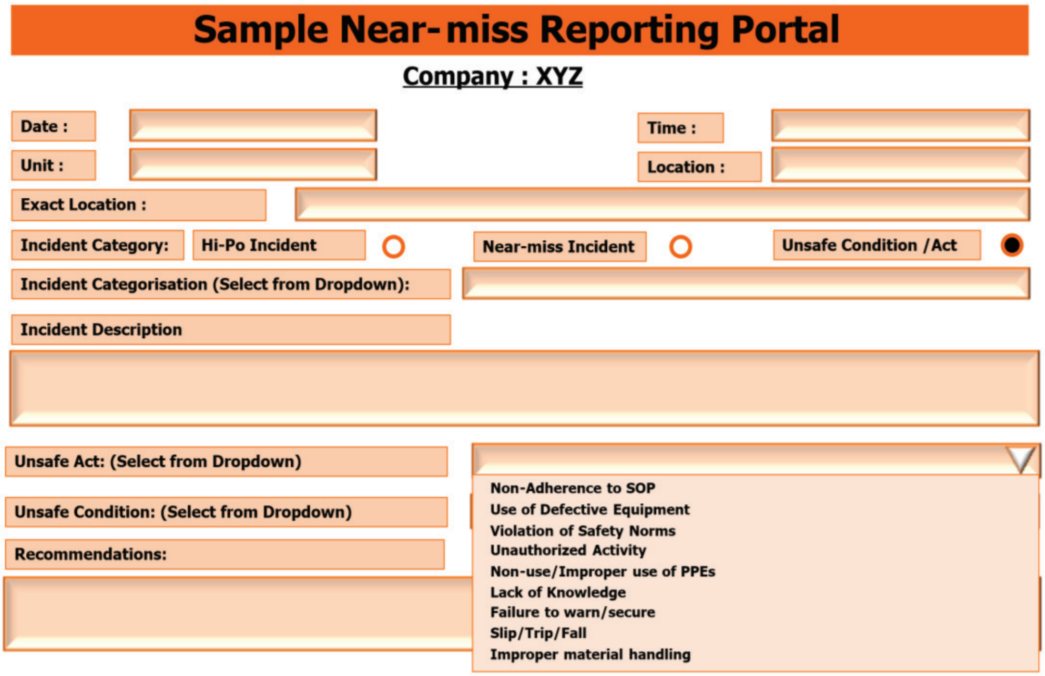
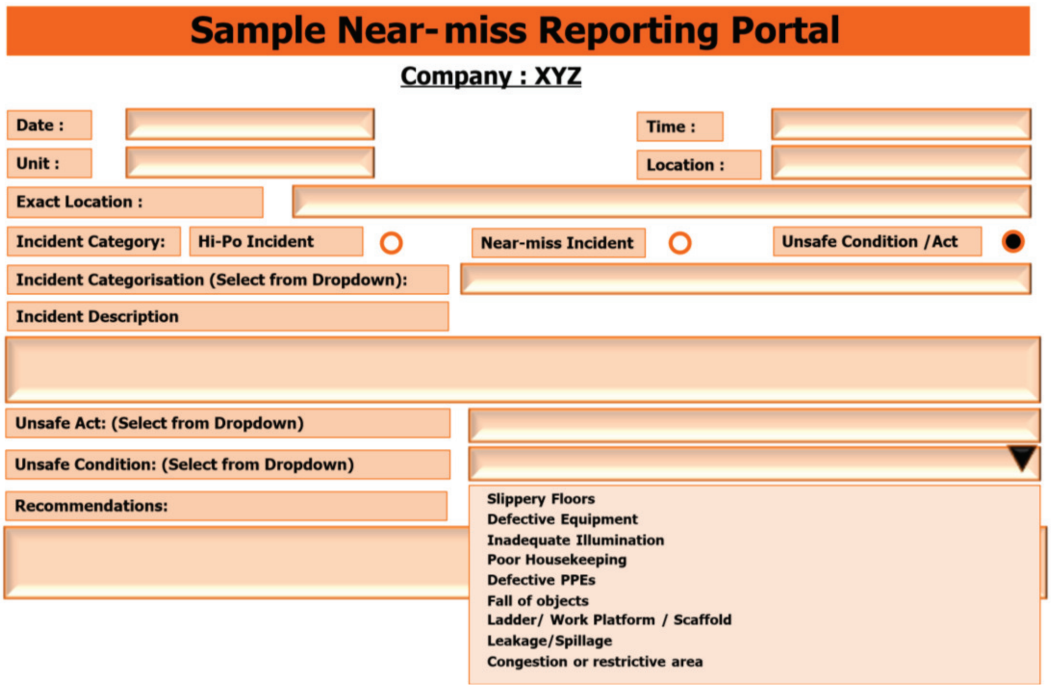


Fig. 3.8: Sample Near-miss Portal for Unsafe Acts

b) **Unsafe Conditions (USC):**

i) Slippery Floors
ii) Defective Equipment
iii) Inadequate Illumination
iv) Poor Housekeeping
v) Defective PPEs
vi) Fall of objects
vii) Ladder/Work Platform/Scaffold
viii) Leakage/Spillage
ix) Congestion/Restrictive Area



Sample Near-miss Reporting Portal

Company : XYZ

Date :

Time :

Unit :

Location :

Exact Location :

Incident Category: Hi-Po Incident | Near-miss Incident | Unsafe Condition /Act

Incident Categorisation (Select from Dropdown):

Incident Description

Unsafe Act: (Select from Dropdown)

Unsafe Condition: (Select from Dropdown)

Recommendations:

Slippery Floors
Defective Equipment
Inadequate Illumination
Poor Housekeeping
Defective PPEs
Fall of objects
Ladder/ Work Platform / Scaffold
Leakage/Spillage
Congestion or restrictive area

Fig. 3.9: Sample Near-miss Portal for Unsafe Conditions

This classification of incidents has the following advantages:

i) The person reporting will have a basis for identifying the nature of the incident.

ii) The person reviewing the incident can use this classification to prioritize the incident.

iii) This classification provides an excellent tool for classification and analysis of the observations.

iv) This classification provides details on the area of concern for management to review.

Again, the person reports near-miss has to go through the following two steps:

i) **Basic Analysis:** Here, the person reporting the incident does a basic analysis of the observations. He analyses the observation and gives basic and root causes of the incident. The basic and root causes are normally predefined, and the person reporting the same shall select from the drop-down list.

ii) **Recommendation:** The person reporting the incident also suggests some recommendations for preventing such an incident in future. For Unsafe Acts and Conditions, the recommendation shall be the immediate action to rectify the same at the site. Hence, it is very important. But in cases where a near-miss incident is being reported, the person may or may not be able to suggest the recommendations. In case of Hi-Po incidents also, it may not be possible for the person reporting the incident to suggest remedial measures accurately. This may require the expertise of the multi-disciplinary committee.

2) **Review of the Incident:**

There are two ways an incident to be reviewed based on its category:

i) *Unsafe Acts/Conditions:* They are reviewed by the respective area in charge. He will carry out an internal investigation of the incident and find out the cause of the incident. He will also suggest corrective actions. In some cases, the causes of this incident may be maintenance issues. Such maintenance issues will be resolved by creating maintenance notifications. After creating the notifications, the near-miss will be forwarded to the concerned service departments for taking necessary actions.

ii) *Hi-Po Incident:* Hi-Po incidents are initially reviewed by an officer above the range of the plant in charge. Mostly done by the concerned head of the department (HOD). He reviews the incident and decides whether this incident can be considered as a Hi-Po or not. Once it is decided that this incident can be reported as a Hi-Po, the action is being initiated as per the laid-down procedures. In some organisations, there are provisions for the system to generate a notice/email to the management on reporting of a Hi-Po incident. The FIR is then forwarded to a committee for investigation of the incident. The committee conducts the investigation and submits the report within a stipulated time frame. The recommendations that come out of the investigation are then forwarded to the concerned departments for corrective actions. Also, the recommendations arising out of the investigation of Hi-Po incidents are properly tracked to ensure that they are complied with in a time-bound manner.

3) **Closing of the Incident:**

The near-miss incidents are closed at the site by the service departments. The recommendation of the Hi-Po incident investigation and the corrective actions from analysis of unsafe acts, as well as conditions, are forwarded to the maintenance departments. The maintenance departments make an action plan and complete the recommendations in a time-bound manner. Once the points are completed, the representative from the service departments confirms the same in the system. Once the incident is marked as closed in the system, the system will generate a notification to the area in charge on the same. The area in charge will then ensure that the points are completed to his satisfaction and provide the confirmation in the system and mark the observations as closed and ultimately the near-miss.

4) **Management Review:**

Management review is an important part in the success of any safety management system such as the near-miss system. The progress and outcome of the system shall be constantly monitored. In Oil & Gas industries, the near-miss management system is rigorously monitored at the management level.

5) **Setting Targets:**

Setting targets is very important in ensuring that near-miss incidents are reported and closed. It is to be accepted that reporting near-miss incidents need extra effort on the part of the employees. Hence, if it is not monitored properly, it is very difficult to ensure that they are reported in the first place.

Here are some of the KPIs that can be used to review the progress:

i) *Number of Near-misses Reported:* The most common way to overcome this is to set a target for the number of near-misses to be reported by a section/department. It is commonly decided based on the number of employees in that section. So, the number of near-miss incidents, including unsafe conditions, acts, and practices reported by each section, is reviewed periodically.

ii) *Closure of Near-misses:* Near-miss closure also needs to be reviewed periodically. The number of near-misses reported in each section are to be reviewed by the area in charge and to be closed. Area in charges are given targets in this, and this is monitored by the management on a monthly basis.

iii) *Time taken for closure of Incidents:* Organisations can make a target of how quickly the near-miss incidents will be closed. They can keep a target like maximum 30 days for closure of the incidents depending on the nature of near-miss. So, management will review the number of incidents pending for closure for more than 30 days.

iv) *Reporting of Hi-Po Near-miss incidents:* Some organisations are also giving targets for reporting Hi-Po near-miss incidents. It is due to the fact that in some organisations, Hi-Po near-miss incidents are happening very frequently and by reporting and analysing and taking proper actions, the same can be reduced.

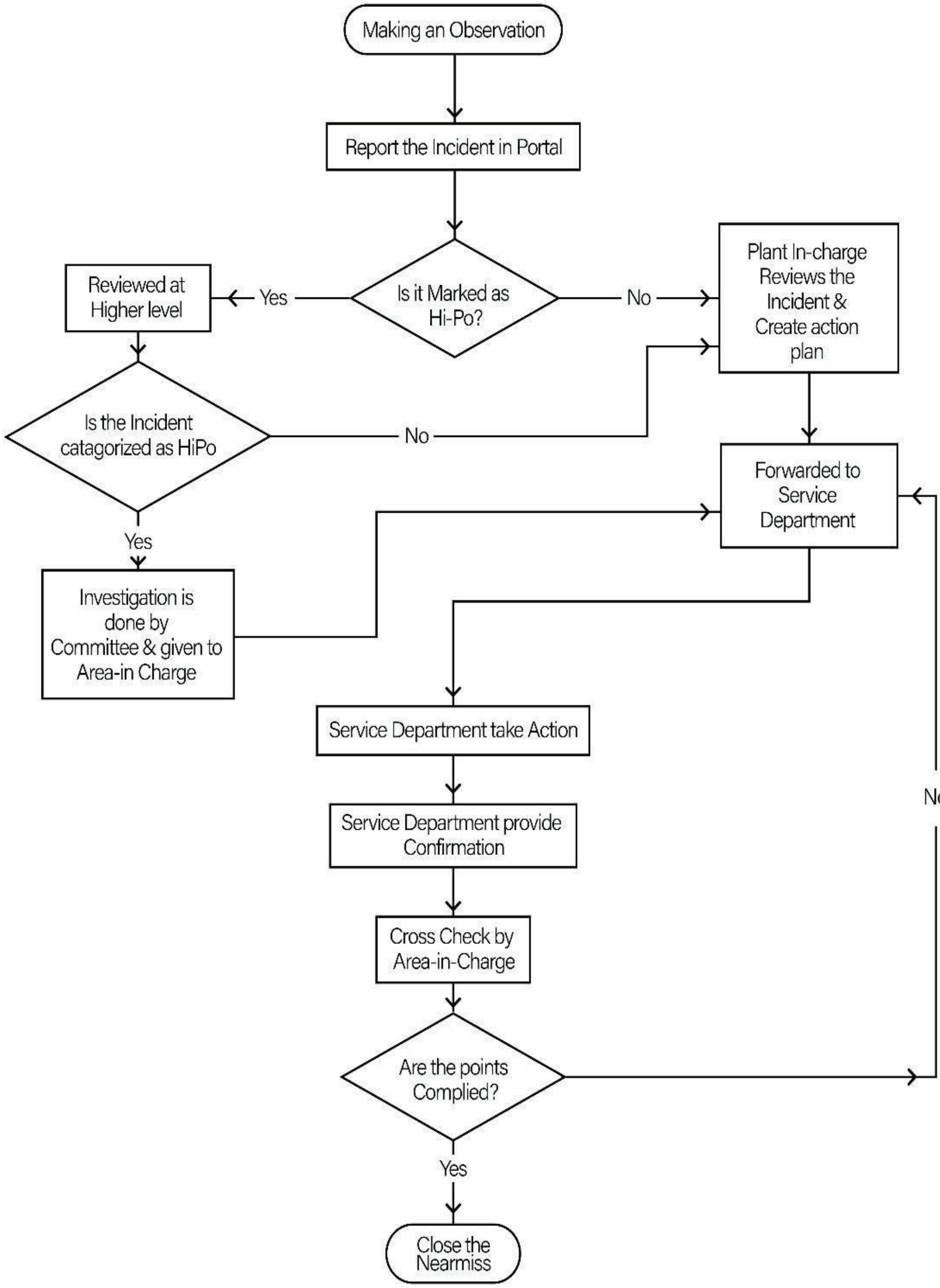


Fig. 3.10: Flow Chart of Near-miss Reporting

3.16.3 Near-miss reporting by Contractor Employee:

In some of the industries, it is not possible to report near-miss in a company's on-line near-miss portal by a contractor employee. In such cases near-miss can be reported through a format available at conspicuous locations inside the plant area. A box to be provided to drop the near-miss formats after filling up. The same to be collected by the Fire & Safety department on a regular basis and make entry for record purpose with analysis.

The format is enclosed as *Appendix – 1.*

3.17 Human Factors in Near-miss:

As we have covered a lot on near-miss reporting & analysis, now let us review the effect of human factors on various steps of near-miss reporting. As there is much human involvement in the near-miss system, the result of the system is highly subjective.

3.17.1 At Reporting Stage:

1. *Understanding the Incident:* When an incident is observed at site, different people perceive it in different ways. A small incident, like oil falling on the ground from a container, can be perceived in different ways by different personnel. One person can see it as a human error whereas another person can see it as a housekeeping issue, and someone else can see it as a near-miss, whereas someone could be seriously hurt due to a slip & trip. So, perception plays a very important role in near-miss reporting.

2. *Intention of Reporting:* Another factor that affects near-miss incident reporting is the mentality of the person who reports the incident. There are two sides:

   a) *Under-reporting:* Under-reporting is among the significant issues with near-miss reporting systems. Firstly, it needs separate efforts from the regular job to report a near-miss incident. Consequently, in many cases, people do not give extra effort to report the near-miss. Secondly, the serious nature of incidents remains unreported merely due to the fear of management. This is the reason why the number of process-related incidents, most of which are very serious in nature, remains unreported. As a result, people tend to report only those incidents in which no person can be blamed. As a result, unsafe conditions get more and more reported, and actual near-misses remain unreported.

b) *Over-reporting:* Many organisations provide a target for the employees to report the near-misses. This forces them to meet the target. As a result, people tend to report many observations that are normally not near-misses. If we analyse near-miss data of some industries, we may find that most reported near-misses are related to housekeeping only. This not only consumes productive work hours but also distorts the analysis results.

3.17.2 At Reviewing Stage:

At the reviewing stage, near-miss is also highly influenced by individual opinion. The perception of the reviewer towards the reported near-miss incident is very important. In case of the Hi-Po incident, it is very important that the person reviewing that too has a good idea of the risk involved & possible outcomes.

Another factor to be considered is the analysis of the incident. It is essential to remain very particular during the investigation of Hi-Po incidents. The team doing the investigation should do the same religiously and come up with the factual result/root cause analysis.

3.17.3 Completing Recommendations and Closing the Incident:

In many organisations, there are time frames and targets for complying with the recommendations and closing the incidents. Sometimes, this leads the personnel to close the near-miss incidents in the system without following up on them at site.

The volume of near-miss incidents reported in the on-line system also plays an important role in this regard. As the near-miss system is extended for the employees to report unsafe acts and conditions, the number of observations reported in the system drastically increases. This makes it difficult for the plant in charge to follow up properly. Once this gets into the habit of the person, he tends to close the incidents that need special attention, too.

3.17.4 Behaviour Aspects of Near-miss Management:

- *Set the requirement:* Decide what we must capture.

- *Set Targets:* Determine how to encourage near-miss reporting without over reporting.
- *Spread Awareness:* There are many fields like Process Safety Management, Behaviour Based Safety-related observations etc. which are not getting reported properly. Personnel shall be trained to identify these incidents and report them.
- *Maintain Trust:* Personnel reporting near-misses shall not be subjected to questioning. The name of the person shall be kept confidential as far as possible.
- *Train the Reviewers:* Reviewers hold a crucial position in the system. They must be properly trained and must be aware of the system.
- *Establish Procedures:* There shall be no ambiguity in the system. It shall be clear on how to respond to the different kinds of incidents and how to go forward.
- *Maintain Effective Communication:* The compliance status of the recommendations and the result coming out of the analysis shall be shared with the employees, as practicable as possible.

3.18 Examples of Near-misses:

Examples of different types of near-misses that could apply to various industries are mentioned below. These can be used as guides to determine when to report and how to describe an event. In each of these scenarios, one can see that the event could have easily led to an injury, if it happened in a different way.

a) **Slips, Trips and Falls:**

i) A worker trips and falls in a dimly lighted space.

ii) A worker falls when attempting to ascend an unstable ladder.

iii) An engineer slips on condensation that has accumulated on the floor but does not fall (this time).

iv) A visitor slips while placing their foot on an uneven drain grating.

v) A trip occurs when an employee endeavours to move around packaging items positioned on the floor.

vi) A coworker slipped over an unmarked step and fell without sustaining injuries.

vii) A visitor slips when walking on an uneven floor.

b) **Risky Behaviour and Horseplay:**

i) A worker endeavours to swiftly retrieve an object left on a steep roof without fall protection measures.
ii) A worker persists in their tasks despite experiencing dizziness and ultimately loses consciousness.
iii) Two workers are throwing spanners and hit a third worker (no injury).
iv) A driver collided with a drum while operating a forklift in a warehouse aisle.
v) A person jumps to a lower level, exerting excessive pressure on the back and knees upon landing.

c) **Narrow Escapes:**

i) A supervisor finds a live and damaged electrical cord lying on the floor prior to any contact being made.
ii) A worker's clothing gets caught in a machine; it tears before an injury occurs.
iii) A worker's leg was briefly entangled between a materials pallet and a support structure.
iv) Before being struck by a hot object carried by another worker down a small passageway, a worker jumps out (narrowly avoiding burn injuries).
v) A hammer that has fallen from a height near a worker without causing any harm or damage to him.

d) **Working at Height:**

i) A worker loses his balance while trying to catch a material that he threw from the second storey roof to the ground floor.
ii) A worker lacking fall protection on a rooftop slips and falls.
iii) One worker falls while leaning over an unsecured beam on a 10-meter platform, but his fall protection PPE catches him.
iv) Inadequately constructed scaffolding starts to collapse as workers climb.
v) Before work starts, a coworker sets up a fall arrester device, and the supervisor notices mistakes.

e) **Signage & Hazard Communication:**

i) A defective indicator light almost caused one worker to come into contact with a very hot surface.

ii) A hazardous material that was temporarily kept in the wrong container is encountered by the supervisor.

iii) Two automobiles in motion nearly collide at an intersection with poor sight.

iv) Electrical work is almost done on a motor that needs to be locked out because of the absence of signage.

v) A work is going on at height without barricading at ground level, causing trespassers to pass unsafely.

vi) Many workers pass through a plant area that is under construction without taking the necessary safety precautions because they have not been informed.

f) **Equipment Operation & Maintenance:**

i) When operating an excavator, a worker fails to look for underground power lines.

ii) An employee tries to manually unclog a hazardous piece of machinery without switching off the machine's power source.

iii) A hydra operator narrowly misses hitting a worker.

iv) When no workers are inside, a wall collapses because a driver is operating a hydra close to a trench.

v) Sparks from poorly maintained equipment fall in ignited materials without causing a fire.

3.19 Summary:

Every industry needs to adopt a near-miss management system that enhances company health, safety, and environmental practices with operational and strategic principles. To improve the near-miss management system, one must pay close attention to the specifics of how near-misses are found, reported, examined, and the timely implementation of the necessary corrective measures. Near-miss system development is most effective when it is first created and built with everyone's help. To lessen the chance of an injury or damage, all records should be kept, and all near-miss situations should be closed. Eliminating blame-casting, looking into near-misses, and putting site-wide reforms into place are all necessary to strengthen the system. Managing all HSE tasks requires a digital platform, which is crucial given the increasing digitalization of all fields. Having a computerized near-miss management system is currently one of the most reliable and complete methods of handling near-misses.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. A near-miss is:

□ a) An incident resulting in an injury or property damage.

□ b) Any unplanned event that did not cause an incident, but could, if conditions were to change.

□ c) A planned event that caused an incident.

□ d) All of the above.

2. According to Heinrich's "Safety Pyramid", approximately how many near-miss events occur for each major injury?

□ a) 50

□ b) 100

□ c) 150

□ d) 300

3. A culture of compliance focuses on regulatory compliance rather than concern for the employee.

□ a) True

□ b) False

4. Fear of retaliation is a major reason why employees may be reluctant to report a near-miss.

□ a) True

□ b) False

5. The benefits of an effective near-miss reporting program may include:

- □ a) Decreased exposure in the workplace hazards.
- □ b) Reduced injuries and related events.
- □ c) Increased employee awareness of safety in the workplace.
- □ d) All of the above.

6. Maslow's hierarchy is a methodology used to address workplace hazards.

- □ a) True
- □ b) False

7. Fear of discipline and employee embarrassment are major barriers to the success of an effective near-miss reporting program.

- □ a) True
- □ b) False

8. What is the purpose of investigating near-misses in the workplace?

- □ a) To find out who is to blame for an accident.
- □ b) To punish an unsafe act committed by an employee.
- □ c) To improve workplace safety and reduce accidents and injuries.

9. A high-potential near-miss is an incident that could have resulted in a severe injury, lost time injury, a fatality or hospitalization.

- □ a) True
- □ b) False

10. An effective near-miss programs focuses on quality rather than the quantity of near misses reported.

- □ a) True
- □ b) False

11. Near-misses happen how many times more frequently than actual accidents?

- □ a) Twice as often.
- □ b) 10 - 100 times more often.
- □ c) No-one knows.
- □ d) None of the above.

12. A near-miss is ANY incident which could have led to damage of property or injury to an employee but did not.

- □ a) True
- □ b) False

13. 75 % of workplace accidents that happen are preceded by a near-miss incident.

- □ a) True
- □ b) False

14. When should you report a near-miss to your supervisor?

- □ a) Only if there was damage to property or injury to an employee.
- □ b) At your next safety meeting.
- □ c) Immediately.
- □ d) After it happens more than once.

15. An employee injury should be reported as a near-miss.

- □ a) True
- □ b) False

16. When you are involved in a near-miss incident, it is important to cooperate fully in the investigation to assist your supervisor to institute new Safety Rules and Procedures.

- □ a) True
- □ b) False

17. What are the questions that need to be answered in a near-miss evaluation?

- □ a) Why did it happen?
- □ b) What equipment and procedures need to be examined?
- □ c) What can be done to prevent accidents from happening?
- □ d) All of the above.

18. What does the term "root cause" mean?

- □ a) Type of behaviour that resulted in a near-miss/accident.
- □ b) Underlying reasons why hazards exist.
- □ c) To identify the personnel responsible for the near-miss incident.

19. A thorough near-miss evaluation covers both equipment issues as well as employee awareness and training issues.

- □ a) True
- □ b) False

20. Workplace safety and all near-miss and incident investigations require the full cooperation and participation of everyone in the workplace.

- □ a) True
- □ b) False

: (1.b, 2.d, 3.b, 4.a, 5.d, 6.b, 7.b, 8.c, 9.a, 10.a, 11.d, 12.a, 13.b, 14.c, 15.b, 16.a, 17.d, 18.b, 19.a, 20.a)

REFERENCES

1. Heinrich, H. W. (1941). *Industrial Accident Prevention: A Scientific Approach* (4th edition). McGraw-Hill Book Company Inc.

2. Bird, F. E. (1966). *Damage Control: A New Horizon in Safety Management*. Institute Press.
3. Occupational Safety and Health Administration (OSHA). *Near Miss Reporting*. https://www.osha.gov
4. ConocoPhillips Company. (2003). *Safety Performance Study*. Internal Publication.
5. Synesis Consulting. (2023). *Behavioral-Based Safety (BBS) and the ABC Model*. https://www.synesisconsulting.org
6. Oil Industry Safety Directorate (OISD). (2025). *Case Studies on Industrial Safety Incidents*. https://www.oisd.gov.in
7. ISMS Standard – 1008. *Incident Reporting & Investigation*. Indian Oil Corporation Limited, Refineries Head Office, Scope Complex, Core – 2, 7-Institutional Area, Lodhi Road, New Delhi – 110 003

* * *

Chapter – 4

Hazard Identification & Risk Assessment – To Ensure Safety of Workers and Workplaces

CHAPTER – 4
HAZARD IDENTIFICATION & RISK ASSESSMENT – TO ENSURE SAFETY OF WORKERS AND WORKPLACES

4.1 What is Hazard?

Anything in the workplace area that poses a risk of injury involving hazardous chemicals, electrical equipment, working at height, or poor housekeeping practices etc.

4.2 What is Risk?

Risk denotes the likelihood of an undesirable event occurring, frequently characterized by uncertainty and the potential for damage or loss. It quantifies the probability of an adverse result occurring in a specific context or action. Risk fundamentally refers to the probability of adverse events resulting in harm, injury, or other negative outcomes.

Fig. 4.1: Hazard vs. Risk

4.3 Hazard Categories:

Workplace hazards can generally be classified into five categories as mentioned below. Taking into account each category during a hazard assessment will ensure a comprehensive list of hazards:

- **Physical hazards** represent the category of hazards commonly associated with "safety." They include mechanical risks such as entrapment in machinery, crushing incidents, or being run over. Physical hazards also cover risks from falling objects, slips, trips, and falls from elevations. In addition, they involve exposure to various forms of energy, such as electricity, sound, extreme temperatures (both hot and cold), fire, and explosions as well as radiation sources including radio waves, microwaves, ultraviolet light, infrared light, and ionizing radiation;

- **Chemical hazards** involve exposure to fumes, airborne gases, mists, vapours, dust, as well as solids and liquids. The primary routes of exposure include inhalation, ingestion, and skin contact (including contact with the eyes);

- **Biological hazards** involve exposure to living organisms or their by-products. These include animal-related risks such as bites and stings; allergic or toxic reactions from plants and animals (e.g., waste, dander, venom); microorganisms such as mold and mildew; and infectious diseases transmitted through vectors, airborne particles, or bodily fluids;

- **Ergonomic hazards** arise from the interaction between individuals and machines (such as computers, controls, readouts, gauges, and signals) or equipment (including seating and workstation design). They also include environmental factors that affect human performance and comfort, such as illumination, thermal conditions, body posture, and repetitive motion;

- **Psycho-social hazards** consist of factors that affect mental health and well-being in the workplace. These include occupational stress, workplace aggression, monotony, and sleep deprivation.

4.4 Hazard Identification & Risk Assessment (HIRA):

It is a methodical procedure employed to recognize potential hazards in a workplace or process and evaluate the corresponding risks. This approach seeks to manage risks within acceptable parameters, safeguarding personnel, the public, and the environment. HIRA entails recognizing prospective hazards, assessing their possible repercussions, and estimating the probability of their occurrence.

4.4.1 Hazard Identification:

"Hazard Identification (HAZID)" can be defined as the process of identifying risks, constituting the fundamental initial phase of a risk assessment. Identifying hazards has two potential purposes:

i) To acquire a compilation of hazards for further examination utilizing alternative risk evaluation methodologies. This is occasionally referred to as "failure case selection."

ii) To conduct a qualitative assessment of the importance of the hazards and the strategies for mitigating the associated risks. This is occasionally referred to as "hazard assessment."

In the hazard identification phase, the criteria for hazard screening will be defined, and potential hazards and incidents will be assessed. The facility will be partitioned into multiple portions for this purpose. Moreover, the recognized hazards will be categorized as critical or non-critical. It is essential that the threats deemed non-critical are meticulously documented to illustrate that the associated events can be safely overlooked. The identification of failure instances will be executed by the development of checklists, examination of accident and failure data, Hazard and Operability Studies (HAZOPs), or by comparing with extensive research and insights from previous projects.

4.4.2 Risk Assessment:

Risk assessment determines the possibility of workplace injuries, illnesses, or diseases from hazards revealed during hazard identification.

There are specific logical procedures to follow when conducting a risk assessment:

Step 1: Identify Hazards

Identify any threats that could adversely affect the organisation's operational capacity. Potential hazards detected during risk assessments may involve natural disasters, utility outages, cyberattacks, and power failures etc.

Step 2: What or Whom may be harmed?

Identify the business assets that might be adversely affected, if the risk materializes. Business assets considered vulnerable to these hazards may encompass essential infrastructure, information technology systems, operational processes, corporate reputation, and staff safety.

Step 3: Level of Risk and Control Measures

A risk analysis can ascertain the impact of hazards on corporate assets and establish a risk management strategy to mitigate or eradicate these effects on those assets. Additional hazards encompass property damage, business disruption, financial loss, as well as legal penalties.

Step 4: Record the Findings

The concern must document the risk assessment findings and archive them as readily available official records. The records must have information regarding prospective hazards, their corresponding risks, and strategies for hazard mitigation.

Step 5: Review Risk Assessment Regularly

The potential hazards, risks, and their associated controls may vary swiftly in a modern corporate environment. Organisations must regularly revise their risk evaluations to reflect these changes.

4.4.2.1 Types of Risk Assessment:

There exist two categories of risk assessments:

i) *Qualitative:* Probability estimation of an object based on known risk information applied to the relevant circumstances.
ii) *Quantitative:* This type is subjective, reliant on personal judgment, and supported by generic data risk.

Qualitative and quantitative risk assessments are not mutually incompatible. Qualitative evaluations are simpler to conduct and are necessary for legal considerations. A broad risk assessment can be conducted when several types of employment exhibit analogous hazards and hazards across different workplaces or physical environments.

Industries utilize the semi-quantitative method for its clarity and precision in practical applications. This strategy ranks or prioritizes risks by assigning numerical numbers or scores to qualitative risk factors. This risk assessment method combines qualitative and quantitative methods. This method balances qualitative and quantitative risk assessments, making it appropriate for many applications.

4.4.2.2 Importance of Risk Assessment:

Risk assessments are considered essential as they form a core element of an occupational health and safety management plan. They provide assistance in:

- Promote awareness of hazards and risks.
- Identify the individuals who may be at risk (e.g., employees, custodial personnel, visitors, contractors, the public, etc.).
- Determine whether a control system is needed for a specific hazard.
- Evaluate the adequacy of existing control mechanisms and ascertain if further actions are required.
- Avoid injuries or illnesses, particularly during the design or planning stage.
- Rank hazards and implement control measures.
- Adhere to applicable legal requirements as necessary.

4.4.2.3 Goal of Risk Assessment:

The objective of the risk assessment process is to identify hazards and subsequently eliminate or mitigate their associated risks by the implementation of appropriate control measures, as required. This action fosters a safer and healthier work environment.

The objective is to address the subsequent questions:

i) What can happen, and under what circumstances?
ii) What are the possible consequences?
iii) How likely are the possible consequences to occur?
iv) How severe are the possible consequences?
v) Has an adequate level of risk reduction been achieved, or is further action required?

4.4.2.4 Requirement of Risk Assessment:

A risk assessment may be necessary for various reasons, including:

- Before implementing new procedures.
- Prior to the implementation of modifications to current processes or operations, including changes to products, machinery, tools, or equipment.
- Upon the availability of fresh information regarding injury.
- When hazards are identified.
- Before working in a new environment.
- Upon the emergence of fresh information regarding hazard controls or best practices.
- Before undertaking the repair or commissioning of equipment.
- Prior to executing routine or non-routine tasks.
- When the law requires the implementation of a risk assessment.

4.4.2.5 Plan for Risk Assessment:

The different steps for risk assessment planning are:

- Define the parameters of the risk assessment, specifying the aspects under evaluation, such as the product's lifespan, the geographical location of the job activity, or the categories of hazards involved.
- The required resources (e.g., training a team to conduct the evaluation, the sorts of information sources, etc.).
- What specific risk analysis measures would be employed (e.g., the accuracy required for the scale or parameters to yield the most relevant assessment)?
- Who are the associated stakeholders (e.g., managers, supervisors, employees, labour representatives, suppliers, etc.)?
- What applicable laws, rules, codes, or standards exist in your jurisdiction, together with associated organisational policies and procedures?

4.4.2.6 Procedure for Risk Assessment:

In general, to do an assessment, one should:

i) **Assemble a risk assessment team.** Evaluations must be conducted by a qualified individual or team possessing a comprehensive understanding of the subject matter under examination. Integrate the supervisors and employees engaged in the process under review into the team or as informational resources, as they possess the most comprehensive understanding of the operation. Also consult the health and safety committee or representative.

ii) **Select the job or process to assess**. Consult the preceding section, "Requirement of Risk assessment," to assist in prioritizing your evaluations. Risk assessments must be conducted for every position. Positions or assignments characterized by elevated injury and illness rates, employee apprehensions, and additional considerations should be prioritized.

iii) **Break down the job or process into tasks**. Divide the work or process into tasks or basic procedures to understand the risks.

iv) **Identify the hazards of each task**. Upon recording the fundamental procedures or tasks, ascertain the hazards associated with each step or task. Enumerate the hazards derived from observations and inspections, historical causes of incidents and injuries, input from workers and managers directly engaged in the task, and additional factors.

v) **Assess the risk of each hazard.** Assess the probability of harm, including injury or disease, associated with each hazard, as well as its severity. Employ a risk assessment methodology suitable for your workplace. Consider routine operations and exceptional events like maintenance, shutdowns, power outages, emergencies, and rough weather. Review the "Material Safety Data Sheet (MSDS)," manufacturer documentation, data from reputable organisations, testing results, workplace inspection reports, and workplace incident (accident) records to determine the nature and frequency of occurrences, illnesses, injuries, near-misses, and similar events.

vi) **Control the risk of each hazard.** Using the hierarchy of controls, determine how to remove or lessen the risk.

vii) **Evaluate the effectiveness of controls.** Implement a review mechanism to assess the efficacy of monitoring controls.

viii) **Communicate the results.** Risk assessment results must be shared with employees, management, and other stakeholders. Employees must be aware of any occupational hazards and the measures established to ensure their safety. Preserve any pertinent documents or records. Documentation may include the explanation of the risk assessment process, the description of evaluations performed, or the definition of how conclusions were reached.

4.4.2.7 Key Points to Consider During Hazard Assessment:

When doing an assessment, consider the following points:

- The techniques and protocols employed in the processing, utilization, management, or storage, etc.
- The current and potential exposure of employees, including the number of workers at risk, the nature of that exposure, and the frequency of such exposure.
- The measures and protocols necessary to reduce such exposure via engineering controls, work practices, hygiene standards, and facilities.
- The duration as well as frequency of task execution.
- The site of job execution.
- The apparatus, tools, materials, and their utilization in processes, including the physical condition of a chemical or the conveyance of heavy cargo over a distance.
- Possible connections with adjacent activities and the influence of the task on others (e.g., cleaning employees, tourists, etc.).
- The lifecycle of a product, process, or service encompasses design, construction, utilization, and decommissioning.
- The education and training gained by the personnel.
- The typical response of an individual in a particular situation, such as the most prevalent reaction to a machine's failure or malfunction.

It is essential to consider both the present condition of the workplace and any potential scenarios throughout the assessment.

The employer and health and safety committee, if relevant, establish the need and scope of a control program by analysing hazard/risk.

4.5 Hazards Identification – An Example:

Let us consider an example. It may be beneficial to construct a chart or table like the following:

Job Title: Plant Operator

Task: Sampling of Sour Water in Oil Refinery

Table – 4.1

Sr. No.	Steps/Task Description	Hazards	Likelihood	Consequences	Hazard Controls
1.	Inhalation of H_2S gas during taking a sample.	May cause senseless/ death due to inhalation of H_2S gas.	--	--	Use of Respirator/ Gas Mask, Carrying H_2S Gas Detector.
2.	Going for sampling alone.	May not be able to call for help if needed.	--	--	Carrying Walkie-Talkie and H_2S Gas Detector.
3.	Working for long hours.	Fatigue, stress, short rest time between shifts.	--	--	Continuous duty to be avoided to the extent possible.
4.	Slip, Trip during movement inside the plant area.	Injury to body parts.	--	--	PPEs like Safety Shoes, Helmet to be used.

Hazard mapping is a technique for hazard identification conducted by the employees themselves.

All personnel from a designated work area, including supervisors and managers, convene to identify hazard sites on the building's floor plan. Subsequently, the committee deliberates on the management of these hazards and prioritizes their resolution. This method leverages employees' expertise and experience, empowers them, and fosters engagement and collaboration.

4.6 Prioritization of Hazards:

Assessing or prioritizing hazards is a method to identify the most critical hazards and, consequently, which ones to address first. The likelihood of employee exposure to the hazard and the severity of an incident, injury, or disease determine priority. You create an action list by rating hazards by risk. Risk assessments with well-defined boundaries for probability and severity will enable the prioritizing of threats necessitating urgent attention.

4.7 Methods of Hazard Control:

After setting priorities, the organisation can identify strategies to mitigate each individual hazard. Hazard control strategies are often categorized into the following classifications:

- Firstly - Elimination
- Secondly - Substitution
- Thirdly - Engineering Control
- Fourthly - Administrative Control
- Lastly - Provision and use of suitable Personal Protective Equipment

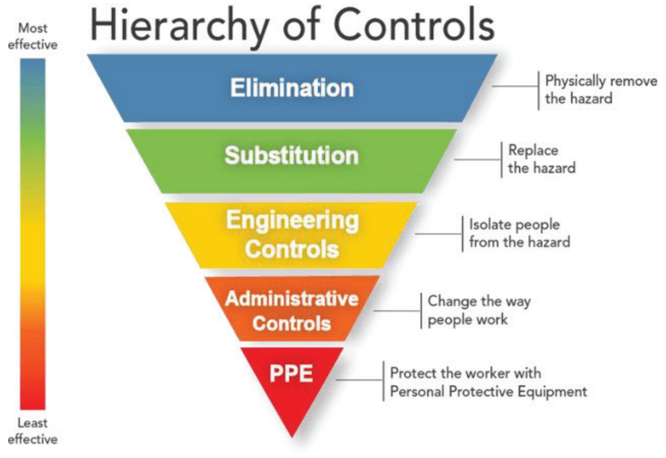


Fig. 4.2: Hierarchy of Controls

4.7.1. Elimination:

The elimination of hazards signifies the total eradication of risks, hence making all known potential accidents and health concerns impossible.

This is a conclusive answer and should be prioritized initially. Following the removal of the hazard, any additional management controls, such as workplace monitoring, surveillance, training, safety auditing, as well as record-keeping, will be rendered unnecessary.

4.7.2 Substitution:

Substitution entails replacing a hazard with one that poses a reduced risk.

4.7.3 Engineering Controls:

Engineering controls are tangible measures that mitigate hazards. This includes structural modifications to the work environment or processes, establishing a barrier to disrupt the transmission pathway between the worker and the hazards.

4.7.4 Administrative Controls:

This mitigates or eradicates exposure to a hazard through compliance with procedural instructions. Documentation should emphasize the procedures to be undertaken and the controls to be implemented for the safe execution of the activity.

4.7.5 Personal Protective Equipment:

It provides the minimal level of protection and should be employed just as a final measure to address the hazard when it cannot be eliminated or mitigated by alternative methods, for instance:

i) Handling of chemicals – Gloves, Aprons, Safety Goggles.
ii) Protecting eyes from flying particles – Safety Goggles.
iii) Protecting feet – Safety Shoes.

Employee engagement is crucial in the selection and implementation of workplace control measures. Controls may necessitate evaluation to determine their effectiveness, and employees must engage in the feedback process.

Each measure must have a designated individual and a stated deadline for the implementation of controls. This ensures the fulfilment and recording of all essential safety protocols.

4.8 Review and Monitoring of Assessments:

It is essential to ascertain whether your risk assessment was comprehensive and precise. It is crucial to ensure that any modifications in the workplace have not introduced new hazards or elevated previously lower-priority hazards to higher priorities.

Regularly reviewing your assessment is advisable to ensure the efficacy of your control techniques.

4.9 Documentation for Risk Assessment:

It is essential to maintain records of the assessment and any executed control measures. It may be essential to preserve evaluations for a specified duration of years. Confirm the local regulations within your jurisdiction.

4.10 Analysis through Matrix:

The evaluation of risk can be conducted by adhering to the following guidelines:

i) **What is Severity?**

When evaluating a certain hazard, initially inquire, 'Realistically, what is the most severe potential outcome?' Is it a minor injury or a health issue? Severe damage, illness, or maybe death?

ii) **What is Likelihood?**

Assess the probability of the damage or ill-health occurring; is it improbable, highly probable, or situated between these extremes? Ensure that current control methods are considered.

iii) **Reducing the Risk:**

Upon completion of the Risk assessment, the final stage is to determine the precautions necessary to mitigate the Risks. By minimizing hazards, the overall residual risk for any activity can be assessed, aiding in the determination of whether it is safe to proceed with a work.

Presented below is an illustration of a semi-quantitative risk matrix analysis that may be employed.

Steps in a Risk Assessment Process:

Analysis of the Risk:

RISK = **Likelihood** X **Consequence**

Fig. 4.3: Risk Assessment

Where:

Likelihood = The probability or frequency of an injury occurring

Consequence = The outcome of an event (e.g. severity of injury)

Likelihood:

Table – 4.2

Rating	Description	Likelihood
A	Almost Certain	The event is expected to occur in most circumstances.
B	Likely	The event will probably occur in most circumstances.
C	Moderate	The event should occur at some time.
D	Unlikely	The event could occur at some time.
E	Rare	The event may occur only in exceptional circumstances.

Consequences:

Table - 4.3

Rating	Description	Consequences
5	Catastrophic	Death, substantial financial loss.
4	Major	Extensive injury, loss of production, major financial loss.
3	Moderate	Medical treatment required, high financial loss.
2	Minor	First Aid treatment, medium financial loss.
1	Insignificant	No injury, low financial loss.

The blow table mentions the Risk Matrix showing the level of risk index.

Table - 4.4

Likelihood Rating		**Consequences Rating**				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
		1	**2**	**3**	**4**	**5**
A=5	**Almost Certain**	5	10	15	20	25
B=4	**Likely**	4	8	12	16	20
C=3	**Moderate**	3	6	9	12	15
D=2	**Unlikely**	2	4	6	8	10
E=1	**Rare**	1	2	3	4	5

The Level of Risk Corresponding to Risk Matrix is mentioned in the below table.

Table - 4.5

Colour	Description	Definition
	High	Required Priority Action.
	Moderate	Must be reduced as low as reasonably possible.
	Low	Acceptable if as low as reasonably possible.

Example:

We will consider the earlier example (mentioned in below table) and will see the scores of Likelihood & Consequences.

Table - 4.6

Sr. No.	Steps/Task Description	Hazards	Likelihood	Consequences	Risk Index	Hazard Controls
1.	Inhalation of H_2S gas during taking a sample.	May cause senseless/ death due to inhalation of H_2S gas.	Likely (4)	Catastrophe (5)	4x5=20 (High)	Use of Respirator/ Gas Mask, Carrying H_2S Detector
2.	Going for sampling alone.	May not be able to call for help if needed.	Likely (4)	Moderate (3)	4x3=12 (Moderate)	Carrying Walkie-Talkie and H_2S Gas Detector
3.	Working long hours.	Fatigue, stress, short rest time between shifts.	Moderate (3)	Moderate (3)	3x3=9 (Moderate)	Continuous duty to be avoided to the extent possible.

Sr. No.	Steps/Task Description	Hazards	Likelihood	Consequences	Risk Index	Hazard Controls
4.	Slip, Trip during movement inside the plant area.	Injury to body parts.	Unlikely (2)	Minor (2)	2x2=4 (Low)	PPEs like Safety Shoes, Helmet to be used.

4.11 Field-level Risk Assessment:

A field-level risk assessment is another method that is commonly used in industries and workplaces where workers are exposed to dynamic and changing work environments. Field-level risk assessments can use qualitative or semi-quantitative methods for assessing risk, including the matrices shown above.

Field-level risk assessments can also supplement safety meetings with teams as you work together through a common task, highlighting hazards and control measures that are currently in place. It can also be a good opportunity to brainstorm additional controls or better ways to complete the task.

Similar to other risk assessments, each step of the task should be written down and hazards identified. The risk of each hazard can then be assessed based on the likelihood and severity of harm. Then, the team will determine if the current controls in place are adequate or if further measures are needed prior to work beginning. An example of a table that may assist with a field-level risk assessment is shown below.

Table - 4.7

Sr. No.	Steps/Task Description	Hazards	Likelihood	Consequences	Current Controls	Recommended Additional Controls
1.	Inhalation of H_2S gas during taking a sample.	May cause senseless/ death due to inhalation of H_2S gas.	Likely (4)	Catastrophe (5)	Use of Respirator/ Gas Mask, Carrying H_2S Detector	To provide Field Mounted H_2S Gas Detector.

Sr. No.	Steps/Task Description	Hazards	Likelihood	Consequences	Current Controls	Recommended Additional Controls
2.	Going for sampling alone.	May not be able to call for help if needed.	Likely (4)	Moderate (3)	Carrying Walkie-Talkie and H_2S Gas Detector	Talk Back System and CCTV to be provided.
3.	Working long hours.	Fatigue, stress, short rest time between shifts.	Moderate (3)	Moderate (3)	Continuous duty to be avoided to the extent possible.	Software to be developed for sending messages in case of overstay to control it.
4.	Slip, Trip during movement inside the plant area.	Injury to body parts.	Unlikely (2)	Minor (2)	PPEs like Safety Shoes, Helmet to be used.	Proper housekeeping to be maintained.

4.12 Summary:

Hazard identification and risk assessment are crucial for ensuring safety and minimizing injury. A thorough investigation enables the identification of potential hazards, the evaluation of risks, and the execution of control measures to lessen such risks. This systematic approach is crucial for ensuring a safe work environment as well as effective risk management.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *What is the main purpose of hazard identification?*

□ a) To minimise the effect of a consequence.

□ b) For better risk management.

□ c) To identify potential sources of harm or danger.

□ d) To reduce the probability of occurrence.

2. The ____________ process determines whether exposure to a chemical can increase the incidence of adverse health effects.

- □ a) Hazard identification.
- □ b) Exposure assessment.
- □ c) Toxicity assessment.
- □ d) Risk characterization.

3. Which of the following data is not required for hazard identification?

- □ a) Land use.
- □ b) Contaminant levels.
- □ c) Affected population.
- □ d) Estimation of risk.

4. Hazard is defined as the potential to cause harm or loss.

- □ a) True
- □ b) False

5. Why does site history have to be considered for hazard identification?

- □ a) To estimate the risk.
- □ b) To calculate carcinogenic exposure.
- □ c) To know the probable source and causes of contamination on site.
- □ d) For determination of remedial actions.

6. What is the main objective of risk assessment?

- □ a) To evaluate hazards and minimize the risks.
- □ b) Remediation of contaminated sites.
- □ c) Hazard management.
- □ d) To know the source of pollutants.

7. What is the first stage of risk assessment?

- □ a) Exposure assessment.
- □ b) Hazard identification.
- □ c) Toxicity study.
- □ d) Risk characterization.

8. An incident can be called hazardous only when?

- □ a) Stressor has the potential to cause harm to humans and ecological systems.
- □ b) Poses threat to surrounding.
- □ c) Monitoring failed.
- □ d) Outburst of chemicals.

9. The purpose of risk management is to identify potential problems before they occur so that risk-handling activities may be planned.

- □ a) True
- □ b) False

10. Hazard identification mainly focuses on ______________.

- □ a) Chemical source and concentration.
- □ b) Chemical exposure.
- □ c) Chemical analysis.
- □ d) Chemical pathway.

: (1.c, 2.a, 3.d, 4.a, 5.c, 6.a, 7.b, 8.a, 9.a, 10.a)

REFERENCES

1. Canadian Centre for Occupational Health and Safety. (2023). *Hazard and Risk*. https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html
2. Health and Safety Executive. (2022). *Risk assessment: A brief guide to controlling risks in the workplace*. https://www.hse.gov.uk/risk/controlling-risks.htm
3. International Labour Organization. (2014). *Risk assessment and management*. https://www.ilo.org/global/topics/safety-and-health-at-work
4. Occupational Safety and Health Administration. *Job Hazard Analysis*. U.S. Department of Labor. https://www.osha.gov/Publications/osha3071.pdf
5. Safe Work Australia. (2021). *How to manage work health and safety risks:* Code of Practice.
6. Safety Manual (November 2020), Indian Oil Corporation Ltd, Mathura Refinery, Mathura, Uttar Pradesh – 281 005
7. S. S. Manoj (2017). *Study on Hazard Identification, Risk Assessment*. International Conference on Emerging trends in Engineering, Science and Sustainable Technology.

* * *

Chapter – 5

Job Safety Analysis – Helps to Identify & Mitigate Workplace Hazards

CHAPTER – 5

JOB SAFETY ANALYSIS - HELPS TO IDENTIFY AND MITIGATE WORKPLACE HAZARDS

5.1 Job Safety Analysis (JSA):

A Job Safety Analysis (JSA) is an approach that enables the integration of recognized safety and health principles into a specific task or job operation.

5.2 Benefits of JSA:

- The JSA process offers new employees pre-job training on the safe work practices to be implemented.
- The JSA process explains the sequence of job steps, ensuring that all workers are aware of the timing for their designated duties, and explicitly specifies the processes, tools, and personal protective equipment required.

In a JSA, each fundamental stage involves identifying potential hazards and recommending the safest method to perform the task.

5.3 Basic Steps for Conducting JSA:

- Choosing the job for analysis.
- Decomposing the task into a series of steps.
- Recognizing potential hazards.
- Identifying preventive strategies to mitigate these risks.
- Communicate the Safe Working Procedure to subordinate personnel.

5.4 Factors to Consider while Prioritizing JSA:

- *Accident prevalence and severity:* Occupations characterized by frequent accidents or those with infrequent occurrences that lead to major injuries.
- *The potential for severe injuries or illnesses:* The consequences of an accident, hazardous situation, or exposure to harmful agents may be serious.
- *New positions:* Due to lack of experience in these roles, hazards may not be evident or foreseen.
- *Modified jobs:* New hazards may emerge from changes in job practices.
- *Infrequently executed tasks:* Employees may face heightened risks when engaging in non-routine activities, and a JSA serves as a method for assessing hazards.

5.5 Breaking Job into Steps:

A general guideline is that most tasks may be defined in fewer than ten steps. If more steps are necessary, consider partitioning the task into two segments, each accompanied by its distinct Job Safety Analysis, or combine processes where suitable. The following points to be followed:

- Every step is documented in order. Document the outcomes achieved rather than the methods employed. Every item starts with an action verb.
- It is crucial to maintain the proper sequencing of the stages. Any deviation from the prescribed sequence may overlook significant potential hazards or add non-existent risks.

5.6 Potential Hazards:

The job analyst may utilize inquiries such as the following to identify potential hazards:

- Is there a risk of falling objects?
- Is the worker subjected to extreme temperatures, either hot or cold?
- Is lighting a challenge?
- Is the occurrence of dangerous radiation a possibility?
- Is excessive noise or vibration an issue?

- Do tools, machinery, or equipment pose any risks?
- Can meteorological conditions influence safety?
- Can the employee experience tension from lifting, pressing, or pulling?
- Is there a risk of the worker slipping, tripping, or falling?
- Is the worker capable of making detrimental touch with moving objects?
- Is contact permissible with heated, toxic, or caustic substances?
- Is it possible for any bodily component to become caught in or between objects?
- Are there particulates, aerosols, mists, or vapours present in the atmosphere?

5.7 Preventive Measures:

The concluding phase of a Job Safety Analysis (JSA) involves identifying methods to eliminate or mitigate the identified hazards.

Avoid using vague phrases like "exercise caution" or "proceed with care." Clear directives that explain both the actions to be undertaken and the methods of execution are advantageous.

The widely recognized criteria, listed in order of priority, are:

- Eliminate the hazard - This acts as the most effective measure. These methods should be employed to remove the risks:
  - ✓ Select an alternative procedure.
  - ✓ Alter an existing procedure.
  - ✓ Replace with a less harmful material.
  - ✓ Enhance environmental ventilation.
  - ✓ Alter or adjust apparatus or instruments.
- Contain the Hazard:
  - ✓ If the threat cannot be eliminated, contact may be reduced using enclosures, machine guards, worker booths, or comparable equipment.

- Revise Work Procedures:
  - ✓ Consideration may be given to modifying hazardous stages, reorganizing the sequence of events, or implementing additional precautions (such as isolating energy sources).
- Reduce the Exposure:
  - ✓ These measures are the least effective and should be utilized only when no alternative options are available.
  - ✓ A strategy to reduce "exposure" is to diminish the frequency of interactions with the hazard.
  - ✓ The utilization of suitable personal protection equipment may be necessary. To mitigate the consequences of an accident, it may be imperative to establish emergency facilities that involve eyewash stations.

JSA is an effective method for identifying hazards, enabling workers to implement measures for their elimination or management. Upon completion of the analysis, the conclusions must be conveyed to all employees now engaged in or anticipated to undertake that role.

5.8 Revision of JSA:

Specific circumstances necessitate the examination and revision of the JSA. Upon the emergence of these scenarios, work must be halted immediately to reassess the process.

The JSA should be amended if any of the subsequent circumstances arise:

- In the event of an accident or injury.
- In the event of a high-potential near-miss.
- When employee's express safety concerns.
- For the alteration of job procedures.

5.9 Communicate and Implement JSA:

Ensure that the JSAs are comprehensible and accessible. Disseminate the JSA to all individuals engaged in the task and ensure the papers are accessible on-site for review, acknowledgment, and updates.

5.10 Monitor Work and Maintain Controls:

An adequate amount of monitoring must be ensured during the work to maintain the controls. Any deviation from the JSA, that involves the introduction of a new task, alteration of risk, or unforeseen incident, must be distinctly recognized, hazards assessed, and risk mitigation strategies formulated. This modification necessitates approval prior to the continuation of work.

5.11 Job Safety Analysis Format:

The job safety analysis format is attached as *Appendix – 8*. The format to be filled up properly and at location where job will be carried out considering all types of expected hazards (refer below table) and recommended actions including PPEs to be used.

Table – 5.1

Physical Hazard			**Electrical Hazard**	**Chemical Hazard**	**Biological Hazard**	**Others**
Noise	Fall from Height	Force (Push/ Pull)	Shock/ Electrocution	Flammable/ Explosive Substances	Snake/Insect Bite, Virus Infection	Fire
Radiation	Fall (Slip/Trip)	Caught in/on or between	Static Electricity	Inhalation of Toxic Fumes	--	Heavy Wind/ Rain
Confined Space	Fall to Down/ Below	Struck by/against	Arc Flash/ Blast	Ingestion/ Absorption	--	Dust Exposure
Exposure to pressurized steam/air	Fall of Objects from Height	Extreme weather (Hot/Cold)	--	Body/Eye Contact	--	Oil Spill
Contact with hot surface	Contact with moving parts	Poor Illumination	Excavation	Spillage	--	Human Factor

5.12 Summary:

Job Safety Analysis (JSA) is an essential procedure for detecting and minimizing workplace hazards, resulting in safer work conditions, enhanced communication, and a potential decrease in injuries and accidents.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *Which of the following is not one of the five steps in developing a JSA?*

   □ a) Select job to be analysed.

   □ b) Identify the hazards within each step.

   □ c) Revise the job safety analysis.

   □ d) Report the JSA to OSHA.

2. *What criteria are used to determine the priority of tasks to be analysed?*

   □ a) Accident frequency.

   □ b) Accident severity.

   □ c) Repetitive exposure.

   □ d) All of the above.

3. *Who should be involved in developing a JSA?*

   □ a) Experienced workers.

   □ b) Workers from other jobs.

   □ c) Company president.

   □ d) None of the above.

4. JSA is effective only when carried out by safety officers.

   □ a) True

   □ b) False

5. *JSA helps in identifying hazards before they occur and suggests control measures to reduce risks.*

□ a) True

□ b) False

: ***(1.d, 2.d, 3.a, 4.b, 5.a)***

REFERENCES

1. National Safety Council. (2018). *Job Safety Analysis Manual*. NSC Press.
2. Manuele, F. A. (2014). *Advanced Safety Management: Focusing on Z10 and Serious Injury Prevention* (2nd ed.). Wiley.
3. Goetsch, D. L. (2019). *Occupational Safety and Health for Technologists, Engineers, and Managers* (9th ed.). Pearson.
4. Hinze, J. (2006). *Construction Safety*. Prentice Hall.
5. Job Hazard Analysis. U.S. Department of Labor Occupational Safety and Health Administration OSHA 3071 2002 (Revised).
6. Job Safety Analysis (2012). Harvard Campus Services, Environmental Health, Safety & Emergency Management.
7. Job Safety Analysis Procedure (2016), The Tata Power Company Ltd. Document Ref No: TPSMS/CSP/JSA/009 Rev 01.
8. Job Safety Analysis – Guideline. Version 3.2, Watercare, An Auckland Council Organization.
9. Job Safety Analysis (1979), System Safety Development Centre, Department of Energy, Division of Operational & Environmental Safety, USA.

* * *

Chapter – 6

Toolbox Talk – Improves Worker's Safe Behaviour

CHAPTER – 6

TOOLBOX TALK – IMPROVES WORKERS' SAFE BEHAVIOUR

6.1 Toolbox Talk:

Toolbox talks are concise and comprehensible safety meetings held prior to a work shift. Commonly referred to as safety briefings, pre-start discussions, or five-minute safety talks. A toolbox talk is optimally conversational and lasts approximately 5-10 minutes, engaging workers in a discussion about their awareness of health and safety concerns related to their tasks.

6.2 Importance and Purpose:

Regular toolbox talks are designed to highlight workplace hazards, effective mitigation strategies, and optimal methods for ensuring worker safety. These discussions are crucial for mitigating workplace mishaps.

Besides recognizing urgent threats for the day, a successful toolbox discussion can assist with the following:

- Fostering a constructive safety culture throughout the company.
- Maintaining worker vigilance, enhancing team communication, and efficiency.
- Reiterating the obligations and responsibilities of employees and employers.
- Delivering a revised account of risks and strategic responses.

6.3 How to give Toolbox Talk?

There is no universal solution. Tailor your discourse to accommodate the audience present. It is advisable to utilize the local language for communication. New team members may require additional clarification, whilst seasoned individuals may exhibit impatience to depart. As long as you convey the essential points, you may deem it effective. Following points to be noted:

- Explain the reason for conducting a toolbox talk in a manner that fosters worker engagement with the subject matter at hand.
- Ensure you are in a setting that promotes learning, free from interruptions or distractions.
- Organize your discussion points and any materials you intend to utilize. Utilize pertinent visual examples and actual equipment to convey the message.
- Comprehend the subject matter thoroughly and stimulate employee engagement by posing inquiries regarding the topic.
- Conclude the discussion with a summary to emphasize key topics. Document the attendees to facilitate follow-up meetings for those who were absent.
- Obtaining feedback on the effectiveness, messaging, and content of the toolbox discussion is essential. Solicit feedback from employees regarding their opinions and contemplate requesting another supervisor or manager to observe one of your presentations.
- Document any recommendations for future presentations, whether on the same topic or a different one.

6.4 Safety Toolbox Topics:

Selecting an alternative weekly safety topic for your toolbox presentations may seem like a monotonous task. There is a substantial amount of material to address within a limited timeframe, and certain subjects will be more pertinent to your organisation and sector than others. Utilize these safety toolbox subjects to facilitate substantive discussions:

a) **General Safety:**

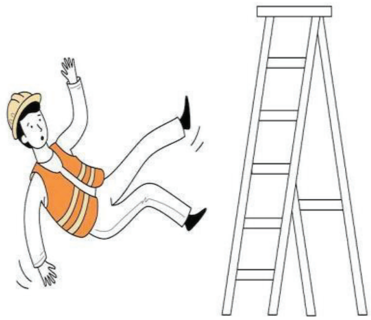
1. Emergency exits and procedures
2. Housekeeping in common areas
3. Ladder safety
4. Manual handling
5. Personal responsibility for safety
6. Preventing falling objects
7. Reporting incidents
8. Safe lifting and carrying techniques
9. Walking and working surfaces
10. Working in extreme weather conditions
11. Traffic safety
12. Safe driving
13. Proper lighting in the workplace
14. Preventing slips, trips, and falls
15. Emergency response preparation

b) **Personal Protective Equipment (PPE):**

16. Body protection
17. Eye protection
18. Fall protection equipment
19. Foot protection
20. Hand protection
21. Head protection
22. Hearing protection
23. Heat and cold protection
24. High-visibility clothing
25. Respirator maintenance
26. Respiratory protection
27. Protective footwear types
28. Face shields and goggles
29. Chemical-resistant gloves

c) **Workplace Hazards:**

30. Confined spaces
31. Fall prevention
32. Handling biohazardous materials
33. Hazardous materials
34. Machine guarding
35. Moving machinery safety
36. Noise hazards and control
37. Overhead hazards
38. Radiation safety
39. Repetitive motion injuries
40. Sharp object handling
41. Struck-by hazards
42. Vibrations and ergonomics
43. Weather-related hazards



d) **Fire Safety:**

44. Fire safety in kitchens and break areas
45. Fire safety in chemical handling areas
46. Fire prevention
47. Fire extinguisher use
48. Fire drills
49. Fire alarm systems
50. Evacuation procedures
51. Electrical fire safety
52. Fire safety for welding and hot work
53. Fire safety in storage areas

e) **Electrical Safety:**

54. Electrical cord safety
55. Electrical hazards
56. Electrical tool usage
57. Lockout/tagout procedures
58. Outlet safety
59. Power tool safety
60. Proper use of extension cords
61. Working near power lines
62. Electrical safety for office equipment
63. Proper use of surge protectors

f) **Equipment and Machinery Safety:**

64. Forklift safety
65. Vehicle safety
66. Tool safety
67. Sharp tool handling safety
68. Safety with hand trucks and trolley
69. Proper use of hoists and cranes
70. Jack safety
71. Machine operation
72. Heavy equipment safety
73. Equipment inspections
74. Conveyor belt safety

g) **Chemical Safety:**

75. Chemical handling and storage
76. Material safety data sheets
77. Hazard communication
78. Spill response
79. Personal protective equipment for chemicals
80. Chemical disposal
81. Safe chemical transportation
82. Chemical exposure monitoring
83. Chemical labelling
84. Chemical emergency procedures

h) **Environmental Safety:**

85. Recycling practices
86. Hazardous waste management
87. Chemical spill containment
88. Sustainable transportation
89. Renewable energy adoption
90. Biodiversity preservation
91. Noise pollution reduction
92. E-waste management
93. Paperless initiatives
94. Sustainable procurement
95. Sustainable building practices
96. Reducing water waste
97. Energy-efficient lighting
98. Reducing office waste

i) **Emergency Response:**

99. First aid procedures
100. CPR training
101. Shifting of patient
102. Bleeding control
103. Emergency contacts
104. Emergency evacuation routes
105. Shelter-in-place procedures
106. Emergency response drills
107. Emergency response team roles
108. Heat-related illness response
109. Cold-related illness response

j) **Health and Wellness:**

110. Ergonomics
111. Hydration and heat safety
112. Stress management
113. Stress reduction techniques
114. Healthy eating at work
115. Exercise and fitness
116. Work-life balance
117. Mental health awareness
118. Mindfulness practices
119. Employee assistance programs
120. Wellness programs

k) **Workplace Culture of Safety:**

121. Encouraging open communication
122. Team accountability for safety
123. Celebrating safety milestones
124. Safety innovation and ideas
125. Safety leadership and commitment
126. Conflict resolution techniques
127. De-escalation strategies
128. Communication during conflicts
129. Mediation and third-party involvement
130. Conflict prevention
131. Promoting team bonding
132. Mindfulness breaks
133. Remote work-life balance
134. Safety awareness campaign
135. Incident reporting
136. Safety audits and checks

l) **Remote Work Safety:**

137. Home office ergonomics
138. Digital security for remote work
139. Mental health in remote work
140. Communication and collaboration
141. Managing remote team performance
142. Remote meeting security

m) **Cybersecurity and Data Safety:**

143. Password security
144. Phishing awareness
145. Data privacy and confidentiality
146. Safe internet usage
147. Secure file sharing
148. Mobile device security
149. Social engineering awareness
150. File encryption best practices

6.5 Common Toolbox Talk Topics:

Discussion topics can be determined by soliciting employee feedback, recognizing alterations in the facility, work procedures, or surroundings, and formulating responses to workplace accidents or occurrences.

Although general safety toolbox talks are permissible, it is desirable to concentrate on pertinent topics related to specific work-related hazards. Below are many prevalent topics and ideas for toolbox discussions:

i) **Construction Safety:**

Construction workers face numerous health and safety hazards on-site that, if insufficiently managed, could lead to accidents, injuries, or fatalities. Common topics discussed in toolbox meetings within the construction industry include the following:

- Top causes of falls.
- Causes of electrocution.
- What to do when struck by an object or caught between objects.
- Preventive tips on how to avoid these common incidents.

ii) **Slips, Trips and Falls Safety:**

Slips, trips, and falls are prevalent causes of workplace accidents and are frequently the most neglected hazards. Consequently, these safety occurrences require a dedicated toolbox talk.

Engage your team in a discussion of the prevalent categories of slip injuries and encourage them to identify potential workplace hazards. Solicit your team's recommendations for mitigating these measures.

iii) **Electrical Safety:**

Electrocutions represent one of the most prevalent injuries observed on construction sites. Addressing this subject in your toolbox talk reinforces awareness among all workers on the hazards of electricity and the precautionary steps necessary when interacting with it.

Reinforce fundamental electrical safety principles, review lock-out tag-out protocols, enumerate significant hazards, and prompt the team to recognize any pre-shift or pre-start concerns.

iv) **Personal Protective Equipment (PPE):**

PPE is utilized to mitigate employees' exposure to risks. Consequently, prior to commencing work, employers must thoroughly communicate the proper usage of these tools and underscore their significance in ensuring workplace safety.

This toolbox provides staff with information regarding the guidelines and conditions of each PPE, as well as the documentation of defective equipment for repair or replacement.

v) **Working at Height:**

In works involving heights, it is essential to conduct toolbox talks addressing the associated hazards, implement the necessary safety measures, and ensure the correct utilization of fall protective equipment.

vi) **Entry in Confined Space:**

Conducting safety toolbox discussions before assigning personnel entry into confined spaces is imperative, as this occupation exposes them to hazardous gases and oxygen deficiency.

In this toolbox talk, examine all hazards associated with the limited area and collaboratively determine strategies to mitigate them in various scenarios. You and your safety personnel may utilize a confined space safety checklist to enhance your toolbox discussion. It can serve as a framework for conducting daily discussions and documenting essential action items.

vii) **Accident/Incident Reporting:**

Accurate reporting of accidents and incidents should be incorporated into the toolbox talks. Enable employees to report occurrences proficiently by addressing the following questions:

- "What do I report?"
- "Who do I report to?"
- "When do I report?"

Utilize an accident and incident reporting checklist to aid your personnel in accurately recording workplace accidents.

viii) **Chemical Safety:**

Workplaces can generate dangerous pollutants, including cleaning chemicals, dust, and gases etc. Typical toolbox discussion subjects related to chemicals include the following:

- Determining tasks that include hazardous materials.
- Hazards associated with each substance.
- Methods to mitigate the risks of harm.

ix) **Excavation:**

Industries involved in construction must prioritize worker safety by integrating this topic into their toolbox presentations. During your team's toolbox talk, ensure you examine the essential standards for excavation safety.

Improve the efficacy of your toolbox conversations by utilizing an excavation safety checklist. It can also be utilized to do inspections of worksites and equipment, ensuring that utilities, barriers, walkways, as well as warning systems are appropriately built.

x) **Fire Extinguisher:**

During fire incidents, companies anticipate that employees will utilize fire extinguishers. Utilizing this topic for a toolbox talk might provide employees with information regarding its location and their responsibilities during fire situations.

Engage your employees in a discussion regarding the many classifications of fire and the corresponding extinguishers suitable for each type. Utilizing checklists aids in finding faults on tags and seals of fire extinguishers, ensuring their safety for usage.

xi) **Fire Safety:**

Enhance knowledge of fire hazards and engage your team in discussions regarding various fire safety concerns that may arise in the workplace. One can deliberate on fire protection strategies to lessen fire-related hazards and prevent injuries and incidents.

xii) **First Aid:**

Engage your team in a discussion to make sure that all members are aware of the fundamental first aid protocols established. In your toolbox discussion, address the following points:

- Site designated for the storage of first aid equipment and supplies.
- Emergency contacts for severe injuries.
- Objectives to implement when delivering first aid to an injured individual until professional assistance arrives.

xiii) **Forklift Safety:**

Prior to starting tasks with forklifts, confer with your team regarding the following:

- Standard safety practices.
- Forklift maintenance tasks;
- Blind spots for forklifts.
- Basic forklift safety practices.

xiv) **Housekeeping:**

An unorganised work environment lowers morale and may lead to employee injuries or, in the worst-case scenario, fatalities.

To mitigate this, you may conduct safety discussions that focus on general housekeeping standards and best practices. In your toolbox talk, you may discuss the consequences of poor housekeeping practices to emphasize the importance of successful housekeeping.

xv) **Manual Handling:**

Back pain, strain, and damage from inappropriate twisting, turning, lifting, hauling, or digging is a prevalent injury across numerous sectors.

Discuss and demonstrate best manual handling skills in your toolbox conversations. You can also determine the best ways to identify and assess manual handling risk in your company.

xvi) **Traffic Safety:**

Prolonged time spent on the road can lead drivers to become complacent regarding prevalent traffic hazards. Traffic safety toolbox talks should include both prevalent and a typical highway risk, as well as recount recent hazards and near-misses seen by the team. This ensures toolbox talks remain pertinent and memorable.

xvii) **Lock-Out Tag-Out (LOTO):**

Emphasizing the processes for controlling hazardous energy during the servicing and repair of machinery and equipment to avert inadvertent activation and accidents.

6.6 Examples of Toolbox Talk in Details:

i) **Toolbox Talk on Hand-Held Grinders:**

Introduction:

Hand-held grinders may inflict severe injuries if used improperly. Adhering to the safe work procedures outlined below will mitigate the risk of injury to yourself or others when utilizing this potent equipment.

Main Points:

- Consistently manage and utilize equipment with caution.
- Adhere to the manufacturer's guidelines for operation, upkeep, and personal safety measures (including protective barriers).
- Maintain a safe distance between combustible materials and the grinding area. Sparks have the potential to ignite a fire.

- Do not remove the manufacturer's protections from grinders during operation.
- Verify that grinding wheels and discs are in optimal condition. Examine them for chips, fractures, and loose retainers before utilization. Grinding produces particulate matter.
- Safeguard yourself with appropriate respiratory gear and adequate ventilation.
- Consistently verify the machine's rated speed against the indicated maximum safe operating speed specified on the wheel or disk.
- All hand grinders must be operated with the guards and handles properly attached.

Discussion:

- Consistently utilize suitable hearing, optical, and facial protection pertinent to the grinding tasks being performed. Utilize a face shield when operating grinding wheels.
- Maintain your safety glasses in best condition, ensuring the lenses remain free of scratches.
- Respiratory protection may be necessary, if your grinding activities expose you to the inhalation of hazardous substances (e.g., dust, metal fumes, or chemicals etc.).
- Fasten loose garments and eliminate ties, rings, watches, and other ornamentations.

- If you are uncertain about the required personal protective equipment, consult your supervisor or employer.

ii) **Toolbox Talk on Eye Protection:**

Introduction:

Eye protection devices have been utilized in the construction sector largely. Undoubtedly, numerous workers have escaped significant ophthalmic injuries as a result. Workers have been protected from harm or blindness due to the timely application of eye protection.

Main Points:

Utilize suitable eye protection to safeguard against nails, wood chips, metal shavings, dust, acids, and other airborne particles and chemicals associated with construction activities. Depending on the occupation, one may don safety glasses, goggles, or a full-face protection.

Discussion:

Particles produced through chipping, grinding, sawing, brushing, hammering, or utilizing:

- *Power Tools*: These particles move at an exceptional speed and collide with the force of a bullet. Use eye protection during all above procedures. Certain occupations may necessitate the use of safety goggles in conjunction with a full-face shield.
- *Invisible Hazards*: The detrimental light rays generated by welding procedures or laser beams are invisible, and their consequences may not show until hours later. Use the necessary eye protection when using this equipment; if nearby, avert your look from welding arcs or regions where a laser beam is utilized.
- *Liquids*: Scalding liquids, such as tar, asphalt, solvents, paint, and masonry or metal cleaning solutions, can cause significant ophthalmic injuries, if they

come into contact with the face. Using suitable eye protection, including a full-face shield and goggles, is essential while transferring liquids between containers and when using caustic or acidic cleaners.

When to Use Eye Protection:

Numerous activities in construction projects necessitate the use of eye protection for workers. This is merely a partial list:

- Utilizing any power tool to cut construction materials.
- Utilizing pneumatic and powder-actuated nail guns.
- Utilizing manual impact implements, such as hammers.
- Chipping, striking, and thrashing on metal, stone, and concrete.
- Electric arc welding and cutting, along with other activities that expose the eyes to airborne particles, dust, hot liquids, molten materials, gases, fumes, and liquids.
- Brushing and grinding.
- Drilling, scaling, and scraping.
- Gas welding, cutting, brazing, and soldering.
- Management of acids, caustic substances, and creosote treated materials.
- Management of heated tar.

iii) **Toolbox Talk on Ladders:**

Introduction:

- Utilize ladders just for uncomplicated tasks of brief duration. They must be utilized solely as a means of access and NOT as a working platform.

- Ladders must be well-constructed, free of missing or defective rungs, composed of durable materials, and provide sufficient strength for their intended application, while being well-maintained. Install ladders exclusively on a stable and even foundation.

Main Points:

- Secure the upper section of the straight ladder. When impractical, securely anchor the ladder at the base using appropriate methods or with the assistance of an individual.
- Elevate ladders to a minimum height of 1.05m for handhold accessibility above their landing position or above the top rung.
- The rungs and the user's boots must be in good shape and devoid of dampness, grime, and grease.

Discussion:

- Do not place a straight ladder at a base angle exceeding 75 degrees or a 4:1 rise-to-base ratio.
- Avoid carrying equipment or items by hand when ascending or descending. Use a tool holster to carry hand tools, freeing hands for ladder stabilization.
- Avoid using aluminium ladders or other electrically conductive ladders for electrical work unless they are completely insulated, particularly at the base. Utilize wooden or fiberglass ladders for electrical tasks or while operating in proximity to electrical cables, etc.
- Utilize a safety harness with a securely secured lanyard when working on a ladder at a height of 2.0 meters or greater, unless a working platform is reasonably possible.
- Examine the ladder for any imperfections prior to each utilization. Avoid utilizing a painted wooden ladder, since the paint may conceal underlying flaws. Attach a warning label to the faulty ladder. Do not position a straight ladder at a base angle greater than 75 degrees or a 4:1 rise-to-base ratio.
- Cover the imperfections. Attach a warning label to the defective ladder.

iv) **Toolbox Talk on Safety Harness:**

Introduction:

Any work above 2 meters from ground level is referred to as height work.
To ensure fall protection, the following provisions must be made:

- ✓ Working platforms.
- ✓ Guardrails, barriers, toe-boards, and fences.
- ✓ Coverings for openings.
- ✓ Gangways and runs.

Main Points:

- Implement appropriate measures to prevent anyone on a building site from falling from a height of 2 meters or greater.
- In extraordinary work conditions, where working platforms are impractical, alternative fall prevention measures such as scaffolds, safety nets, as well as safety harnesses or belts must be provided.

Discussion:

- Primarily, safety harnesses must be utilized for fall protection, since they can mitigate waist injuries resulting from the impact of a fall. Safety harness or belt anchor points must be directly above, and lanyards must be adjusted to maintain minimal free length.
- Safety harnesses or belts are particularly used and fastened to suitable anchor points for rigging work, operations from suspended cages, and climbing fixed ladders.
- The lanyard length must be adequate to permit unobstructed movement in the workplace.
- Confirm that the working platform is stable and capable of supporting the weight of the individual and any items or equipment they may utilize or place on it.

- Maintain workplace safety throughout operations to avert material falls and comply with multilayer job protocols.
- When utilizing a harness, ensure that individuals can secure themselves before assuming a position that depends on the harness's protective capabilities.
- Do not utilize damaged or worn-out harnesses.
- The anchor must be meticulously designed.

v) **Toolbox Talk on Common Mistakes:**

Introduction:

The majority of occupational injuries emerge when tasks performed deviate from standard procedures. A work plan for non-process tasks is essential. Regardless of the method followed, strategizing the task and posing "What if…?" queries will facilitate the identification of hazards and the establishment of controls to avert harm.

Conduct daily hazards assessments and discuss them with your team prior to initiating the work.

Failure to Communicate:

- One of the most effective methods to avert hazardous conditions is to address observed risks or risky behaviours.
- Conveying the risks and shortcomings in processes is crucial for protecting ourselves and our colleagues from potential hazards in the workplace.

Questions for General Discussion:

- What are the prevalent safety hazards you have observed on the job site?

- Could you provide an instance in which you deviated from a procedure or plan, resulting in a safety hazard?
- Consider a singular enhancement that would mitigate prevalent safety risks.

6.7 Documenting Toolbox Talk Meetings:

Toolbox lectures may vary in execution according to the subjects addressed and the nature of the worker involved. It is essential that all discussions and meetings are recorded for future reference and the monitoring of previous threats or issues.

6.8 Role of Training in Toolbox Talks:

Toolbox talks training, usually referred to as safety toolbox talks or just toolbox talks, constitutes a brief safety training session typically held regularly in workplaces. These courses aim to enhance safety awareness, inform workers about potential hazards, and reinforce safe work practices.

From a broader viewpoint, toolbox talks, and training foster the establishment of a robust safety culture inside a business. When safety is publicly concerned, employees are more likely to take it seriously and help each other.

6.9 Review:

i) **Who decides the toolbox talk topics?**

Toolbox talk subjects are typically predetermined by employers and safety officials, based on the specific tasks to be performed. This facilitates the efficiency of the meeting. Employees may also influence the selection of toolbox discussion topics based on their needs and concerns.

ii) **Who leads toolbox talks?**

Toolbox talks are generally led by the supervisor, manager, safety officer, or authorized safety representative of the organisation. Employees may be encouraged to make toolbox talks, particularly if they possess extensive expertise or experience relating to the job, therefore improving worker involvement and participation in safety procedures.

iii) **How often should toolbox talks be carried out?**

Health and safety specialists advocate for the implementation of toolbox talks on a daily, weekly, or as-needed basis according to business requirements. They are significantly influenced by the nature of the employment, occupation, or task, together with the degree of associated hazards.

6.10 Records:

Records must be preserved to substantiate the execution of this Procedure. This includes the Toolbox Attendance Format which is attached as *Appendix – 9*.

In addition to enhancing workplace safety, toolbox talks maintain team members' awareness of potential risks, foster team communication, and demonstrate the company's commitment to employee safety and wellbeing. They assist organisations in adhering to the mandates of regulatory agencies.

6.11 Summary:

Toolbox talks are essential safety meetings that reinforce safe work habits, identify potential hazards, and cultivate a safety-oriented culture, thereby enhancing workplace safety and productivity.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *An example of properly matching the tool to the job is:*

- □ a) Using the right size slot head screwdriver on a slot head screw.
- □ b) Using a wrench to hammer in a nail.
- □ c) Using a hard metal hammer head on hardened steel.

2. *You would turn in/destroy an unsafe tool such as:*

- □ a) A wrench that is too small for the job.
- □ b) A saw with very sharp teeth.
- □ c) A hammer with a chipped or loose head.

3. *You do not need any PPE to work safely with hand tools.*

- □ a) True
- □ b) False

4. *At the end of a task where you used hand tools, you should:*

- □ a) Leave them where they are so they can be used later.
- □ b) Turn them in to your supervisor for inspection.
- □ c) Put them away in their proper storage place.

5. *What type of hand protection is required when a pressure washer is being used?*

- □ a) No PPE is required.
- □ b) Leather work gloves.
- □ c) PVC or heavy nitrile over-gloves.

: (1.a, 2.c, 3.b, 4.c, 5.c)

REFERENCES

1. Occupational Safety and Health Administration. *Safety and Health Topics*. https://www.osha.gov/safety-management
2. Safe Work Australia. (2023). *Toolbox Talks: A Guide to Effective Safety Communication*. https://www.safeworkaustralia.gov.au/toolbox-talks
3. National Safety Council. (2022). *Workplace Safety Training and Toolbox Talks*. https://www.nsc.org/workplace/training/toolbox-talks
4. Health and Safety Executive. (2021). *Talking Safety: Toolbox Talks for Safer Workplaces*. https://www.hse.gov.uk/toolboxtalks
5. Centers for Disease Control and Prevention. (2020). Workplace Safety and Health Topics. https://www.cdc.gov/niosh/topics
6. 106 Toolbox Talks (2017), *Innovative Safety Products*, LLC. www.safetyTalkIdeas.com
7. Toolbox Talks for OSHA Safety and Health (2018), www.oshatraining.com

8. Construction Toolbox Safety Talks, Volume – III (2007). The Associated General Contractors of America, 2300 Wilson Boulevard, Suite 400 / Arlington, VA 22201.
9. 1000 Toolbox Topics. www.sitedocs.com
10. Safety on the Worksite Toolbox Talks, Department of Human Resources, Government of the Virgin Islands.
11. Safety Toolbox Talk Booklet. Indian Oil Corporation Limited, Refineries Head Office, Scope Complex, Core – 2, 7-Institutional Area, Lodhi Road, New Delhi – 110 003

* * *

Chapter – 7

Work Permit System – Ensures Safety of Workers

CHAPTER – 7
WORK PERMIT SYSTEM – ENSURES SAFETY OF WORKERS

7.1 Work Permit:

The work permit system is a written document that ensures that a particular job is being done safely in an industry. This document helps to request a job, review the hazards, suggest counter measures, and authorise the personnel for executing the job safely.

A work permit is a formal agreement between the area supervisor (permit issuer) and the work executor (permit receiver) to conduct the designated inspection, maintenance, repair, and construction tasks in the safest manner possible, thereby preventing personnel injury, safeguarding property from damage, and mitigating fire risks by eliminating communication gaps. This is an authorization for work to be conducted on facilities or equipment after all possible measures have been implemented to ensure the safety of personnel, materials, and machinery prior to the beginning of the task, and such safe conditions are maintained during the execution of the work. While achieving absolute safety may not always be feasible, the system ensures the optimal methods for securing safe working conditions. However, it can occasionally be challenging to avoid certain calculated risks; therefore, it is prudent to ensure comprehensive preparations and measures are in place.

7.2 Necessary to Issue a Written Permit:

Issuing a written permit enables effective and clear communication. It ensures that all requisite measures for ensuring safe working conditions are implemented prior to the beginning of the task, and that all safeguards are observed during its execution. In other words, "*verbal instructions and communications are not relied upon* *due to their susceptibility to human error.*" When any task, such as hot work or similar activities, is performed in areas where flammable or hazardous mixtures may be present, it is essential to positively isolate equipment from all sources. This includes draining, depressurization, and flushing or gas freeing procedures to ensure adequate preparation of the equipment.

A work permit is a formal document that clearly explains the following:

- The Task.
- Equipment involved & its condition.
- Its location.
- Personnel involved.
- Time limitation.
- Precautionary steps to be implemented alongside potential hazards to be faced, if applicable.
- Function as a pre-established checklist for several safety measures.
- Serves as a media of information.
- Imparts a sense of security.
- A record of the whole activity.

7.3 Purpose of Work Permit System:

In industries, every task undertaken poses a risk of personal injury, property loss, or environmental impact. Nevertheless, certain specialized safety measures, when followed, may prevent such incidents. For example, consider a welding job on a pipeline carrying petrol. This job has a very serious potential for fire. If proper precautions are not taken, this could result in a major fire. But for a company in the business of pipeline transportation of petrol, this is a regular activity. Also, they do many other jobs, where they have an open flame in an area where there may be the presence of flammable gases. So, there are certain standard steps to follow for such jobs. In the work permit system, we identify such jobs with a common nature of hazard and identify the precautions. In this case, this job is classified as 'Hot Work.' Similarly, jobs that include working inside a space with limited entry or exit, are classified as 'Confined Space Entry.' So, the Work Permit System ensures that the standard safety precautions for any particular job are followed for every job.

Another feature of the work permit system is the involvement of multiple agencies in the system. Consider the above example. There is a group of people carrying out the operation of the pipeline system. But when a maintenance job comes, which requires a welding job, there is a separate group carrying out that job. The group carrying out the maintenance job will not be familiar with the pipeline operation job. Likewise, the team executing the operational tasks will be unfamiliar with the safety measures pertinent to welding activities. So, it is important that these two groups work together in the activity. Work permit system ensures that both groups adhere to the minimum requirements and work together.

7.4 Statutory Requirements:

Statutory requirements are the main consideration for implementation of the work permit system. Many countries have their statutory requirements to have a work permit system in the industry. In India, Petroleum Industries follow Oil Industry Safety Directorate (OISD) Standard - 105. So, here whenever we talk about the work permit system, it shall comply with the requirements of OISD Standard - 105.

Some of the main requirements of work permit system as per OISD Standard - 105 are:

- All jobs must be carried out with a valid work permit. Areas exempt from permit requirements shall be appropriately designated.
- The work permit system will function based on the 'Owner-in-charge' principle.
- The permit issuer and safety officer shall frequently inspect the work sites to verify compliance with permit conditions.
- Gas testing for oxygen, flammable, and toxic gases must be carried out prior to hot work and confined space entry operations.
- After completion of the work, the permit shall be closed.
- All personnel must get training before being authorized to issue permits.

7.5 Organisational Requirements:

As already mentioned, we can modify the system as per the requirements of the organisation. The work permit system in an organisation with a small organisational structure, with only a few employees, may not work well for an organisation with a lot of work sites and a lot of employees. Similarly, the permit system also varies as per the nature of the organisation. A company doing construction business will be having a work permit system suitable for a construction site. In construction sites, the situation is constantly changing. Therefore, the consideration will be on points like material handling, working at height, excavation, etc. But in an industry like Oil Refinery, the main considerations are different as hazards are present everywhere in the Refinery.

7.6 Definitions & Abbreviations:

a) **Cold Work:** Cold Work refers to an operation that fails to generate adequate heat to ignite a combustible air-hydrocarbon mixture or a flammable material.

b) **Hot Work:** An action capable of generating a spark, flame, or other ignition source with adequate energy to initiate combustion, particularly in the presence of flammable vapours, gases, or dust. This encompasses all activities that generate sparks, such as the operation of internal combustion engines, the breaking of concrete, the use of normal torches, and the use of battery-operated devices, among others.

c) **Excavation:** Any work that necessitates the excavation or digging of soil. An excavation is a human-made cut, hole, trench, or depression in the earth's surface created by the removal of soil or rock. A trench is a narrow excavation, relative to its length, created beneath the ground's surface.

d) **Working at Height:** Any operation carried out at a height of 2 meters or more on temporary structures, scaffolds, or on a structure not designed for that specific task safely.

e) **Radiation Work:** Any activity using a source of ionizing radiation that fails to produce sufficient heat to ignite a flammable air-hydrocarbon mixture or a combustible material.

f) **Confined Space:** It is a confined area with identifiable risks and few entry points. It is not intended for regular human occupation and is typically inadequately ventilated, including vessels, boilers, storage tanks, and big diameter pipelines. The excavation exceeds 1.2 meters in depth; entry into floating roof tanks, when the roof is more than 3 meters below the top, as well as spaces situated below ground level, such as pits and drain channels, shall also be classified as confined spaces.

g) **Lower Explosive Limit (LEL):** LEL can be defined as the minimum concentration of a vapour in air (or another oxidant) at which flame propagation fails to occur upon contact with an ignition source. This is often articulated as the volumetric ratio of vapour in the atmosphere.

h) **Upper Explosive Limit (UEL):** UEL signifies the maximum vapour concentration in air (or another oxidant) at which flame propagation halts upon encountering an igniting source. This is often expressed as a volumetric percentage of vapours in the air.

i) **Pyrophoric Substance:** Substances that ignite spontaneously under ambient air conditions at room temperature. In hydrocarbon industries, iron sulphide is the primary pyrophoric substance, commonly known as pyrophoric iron.

j) **Self-Contained Breathing Apparatus (SCBA) Set:** It is essential personal protective equipment including a face mask, connected to a hose and a fresh air supply, usually in the form of a pressurized air cylinder, to be utilized by the wearer.

k) **Gas Safety Inspector (GSI):** GSI denotes an authorized officer tasked with performing the necessary evaluations before approving a work permit. He must personally ascertain that the tank, vessel, line, equipment, or any other confined space involved is safe for the intended work. He is empowered to autonomously issue Cold Work permits and permits for Working at Height. He is listed under the designation "Issuer."

l) **Fire Permit Signatory (FPS):** FPS refers to an appointed officer empowered to grant work permits. He serves as the 'Fire Permit Signatory' for Hot Work, Confined Space Entry, Vehicle Entry, Excavation Permits, and any other permits. He grants the permit for the specific task after reviewing the checklist items for the units/areas under his supervision. FPS will execute the permit upon confirming that GSI has completed all requisite testing and has endorsed the permit. He falls under the heading of "Issuer."

m) **Receiver (Permittee):** The 'Receiver' is the appointed individual allowed to obtain the work permit. The 'Receiver' typically refers to the departmental officer responsible for implementing the specific task for which the permit has been granted. The executing officer may be the Engineer In charge, Site In charge of the project, or another appointed individual from the executing department, usually the service department.

n) **Blanket Permit:** The hot work permit is granted to locations following careful evaluation of safety, ensuring minimal fire threats and assessment of risks from adjacent facilities, with local management's consent for a maximum duration of one month. The permit does not require shift-wise renewal; nonetheless, the executor must verify compliance with permit conditions throughout the duration of the activity.

7.7 Works require Permit:

Typically, all maintenance, repair, and construction activities must be carried out with an appropriate work permit. Jobs requiring a work permit include, but are not limited to, the following:

- Major and minor maintenance work.
- Inspection.
- Construction.
- Alteration.
- Erection and dismantling of a scaffold.
- Cleaning activities of process equipment.
- Work at height.
- Any hot task, including the usage of standard battery-operated equipment in operational zones.
- Entry into confined space.
- Excavation.
- Vehicle entry into process areas.
- Isolation and energization of electric equipment/facilities.

- Utilization of mechanical methods for material handling in operational zones.
- Radiography.

7.8 Works Exempted/Partially Exempted from Permit:

The following works are excluded from the permit requirement:

- Standard tasks performed by operations department workers (e.g., pump changeover, furnace ignition, valve operation, etc.). Safety precautions are included in the system throughout the execution of the above-mentioned tasks and are detailed in the operating manuals.
- Standard procedures are performed on equipment brought into the workshop by the maintenance department, and the regular operation of workshop equipment (except for the hot work permit).
- Conducting routine testing of samples and managing chemicals in the Quality Control Laboratory (excluding hot work permits).
- Tasks performed during emergencies (such as fires, explosions, rescues, or uncontrolled releases of dangerous chemicals) to manage the situation.
- Activities conducted at the construction site with managerial authorization (excluding permits for hot work, radiography, and working at height).

7.9 Issuance of Permit:

- The permittee, responsible for direct supervision of the task, shall make a request for the requisite permits. All permits shall be granted in duplicate or triplicate, depending upon the type of permit. There are mainly 06 types of work permits depending upon the nature of the job e.g. Cold Work Permit, Hot Work/Entry into Confined Space/Vehicle Entry Permit, Excavation Permit, Working at Height Permit, Radiation Permit, Electrical Isolation and Energization Permit.
- The "Electrical Isolation and Energization Permit" shall be initiated by the equipment custodian (Operation in charge).

- Permission for the job to be completed by a contractor must be obtained and signed by the maintenance, project, or construction engineer, rather than by the contractor.
- The validity period, in terms of date, start time, and completion time, must be mentioned.
- The work's location must be clearly specified in relation to the plant, plant area, building, vessel, or equipment. The identification number of the equipment must be provided. A site drawing should be attached to the permit whenever required for clarity.
- The designated area GSI shall verify the permit requirements indicated in the specified format. The permission will be granted only upon fulfilment of all conditions. Any supplementary precautions and comments, if applicable, must be clearly stated. All items must be distinctly marked in the boxes designated as "Done" and "Not Required."

7.10 General Requirements of Work Permit:

1) All maintenance, alteration, and construction activities within the industry must be carried out under a valid "Permit to Work." Typically, operational workers do not need work permits for ordinary tasks, but in extreme circumstances where exposure to specific dangers is probable, work permits are mandated. The necessity of a work permit in these instances is to be determined by the FPS of the respective region or unit in charge.
2) Separate permits must be allocated for each task. Engaging in multiple jobs under a single permit is prohibited, with the exception of entry into confined space and hot work conducted within the same confined space using certain equipment. In such instances, composite permits may be given, and the permit must cover all relevant issues pertaining to both jobs.
3) In a confined space where many agencies are required to work, risk identification and assessment may be conducted by a permit-issuing team alongside various executing agencies, which may then formulate a strategy for the safe execution of tasks. The assessment will include a Job Safety Analysis (JSA) for each specific activity as well as for the group as a whole. The work

plan requires Management's approval. A unique authorization for "Entry into Confined Space" may be obtained in such circumstances.

4) Permits and clearances must be in printed format, in duplicate or triplicate as required by the nature of the task, serially numbered, with a designated format number and distinct colour codes for various types of permits and clearances. However, now-a-days some industries are following an on-line system, where printouts are to be made available at work sites positively.
5) Each permit shall be accompanied by a duly signed "Dos and Don'ts" document, and the specified safety requirements must be adhered to at the work site.
6) The type of permit necessary shall be determined by the nature of the job.
7) A 'Working at Height Permit' is mandatory for tasks carried out at a height of 2 meters or above on a temporary or fixed structure not designed for the safe execution of specific jobs.

   i) Some of the points to be noted:

   - Prior to the start of erection for all scaffolds, a pre-erection checklist in the specified format must be completed, and adherence to safety requirements is mandatory.
   - A safety harness with lifelines anchored to a fixed structure is essential for operating at elevated heights. Safety netting should also be provided.
   - All scaffolds must be inspected and certified in the designated format prior to utilization.
   - Workers engaged in elevated tasks must possess a medical certificate issued by a physician.

   ii) For working at height jobs, the followings are to be ensured:

   - All tools must be carried in tool kits to avert their fall.
   - It is illegal to discard or throw items or equipment from an elevated position.
   - Refrain from jumping between different members of a structure. Utilize the designated pathway.
   - Both hands must remain free while climbing the ladder. It is advisable to avoid bypassing the steps of the ladder.

- Refrain from doing movements on the overhead beam without adequate fall protection measures.

8) All excavation permits and excavation clearances are required in the specified format. Furthermore, approval for road closure must be obtained in the designated format, and this information shall be circulated to all relevant parties in the specified manner.

   For Excavation Permit jobs, the following information must be ensured:

   - A protection barrier or warning sign, measuring 1 meter in height and including a red and white band or a self-illuminating caution board, must be erected around the excavated site.
   - Excavated material should be piled at least 1 meter from the edge of the excavation or trench, or the depth of the trench, whichever is larger.
   - At least two entries and exits must be provided. Additionally, a ladder shall be provided for every 7.5 meters, or any fraction thereof, of an excavated trench.
   - Appropriate angle of repose or adequate shoring/strutting to avert cave-ins shall be provided in accordance with applicable rules and safe operational procedures.
   - Excavation clearance shall be taken from multiple departments in the specified format prior to applying for an excavation permit.

9) For Radiation Permit jobs, the following shall be provided:

   A warning or protective barrier of 1 meter in height shall be provided around the area, adhering to the distance specifications given in the permit, with radiation signs and symbols clearly displayed by the permit holder.

10) The permit-issuing authority must ensure that the permit criteria are fulfilled prior to issuing the permit. It is vital to make sure that permit conditions are maintained during the execution of the task.

11) Prior to the issuance of a permit, an inspection of the equipment is required to confirm that the equipment/facility is adequately equipped for the safe execution of the designated work, the area is cleaned, and all safety measures have been implemented. Wherever necessary, ensure that equipment is isolated, drained/depressurized, properly purged, water flushed, gas tested

(including oxygen deficiency test) through portable gas meters, and readings have been recorded in the permit.

12) Hot work is prohibited until the Explosimeter indicates a reading of zero. Access to confined spaces, where no hot work will occur, is permissible, if flammable gases do not exceed 5% of the Lower Explosive Limit (LEL). Entry with an air-supplied mask may be permitted with LEL up to 20%. The oxygen level should be at least 19.5% vol. and the concentration of toxic gases below the threshold limit value.
13) Clearance for "Confined Space Box-up" in the prescribed format shall be obtained solely for those areas where a "Confined Space Entry" permit has been obtained. The clearance must be obtained in duplicate, with one copy returned to the issuer upon completion of the work.
14) "Electrical Isolation and Energization of Equipment" permit shall be taken as per requirement.
15) All stakeholders will get training on the "Work Permit System" to ensure proper implementation in compliance with applicable standards and guidelines. Additional refresher courses will be organised, and records will be kept with the area manager and the Training Department to ensure that no unskilled individual signs the permit. He shall proactively start training for the individual whose validity is nearing expiration.

7.11 Responsibilities of Permit Signatories:

7.11.1 Gas Safety Inspector (GSI) as Issuer:

- To ensure the equipment, facility, or area is adequately prepared before offering for maintenance, repair, construction, or inspection in accordance with established procedures.
- Verify that the equipment, facility, and environment are secure for the specific task.
- Permits are properly filled up and precautions are categorically stated.
- A gas test has been carried out when necessary (gas tests are obligatory for hot work and entry into confined spaces).

- GSI shall confirm that the tested atmosphere is free of gas or that gas concentrations are within permissible limits for the specified task prior to endorsing any work permit and shall ensure that all necessary precautions have been taken to keep the atmosphere under control throughout the operation.
- Avoid providing generic or vague comments regarding the permit that lack specificity.
- For height work, ensure the availability of secure access to the site and the supply of ladders, platforms, or scaffolding for the safe execution of tasks. Inspect the scaffolds secured with green tags.
- Ensure effective energy isolation and determine the necessary extent of isolation for the task.
- Authorization or clearance will not be granted unless it is confirmed that the conditions specified in the work permit have been thoroughly met and the area is deemed safe for the designated task. All energy sources must be positively isolated for confined spaces.
- Finalize the permit upon job completion and retain a copy for no less than three months. Copies of "Hot Work/Entry into Confined Space/Vehicle Entry" must be returned to the fire station after completion.
- Always keep a copy of the permit with you.
- Refrain from signing the permission without appropriate authorization.

7.11.2 Fire Permit Signatory (FPS) as Issuer:

- The FPS shall check the permit submitted by GSI to determine the adequacy of the safety requirements specified therein and may conduct physical inspections of critical compliance items, which involve gas testing, isolation, tagging, and LOTO implementation, and suggest corrective actions prior to issuing the permit.
- He will carefully assess the work site conditions for all critical operations (including hot work in operational units/near OSW lines, working at height, entry into confined space, radiography, etc.) and ensure compliance with permit conditions before signing.

- His experience may enable him to identify extra hazards and risks in jobs that require attention, which he will incorporate into the permit for compliance.
- Prior to signing, he shall verify that the criteria stipulated in the permit by GSI are completely adhered to on-site.
- The permit shall be cancelled, if the specified restrictions are breached or if the job's safety is compromised for any other reason. All relevant parties should be informed about the withdrawal.

7.11.3 Receiver (Permittee) / Executing Authority:

- Regarding the permit, the Receiver (Permittee) must review the permit and disseminate the instructions as specified within it for compliance. In the event of any doubt, he shall seek clarification from the Issuer.
- Refrain from signing without proper authorization.
- Ensure adherence to the measures specified in the permit at the location.
- Verify that the equipment utilized is safe for the specific work in that area.
- Verify that all power-driven apparatus, including cables, cable insulation, and cable joints, conform to standards and are maintained in optimal condition.
- Ensure that permits are always accessible at work sites throughout the duration of operations.
- Perform duties exclusively at a designated place.
- Ensure the utilization of sanctioned types of spark arrestors on the exhaust systems of all internal combustion engines.
- The responsibility for inspecting and certifying, including attaching tags on each scaffold, shall be with the executing authority.
- All tasks shall be executed in accordance with established maintenance protocols and pertinent safety regulations.
- Confirm the presence of a legitimate medical fitness certificate for employees working at a height of 2 meters or above under the "Work at Height" permit.
- Ensure that the area is cleared after job completion.
- Close the permit after completion of the work and submit it to the relevant authorities.

7.11.4 Head of the Department (HOD):

- To evaluate the requirement for a job outside standard working hours.
- To evaluate the sufficiency of safety measures outlined in the permit and to reinforce them, if necessary.
- An independent assessment may be conducted to evaluate safety compliance at the site.

7.11.5 Fire Station Operator (During Registration):

- Verify that the authorized signatories have signed the permit in the designated columns.
- The permit is accurately completed, including the duration, location, nature of the work, and all checklist items are addressed.
- The gas test has been carried out, and the readings are documented in the “Hot Work/Confined Space Entry/Vehicle Entry” permit.
- Notify the Shift In charge of the Fire Station, if standby coverage has been requested from the Fire Station.

7.11.6 Functional General Manager (GM):

- To ascertain the necessity of a blanket permit for the excavation and dyke cutting of a tank.
- Is the area secure for the job in relation to a blanket permit?
- To evaluate the sufficiency of safety measures outlined in the permit and to enhance them if necessary.
- An independent assessment may be conducted to evaluate safety compliance at the site.
- For dyke cutting, ensure that resources are deployed on-site to mitigate any inadvertent release from tank containment.

7.12 Type of Work Permits, Clearances, and Formats:

There are mainly 06 types of work permits followed in industries depending upon the nature of job which are outlined below:

- Cold Work Permit
- Hot Work/Confined Space Entry/Vehicle Entry Permit
- Excavation Permit
- Permit for Work at Height
- Radiation Permit
- Electrical Isolation and Energization Permit

7.12.1 Cold Work Permit:

Cold work permits are those permits that do not provide sufficient heat energy to ignite a flammable atmosphere. These are jobs that cannot cause a fire, if a flammable atmosphere is generated in vicinity of the location of the job. Almost all jobs other than hot jobs are considered in this category. This includes jobs like cleaning, opening of flanges, servicing of equipment, etc. The main thing to be noted during such jobs is that this job should not create such a condition that can cause a fire. For example, consider a job that involves servicing equipment that has an intrinsically safe enclosure. If we open the enclosure, the equipment may be a cause for ignition. So, such activities shall come under hot jobs.

The most important question here is to identify how hazardous a cold job can be and what are the precautions to be taken here. It is to be reminded that cold works are those permits assessed by the permit signatories as those jobs which do not come under any category. So, if there is any misinterpretation of the hazardous nature of the job, there could always be an accident. So, it is very important to assess the jobs and hazards properly.

Now, let us see a sample permit and discuss various points mentioned in it. The Format for "Cold Work" permit is mentioned in *Appendix – 2*.

A cold work permit is a very simple permit. Here, we have only to take the basic precautions to ensure that the job is executed safely. The major points taken care of in the checklist part are:

i) *Checking the work area and the surrounding area:* It is vital to make sure that the work location and the area are entirely safe for use. There should not be any adverse effect on the job by the activities going on in nearby areas, and the job that we are going to carry out should not pose any hazard to the activities in the surrounding area.

For example, consider that work is planned near a vent line of a vessel which may vent toxic gases at a certain interval. Here we want to ensure that the venting is not done when the job is going on or the job is stopped when the venting is going on.

ii) *Ensuring the equipment is safe to work:* This is the most important step in the work permit system. We will discuss this in depth when we talk about other permits. As of now, we want to ensure that the equipment is ready for personnel to work on it.

For example, if a job is to be done on a pump, it is to ensure that the motor is de-energized and disconnected from the pump. When we are de-energizing the motor, the tag details of the same should be mentioned in the permit.

iii) *Then comes the gas testing part.* Gas testing is of relatively less significance in the case of the cold work permit as compared to other permits, such as a hot work permit or a confined space entry. But it is quite important and should not be skipped.

7.12.1.1 Sample Flow Chart of Cold Work Permit:

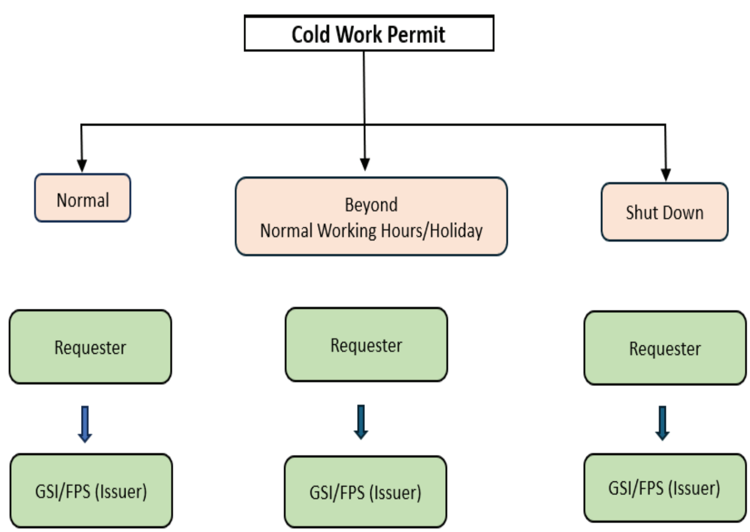


Fig. 7.1: Flow Chart of Cold Work Permit

7.12.2 Hot Work/Confined Space Entry/Vehicle Entry Permit:

In contrast to cold work, hot work is any job that generates sufficient energy to ignite a flammable atmosphere. The examples are welding, gas cutting, and many more. Due to its capability to cause ignition, hot jobs are of a very critical nature in industries handling flammable material, such as hydrocarbon industries and gas processing plants. Hence, it is very important to rigorously follow the permit procedure and safety precautions to do such jobs safely.

The format for the "Hot Work Permit" is mentioned in *Appendix - 3*.

Each Hot Work Permit shall be provided with a duly signed "Dos and Don'ts for Hot Work Permit." The same is included in *Appendix - 3A*.

There are many places in industry where normally people need not enter but will have to enter in case of a special job requirement. Consider a furnace, for example. Normally, personnel do not need to enter the furnace. But during plant turnarounds, the furnaces are shut down and opened for inspection and maintenance. But there may be hazards present inside this area which can cause harm to the person entering it, such as hot surfaces, presence of fuel gas, etc. This also has many other hazards such as low light, falling or damaged material from top, and even getting trapped inside, if someone unknowingly closes the access. Such places are called confined spaces.

A confined space is characterized as an area with restricted access and egress, not intended for prolonged human habitation. A typical workplace may be classified as a confined environment, if access to it is obstructed. A confined space job is defined as a task in which an individual totally or bodily enters the space to perform work.

Confined spaces have many hazards associated with them. Some of them are:

i) **Oxygen Deficiency:** It can be due to consumption of oxygen by organisms in space or due to chemical processes like oxidation or rusting.

ii) **Toxic Gases:** Toxic gases get accumulated inside the confined space due to improper cleaning, release from deposited material, chemical reactions etc.

iii) **Presence of Flammable Atmosphere:** Flammable atmosphere is mainly due to the materials handled in space.

iv) **Entrapment Hazards:** Some confined spaces are complex in nature that the person at the entry point may not be able to see, if any person is working in the area. In such cases, there is a hazard that the space may get closed with the person still inside the area. So, precautions are also to be taken to prevent this too.

The Format for "Confined Space Entry Permit" is the same as "Hot Work Permit" (Composite Format) which is mentioned in *Appendix - 3*.

Likewise, a properly signed "Dos and Don'ts for Confined Space Entry" "shall be included with each Permit for Confined Space Entry. The document is added as *Appendix - 3B*.

Before issuing a permit for "Confined Space Entry," the requirement of Pre Entry checklist for Confined Space" format shall be complied. The format is enclosed as *Appendix - 3C*.

The attendance of each entrant in a confined space shall be recorded by the attendant at the equipment's manway. The format for the same is provided as *Appendix - 3D*.

Every confined space that has been opened must be closed after getting the requisite clearance. The format for "Confined Space Box-up Clearance" is included as *Appendix-3E*.

Note: The format for "Vehicle Entry Permit" is same as "Hot Work Permit" (Composite Permit) and only relevant points to be filled up.

7.12.2.1 Sample Flow Chart of Hot Work/Confined Space Entry/Vehicle Entry Permit:

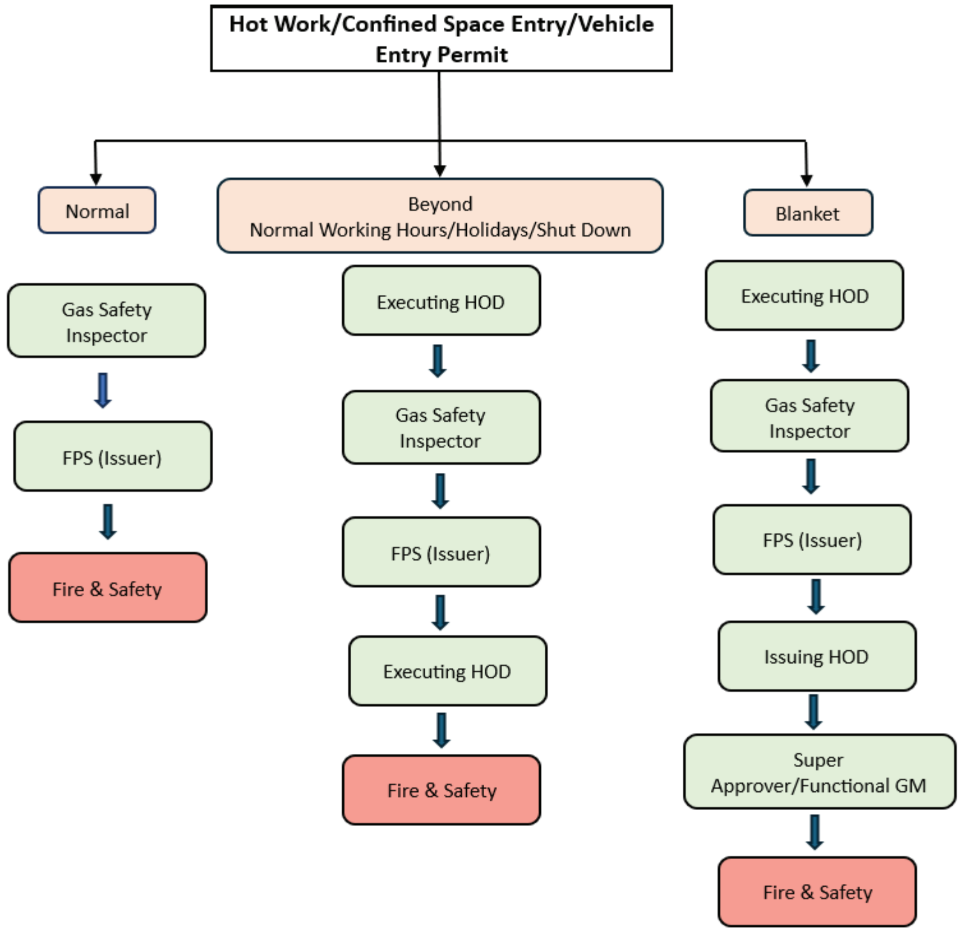


Fig. 7.2: Flow Chart of Hot Work/Confined Space Entry/Vehicle Entry Permit

7.12.2.2 Explanatory Notes on "Cold Work/Hot Work/Confined Space Entry/ Vehicle Entry" Permit:

The explanatory notes for completing the work permit and its checklist elements are detailed below to explain the fundamental principles and highlight their importance:

i) *The exact location (Area/Unit/Equipment No.):* The exact area where the work is to be performed must be recorded accordingly. For instance, Column No. 101, Tank Farm A, Tank No. 501, etc.

ii) *Description of work:* A comprehensive account of the tasks to be performed shall be recorded. Whenever possible, sketches with signatures shall be attached to prevent miscommunication.

iii) *Equipment/Area inspected:* The equipment or workplace must be checked to confirm its safety for carrying out the work and to assess additional safety requirements or specifications. For the equipment/vessel box-up permission, it is required to verify that the work is completed, all personnel have exited, no maintenance tools remain, and debris has been cleared.

iv) *Surrounding area checked/cleaned:* Hazardous situations for work execution may arise from the surrounding environment. It must be cleaned to remove combustible substances, such as oil, rags, grass, etc.

v) *Coverage of sewers, manholes, closed blowdown (CBD), and heated surfaces:* Combustible gases may come from adjacent sewers. Uninsulated hot surfaces, such as equipment and pipelines, can act as ignition sources; therefore, they must be properly insulated to prevent fires.

vi) *Risks from both routine and non-routine operations have been assessed and personnel notified:* Nearby operations, whether routine or non-routine, that may generate harmful conditions for the permitted job must be considered, and relevant individuals should be duly notified.

vii) *Equipment must be electrically isolated and tagged:* Before issuing a permit, it is essential to verify that electrical isolation is completed, switches are locked out, and cautionary tags are appropriately signed with the date and time recorded.

viii) *Running water hose, portable fire extinguisher provided, and fire water system accessible:* A running water hose and a portable fire extinguisher are necessary for flushing or diluting hazardous chemicals, extinguishing sparks, and promptly extinguishing small fires. To address any emergency, it is necessary to verify that the firewater system, including firewater pumps, storage, and network, is inspected and maintained in a state of readiness for prompt utilization.

ix) *Equipment that is blinded, disconnected, closed, isolated, or has an opened wedge:* The equipment for which the work permit is given must be isolated from the rest of the plant to ensure that there are no changes in the work environment concerning the presence of toxic or flammable gases, liquids, hazardous chemicals, etc., during the work process. Blinding is one of the most effective means of isolation. Blinds must be installed near the equipment in the best possible way. If lines cannot be blinded, they should be disconnected, and the exposed ends must be closed with pipe covers, plugs, or blind flanges.

x) *Equipment properly drained/depressurized:* Equipment under pressure must be depressurized after isolation. This should be followed by draining, purging, or water flushing, as appropriate.

xi) *Equipment holding liquid hydrocarbons:* This must be entirely emptied. There exists a potential for neglecting liquid accumulation in pockets or hard-to-reach regions, that involve level gauges, small nozzles or bleeders on vessels, and laterals in the piping system. All low point drains (LPDs) should be in unplugged condition.

xii) *Equipment adequately steamed and purged:* The purging of equipment (tanks, vessels, pipes, etc.) is conducted to eliminate flammable hydrocarbons and poisonous gases. Steam/Inert Gas is utilized for gas freeing of vessels and pipelines in various locations. Alternative methods of purging include displacement with water and the removal of residual gas using a suitably grounded air blower. All high point vents (HPVs) must be disconnected during purging. The process must be carried out systematically to involve the entire equipment or plant and continue until the concentration of dangerous or flammable gas is reduced to permissible levels.

xiii) *Water flushing of equipment:* Water flushing serves as an efficient method for cooling, cleaning, and gas freeing equipment. It is also utilized to eliminate residues of acids and chemicals. Metallurgy of equipment must be checked prior to utilizing sea water or saline water. Occasionally, it is essential to flush with demineralized water based on the equipment's metallurgy.

xiv) A gas/oxygen deficit test is to be carried out. The gas test includes the assessment of:

- ✓ Hydrocarbons using the Explosimeter.
- ✓ Oxygen Deficiency measured through Oxygen Meter.
- ✓ Multi-gas meter for detecting toxic gases that involve H_2S, CO, SO_2.
- ✓ Nickel Carbonyl and Chlorine, among others, utilizing methods such as the Indicator Tube Method and Lead Acetate Paper.

xv) *Shield against sparks provided:* Hot work activities such as welding and grinding produce sparks that can ignite surrounding materials. To safeguard the operational area from the dangers of created sparks, shields must be installed to trap these sparks. The shield material shall be non-combustible and maintained in a wet state using water.

xvi) *Proper ventilation and lighting provided:* In the absence of natural ventilation, fans or air blowers are to be utilized. These are also necessary for the rapid dispersal of fumes produced during welding operations. Only authorized reduced-voltage extension lights (not exceeding 24 Volts) are permitted for use in confined spaces, prioritizing personal safety.

xvii) *Proper means of exit provided:* Proper exit routes are necessary in the event of emergency arising from work-related incidents or other circumstances. The consideration of an alternative escape route is very much essential.

xviii) *Area cordoned off and caution boards provided:* To prevent unauthorized access to the work area and to alert personnel against actions that may endanger individuals engaged in the permitted task, precautionary tags or boards must be installed to indicate messages such as "No Entry" on roadways or "Caution - Men at Work Inside" at vessel manholes, as well as "Danger - Radiography in Progress," among others.

xix) *Portable equipment/Hose nozzles properly grounded:* To reduce the possibility of static electricity generation, portable equipment and hose nozzles, including those utilized in shot blasting guns, shall be properly grounded. The use of hydrocarbon lines for grounding should be avoided. An ELCB (30 milliamp circuit breaker) must be installed on electrical circuits or cables that provide power to portable equipment.

xx) *Trained Attendant provided for entry to confined space:* Upon an individual's entry into a confined space, a minimum of two designated trained persons must be positioned at the manway or entry point. The designated person must keep communication with others in the confined space and take remedial actions during an emergency.

xxi) *Personnel designated for fire watches from Process, Maintenance, Contractor, and Fire & Safety Department:* Based on the job's criticality, the work permit issuer will determine the type of standby required, including the department, level, quantity, and any supplementary firefighting and rescue related facilities.

xxii) *Iron sulphide removed/maintained in a moist state:* Pyrophoric materials may exist in the operational vicinity or equipment handling hydrocarbons. Iron sulphide scale is the most common pyrophoric material found. These should either be relocated to secure areas or maintained in a consistently wet state to avoid auto-ignition.

xxiii) *Checked spark-arrestor on mobile equipment:* No vehicle or engine without a PESO approved spark arrestor is allowed in operational zones.

xxiv) Prior to commencing hot work, an inspection for oil or gas traps behind the equipment or inside the pipeline must be carried out.

xxv) Adequate communication facilities, such as intrinsically safe or hands-free devices like Walkie-Talkies, shall be supplied to stand-by personnel to maintain contact with individuals inside the confined space during the operation and to respond promptly, if assistance is needed.

xxvi) The attendant at the manway of a confined space must be trained in rescue operation and the use of Self-Contained Breathing Apparatus (SCBA) set and must have the necessary equipment at site to provide assistance as needed. He shall communicate effectively with emergency teams, as necessary.

xxvii) Continuous inert gas flow is necessary when access into a confined space in an inert environment is required. The continuous flow of inert gas must be arranged to sustain the oxygen concentration and other gases within specified limits.

7.12.3 Excavation Permit and Clearances:

7.12.3.1 Excavation Permit:

Excavation jobs inside an industry also pose some hazards. The main hazards associated with excavation job are:

- The presence of pipes and other utility services inside the soil can be damaged and cause accidents.
- Collapse of excavation.
- Fall into the excavated pit.
- Collapse of the nearby structure due to the collapse of the excavation etc.

If we look in the excavation permit format, we can see that unlike other permits, this permit does not have any permit checklist. This is maintained because an excavation permit is just a permit to do an excavation. This means that, with an excavation permit we do the excavation and after that if we want to do a work inside an excavation, we do the same by taking the relevant work permit.

An excavation permit is necessary for carrying out any excavation within the plant. The "Excavation Permit" format is included as *Appendix - 4*.

A signed copy of the "Dos and Don'ts during Excavation Work" must accompany each Excavation Permit. The document is included as *Appendix - 4A*.

A duly completed, signed, and recorded "Excavation Clearance" is a prerequisite for obtaining any Excavation Permit. The format is included in *Appendix - 4B*.

Whenever a temporary road closure, road cutting, or obstruction of main roadways is necessary within the plant, the requisite approval must be secured using the "Format for Road Closure," attached as *Appendix - 4C*.

The details on the closure of the main road will be circulated in the format provided in *Appendix - 4D* .

a) Requirements for Excavation Permit:

Below mentioned are some of the requirements for excavation permit:

i) Exact location of the excavation with drawing.
ii) Dimension of the excavation (Note: For work inside excavation more than 1.2m. in depth, confined space entry permit is required).
iii) *Manual or Mechanized Excavation:* In a location where there are underground facilities, it may not be possible to do mechanized excavation. In such cases, it is required to do manual excavation. So, this needs to be assessed at the time of preparation of the permit.
iv) Availability of adequate warning signs.

7.12.3.2 Excavation Clearance:

Another important part regarding excavation permits is the excavation clearance. In practice, excavation clearance comes before the excavation permit. OISD standard also mandates that clearance from multiple departments for underground facilities to be taken before starting of the job and attached with the permit. The major underground utilities include Under Ground Power Cables, Product Lines, Sewage

Lines, Telephone Lines, Internet Cables etc. A sample excavation clearance is also attached as *Appendix - 4B*.

In the clearance, it can be seen that permission from various departments is taken for underground facilities. This clearance is also working on an ownership concept i.e. owners are specified for various underground facilities.

For example: Electrical department will own the underground power distribution cables, Fire & Safety department will own the underground Fire Water Network etc. That owner department will check the area and ensure that no cable/pipeline exists at the location where excavation is planned.

Special Cases of Excavation:

i) *Road Cutting:* When an excavation job includes cutting off a road, it requires special precautions. The various departments, especially Fire & Safety, Hospital for Ambulance, are to be informed about road cutting and the alternate road.

ii) *Dyke Cutting:* Dyke walls are built around storage tanks for containment of material in case of a leakage. When dyke walls are cut, this will expose a hazard of spillage of the material to outside in case of a leakage from the tank. So, sufficient precautions like sandbags to be used in these cases to close the open part daily after completion of the work for that day.

7.12.3.3 Sample Flow Chart of Road Closure Permit:

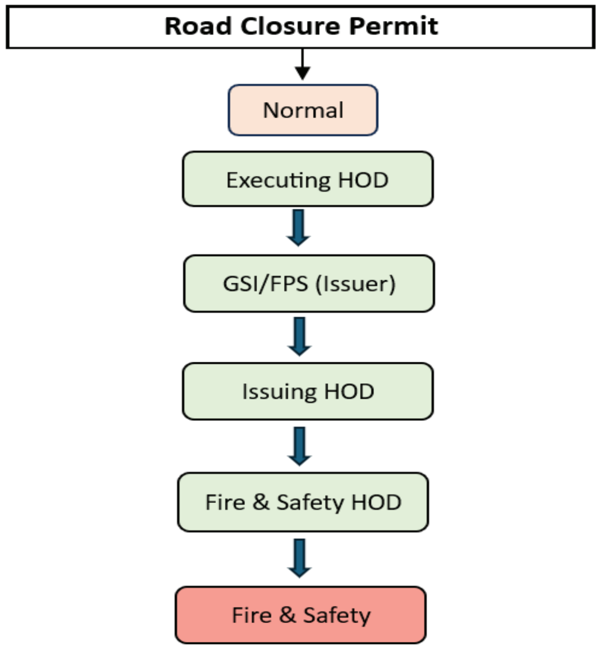


Fig. 7.3: Flow Chart of Road Closure Permit

7.12.4 Working at Height Permit:

Height work also poses a major hazard in the industry. As the name suggests, height work is the work that is done above a certain height on a temporary work platform or a location that is not designed to do a job safely. The height above which the height work permit is required is 2 meters being followed in most of the Indian Industries.

For all working at height (of 2 meter or above), a permit for 'Working at Height' is required. The format for this is available in *Appendix - 5*.

Prior to erection, when scaffold materials are stored at the erection site, a 'Pre-Erection Checklist for Scaffold' must be completed in the designated format. This is included as *Appendix - 5A*.

All tubular scaffolds must be inspected and certified prior to use. The procedure for verification and certification is included as *Appendix - 5B*.

The medical certificate for workmen, required to work at height is required. The format for the same is enclosed as *Appendix - 5C*.

Note: Here the concept of 'location not designed to do a job safely' to be clearly understood. All permanent structures are not designed for a person to do a job on it. For example, slanting roofs. They pose a hazard of personnel falling off the roof. For such places, sufficient safeguard to be taken before starting the job.

7.12.4.1 Precautions for Working at Height:

a) **Scaffolding Safety:** Scaffolds are another important consideration in working at height. Scaffolds are temporary structures designed to do work at a height. Scaffolds are of different types and different load bearing capacity. The building of scaffold itself becomes an activity which requires working at height permit.

The major considerations for a scaffold are:

i) The assembly of any tubular scaffold shall not begin until the on-site verification of scaffold materials (concerning quality and quantity), site preparations, availability of Personal Protective Equipment (PPE), and the presence of qualified employees for assembly has been documented in the designated "Pre-Erection Checklist for Scaffold." Compliance with the checklist requirements is mandatory before initiating scaffold erection on-site. This checklist must be completed in duplicate. The original document shall be preserved by the executor, whereas the first copy shall be held by the issuer (responsible area).

ii) All scaffolds, after erection, must be examined and certified in the specified format by the scaffold supervisor and the officer of the executing department. All scaffolding must be inspected upon completion of erection and subsequently at least every seven days or following weather conditions that may have compromised the stability of the scaffold, or after any modifications.

All inspected and certified scaffolds shall be marked with a "Green Tag" duly filled out and signed by the scaffold supervisor and the officer of the executing department. All incomplete scaffolds, scaffolds undergoing modification or alteration, and those deemed unfit for use shall be marked with a "Red Tag." The tags should be properly filled up and signed.

(*Green Tag*: Indicates that the scaffold is safe for utilization & *Red Tag*: Indicates not safe for utilization.)

iii) Scaffolds have been constructed on stable ground utilizing a sole plate and base plate. A solid foundation is crucial; thus, the ground or floor supporting the scaffolding must be carefully assessed. Soil or artificial terrain requires consolidation. Sole plates must extend beneath a minimum of two standards, and joints should be located within one-half to one-third of the distance between any two neighbouring standards. At the conclusion of the standard, the solitary plate shall extend a comparable distance. A sole plate is unnecessary when scaffolding is built on a concrete surface. Base plates are mandatory for all scaffolds.

iv) Platforms have been equipped with toe boards, guard rails, and the area below is barred.

Toe Board/Kicking Board: It is a board positioned at the edge of a platform or area to prevent the fall of individuals, tools, and materials.

Guardrail/Handrail: A tube connected to the edge of the platform and other locations to protect individuals from falling from a height of around 1 meter above the platform.

v) Access to the scaffold, including the use of a standard aluminium ladder, shall be provided. Optimal access to a work platform is achieved by engaging a dedicated ladder tower (for raised scaffolds) or a cantilever access platform to avoid platform blockage and mitigate the risk of individuals falling through gaps in the guardrail or decking.

b) **Roof Work Safety:**

i) All roofing tasks must be meticulously planned and adequately supervised.

ii) Roof work shall be performed exclusively by individuals who are physically and psychologically capable and possess the requisite knowledge and expertise for the task.

iii) Roof work should not be carried out in weather conditions that threaten worker safety.

iv) Crawling boards, walkways, as well as roof ladders must be securely fastened to a sturdy structure.

v) Roofing brackets must conform to the roof's slope and be adequately supported.

vi) When an individual must kneel or crouch near the roof's edge, appropriate measures shall be taken.

vii) A straightforward barrier composed of intersecting scaffold tubes supporting a tubing guardrail may be installed on an extensive roof where tasks must be performed at or near the edge.

viii) All roof opening coverings must be of strong construction and securely fastened in place.

ix) Roofs with a pitch above 10 shall be classified as sloped.

x) During operations on sloped roofs, adequate and appropriate crawling boards or roof ladders must be supplied and securely anchored in place.

xi) During extensive roofing activities, sturdy protections such as guardrails and toe-boards must be implemented to avert individuals from falling from the roof.

xii) Workers required to operate on or near roofs or areas with fragile materials, where there is a risk of falling, must be equipped with appropriate roof ladders or crawling boards that are sufficiently strong to support them when spanning the roof covering's supports.

xiii) At least two boards must be supplied to eliminate the need for an individual to stand on a fragile roof to reposition a board, ladder, or for any other purpose.

c) **Work on Tall Chimneys Safety:**

i) Tubular scaffolding shall be supplied for the construction and maintenance of tall chimneys. A safety net must be positioned at an appropriate distance beneath the scaffold.

ii) The scaffold floor must consistently be situated at least 65 cm. below the chimney's peak.

iii) The floor beneath the scaffolding shall remain in place as a catch platform.

iv) The gap between the inner border of the scaffold and the chimney wall shall not surpass 20 cm. at any location.

v) Catch platforms shall be erected over:

✓ The entrance to the chimney.

- ✓ Passages and work areas where employees may be at risk from falling objects.

vi) Access for climbing tall chimneys shall be facilitated by:

- ✓ Stairs or ladders.
- ✓ A column of iron rungs securely embedded in the chimney wall.
- ✓ Alternative suitable methods, such as access towers or elevators, etc.

vii) When workers ascend the chimney using the external rungs, a securely attached steel core rope, looped at the free end and extending downward at least 3 meters, shall be supplied at the summit to assist the workers in their ascent to the chimney.

viii) During the construction of independent chimneys, the vicinity of the chimney shall be secured with a fence at a safe distance.

ix) Workers engaged in the building, change, maintenance, or repair of tall chimneys should refrain from:

- ✓ Execute tasks externally without a safety harness attached by a lifeline to a rung, ring, or other secure anchorage.
- ✓ Position tools between the safety harness and the body or in pockets not intended for such use.
- ✓ Manually carry heavy things or equipment to and from the worksite via the chimney.
- ✓ Secure pulleys or scaffolding to reinforce rings without prior assessment of their stability.
- ✓ Operate independently.
- ✓ Ascend a chimney lacking secure ladders or rungs.
- ✓ Chimney work should not start unless appropriate measures to mitigate risks from smoke and gases have been implemented.
- ✓ Work on independent chimneys shall not be conducted during high winds, freezing conditions, fog, or thunderstorms/lightning, etc.

x) All individuals seeking to work at the chimney must undergo a medical examination and possess a valid Medical Certificate demonstrating their fitness for the position in the prescribed format. The certificate's validity shall be one year.

7.12.4.2 Sample Flow Chart of Height Work Permit:

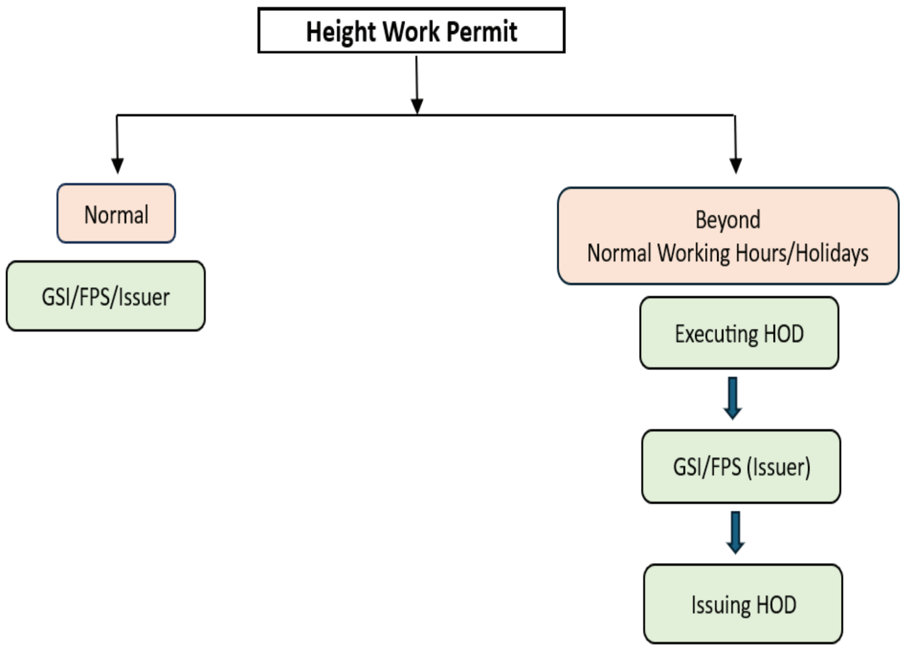


Fig. 7.4: Flow Chart of Height Work Permit

7.12.5 Radiography Permit:

The jobs which generate ionizing radiation, “Radiography Permit” are required. The format for the same is enclosed as *Appendix - 6*.

Radiography Permit shall normally be issued valid for a single shift only, and clearance on the same permit can be renewed/extended up to a maximum of seven calendar days. GSI/FPS of the area shall issue clearance renewal in each shift after checking permit conditions.

Radiography permit is divided into two parts. *Part-1* will be filled by the radiography agency, and an officer of the inspection department will endorse the permit. The permittee/receiver shall fill the permit for validity of time & date, nature of work and location of work before seeking permit from issuer. For obtaining a work permit, permittee shall fill up the above information and send a duly signed copy to the issuer. After checking and filling the *Part-2* of the permit format, the issuer shall hand over the signed permit to the receiver. The receiver will go through the permit, ensure compliance, and sign the permit before starting the job.

GSI/FPS of the area is authorized to issue the permit.

The permit is issued in duplicate, the original copy (Blue in colour) for receiver shall be water marked as "Executor Copy" and duplicate copy (white in colour) for issuer shall be watermarked as "Issuer Copy." In the case of on-line permit systems, the procedures to be followed accordingly.

7.12.5.1 Sample Flow Chart of Radiography Permit:

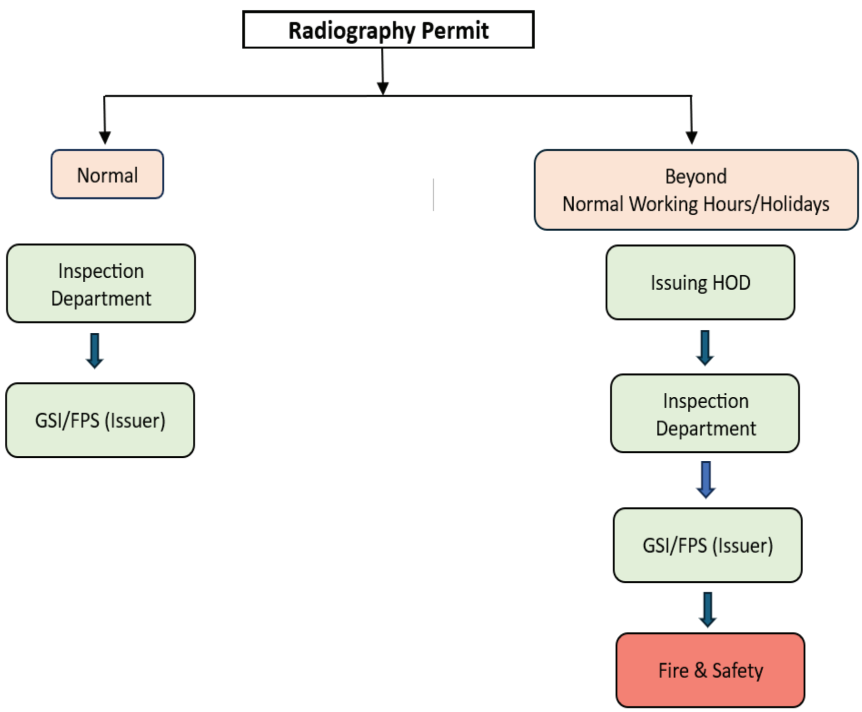


Fig. 7.5: Flow Chart of Radiography Permit

7.12.6 Electrical Isolation and Energisation Permit and Clearances:

Electrical-related work is one category that is quite different from the other work covered by the work permit system. In other permits also we have seen electrical hazards and preventive measures due to the electrical appliances used. But in this session, the discussion is exclusively on work that involves working on equipment that carries electricity such as power distribution panels, switchgear rooms etc. Due to the invisible nature of electricity, special precautions need to be followed in such cases. Here, the electrical permit is basically an electrical isolation permit that follows a certain step to ensure that the equipment is isolated and de-energised in a proper procedure and then energised back.

It is commonly known as Lock-Out Tag-Out (LOTO) system which is described below in detail:

LOTO is a safety procedure that de-energizes and secures equipment, machinery, or processes to prevent hazardous energy from being reintroduced during maintenance, repair, or servicing. This is achieved by locking and tagging equipment or machinery to prevent accidental startup or release of stored energy.

Purpose:

The primary goal of LOTO is to prevent accidental injuries or harm to workers who are working on equipment that could be energized.

By properly de-energizing and securing equipment, workers can complete maintenance tasks more efficiently and safely.

How it Works:

Let us see the flow of LOTO in common.

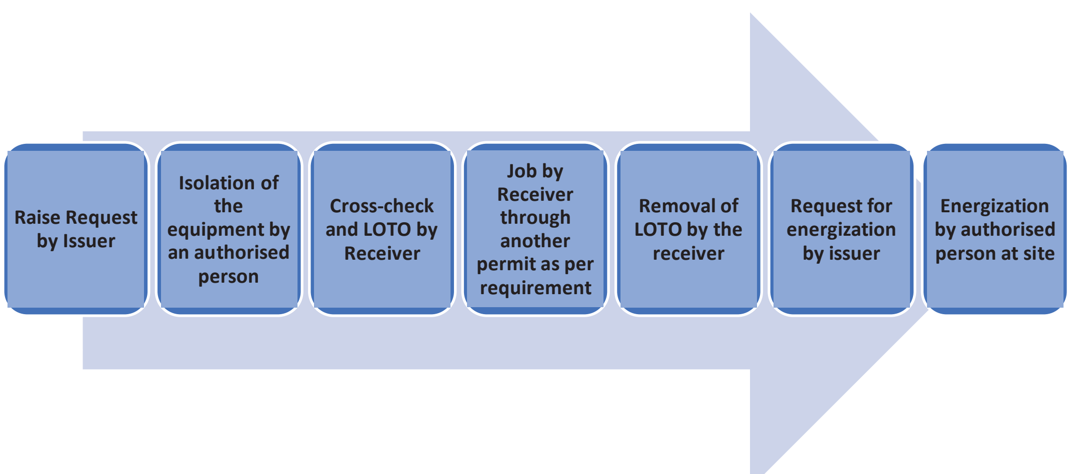


Fig. 7.6: Flow Chart of LOTO

Whenever there is a job on the equipment, the area in charge of the equipment raises a request to the person in charge of the area where the isolation switch of the equipment is located. For example, if there is a motor that needs to be isolated, a request is raised by the plant in charge to the substation in charge for isolation of the motor.

The substation in charge will isolate the motor, de-energize it at the substation and at the site and lock the switch with safety tagging in isolate position.

The area in charge will cross check this and put his lock and safety tag on the switch preferably with the different coloured lock.

The area in charge then informs the executor to do the job on the motor. The executor, then cross checks by himself at the substation and puts his lock & safety tag on the switch. He then proceeds with his activity on the motor.

The same procedure is followed in reverse fashion for energisation of the equipment.

For all electrical isolation and energisation of electrical equipment "Electrical Isolation and Energisation Permit" is required. The same is enclosed as *Appendix - 7.*

Benefits:

- Safety: LOTO meaningfully reduces the risk of injuries and accidents during maintenance activities.
- Compliance: Many organisations and industries have regulations and guidelines that require the implementation of LOTO procedures.

7.13 Steps for Working Safely with a Work Permit:

The work permit system mitigates the risk of accidents and incidents by ensuring that individuals are cognizant of specific hazards and implement the requisite safeguards for the task at hand. It ensures communication occurs between the production and maintenance departments throughout the planning, site preparation, task execution, and ultimately the handover and restoration of the site to its normal state.

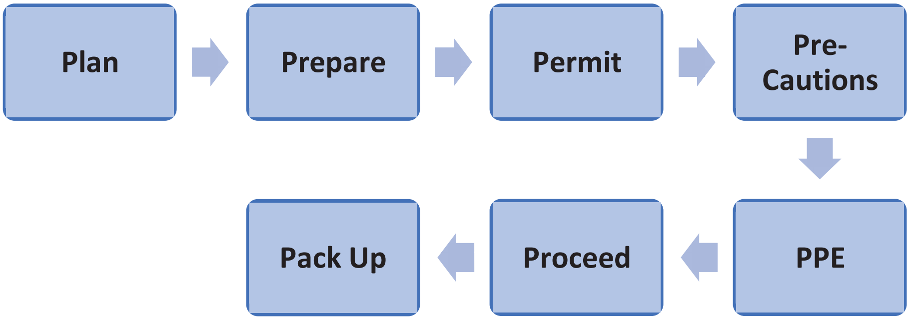


Fig. 7.7: Steps for Work Permit Implementation

Step 1: Plan

Prior to completing a work permit, it is essential to strategize the maintenance task while allowing sufficient time. The nature of each job varies and may subject individuals to distinct hazards and unsafe conditions at the worksite. Effective planning necessitates meticulous advance scheduling of tasks. Effective planning can be executed within an electronic system. When breakdowns occur and emergency maintenance is required, it is still important to make a quick plan.

Planning includes delineating the tasks to be executed, the processes and equipment involved, the necessary spare parts, the essential tools, and the potential need for specialized talents. It also entails ensuring the availability of all forms of safety apparatus, including Personal Protective Equipment (PPE) and gas testing devices, among others.

Step 2: Prepare

Prior to the initiation of work, the work site must be adequately prepared following the planning phase. Preparation at the work site must be conducted in advance and necessitates numerous operations, including process shutdown, equipment cleaning, draining & purging, installation of blinds (where applicable), and ensuring site safety.

The preparation is typically conducted by process employees, although service workers may participate as well. Preparation work often requires an extended duration and can involve multiple shifts, making communication between shifts crucial. The preparatory work includes a site examination conducted by both the production and maintenance teams to determine the specific requirements.

Step 3: Permit

The permission will be generated from the work order or job card, primarily from the maintenance department. The system enables the paperwork of information several days prior to the execution of the real work. The permit clearance process requires time due to the involvement of various departments.

Most hazardous industries possess a central planning office responsible for the preparation, review, and authorization of permits by maintenance agents. The individual accountable for permission authorization (the receiver) signs the permit, after which the Head of Department (HOD) of the receiver approves it. The individual accountable for the task in the field (the issuer) then signs the permit, followed by the HOD of the issuer approving the permit. Subsequently, certain categories of permits are recorded in the Fire and Safety Department.

An effectively structured permit system will ensure that the team thoroughly evaluates the hazards associated with the task, along with the requisite safeguards to be implemented.

Step 4: Precautions

During the permit creation, specific job hazards are recognized, and the necessary procedures for safe works are outlined. Precautions include adherence to defined protocols, utilization of designated instruments, implementation of isolations, provision of supplementary equipment such as hole watchers for confined space operations, and the necessity of specialized Personal Protective Equipment (PPE) like Self-Contained Breathing Apparatus (SCBA) Set etc.

The permit procedure must incorporate isolation management as a fundamental component. Isolations are typically governed by a system of locks and keys, which must be carefully regulated and diligently adhered to.

Step 5: Personal Protective Equipment

The crucial aspect of exercising caution is the utilization of Personal Protective Equipment (PPE). Standard personal protective equipment, including safety shoes and helmets, will likely be mandated for all works conducted within the plant area in accordance with policy and procedure. Any supplementary or specialized personal protective equipment necessary for the task will be detailed on the permit according to the requirements.

The utilization of personal protective equipment must be suitable for the task and in optimal condition. Excessive specification of PPE may occasionally pose supplementary risks; therefore, the PPE requirements must be accurately evaluated by an individual with relevant expertise in the task at hand. For instance, gumboots are recommended for safeguarding against water exposure. However, after the water-related task concludes, the worker engaged in other activities while wearing gumboots creates an inconvenience and poses a tripping hazard. Judgment and direction are necessary to ascertain the practical PPE requirements that enhance safety without introducing additional complications.

Step 6: Proceed

After completion of the permit formalities, the job will start at site. As the permit is signed both by receiver and issuer, it will be counted as a written agreement. At this stage, the permit will have all vital information including job description, location of job, timing of job, the hazards identified, the precautions to be taken (that includes PPEs). In some permits also the name of members mentioned as per their role in the job.

It is very much essential that a print be made available at the work site with clearance for information of different people who come for inspection. Also, the hard copy required by the Fire & Safety officer/inspector to verify whether all the points are being complied at site as per permit conditions or as mentioned in the permit. In the case of On-line Permit System, the documents as per requirement to be made available at site.

Sometimes, it is necessary to do a Job Safety Analysis (JSA) depending on the criticality of the job and site conditions. The JSA is being done by a multidisciplinary team in a structured way, which requires step-by-step analysis to complete the job by identifying specific hazards, risks, and precautions to be taken to work safely.

During the execution of a job, it is imperative to monitor operations to make sure compliance with the precautions outlined in the permit and to verify that no alterations have occurred at the work site or surrounding areas that might risk the safety of personnel present.

Step 7: Pack Up

When work is completed, the facilities at site must be restored and all tools, tackles, and equipment to be packed up. In consultation with plant operation personnel, individual isolations are systematically removed, and the section of the plant is then recommissioned and put back into service. The handing over procedure to be followed by the permit procedure involves both maintenance and operational people to bring back the normal operations.

The permit is then finally to be signed off and the team will move to another site for a new job. Certain definite actions to be taken in this stage, for example contractors should not leave the work site until the site is cleared, all equipment is packed up and the permit is closed.

7.14 Human Side of Work Permit System:

The human side of every safety management system is a very important consideration in the success of its implementation. How strong the system is, unless it is followed in its true sense, the system is not effective. The same is the case for the work permit system too. It has very little technological side, which forces the personnel to follow it. In other words, there are no mechanical interlocks that ensure that the job is not started unless the permit is taken. It all depends on the human factor.

Consider the following scenario:

- If a person is doing a job without getting a work permit, the sole purpose of the work permit system is failure. Only another person can interfere and ensure that the person is doing the work following the work permit system. Hence, this system will be successful only if the personnel are well aware of the system and are ready to willingly follow it.
- Consider the role of Requester & Issuer. They have the role of actually assessing the site condition and ensuring that the site is safe for work. But what happens, if they do not go to the work site and complete the permit by sitting in the office only. The purpose of the system fails here too.

- Consider the case of personnel doing the work at the site. The issuer and receiver had mentioned the safety precautions, but it is the personnel and their line supervisor who has to ensure the compliance at site.

So, we can see that the work permit system is a highly human oriented system. It is rightly called a "Gentlemen's Agreement." The system is an agreement between the two parties. It is the collective responsibility of the two parties to ensure that the conditions are followed, and the job is done safely.

7.15 More than Work Permit System:

Let us see some of the features of work permit system that make it unique:

i) The work permit system is one of the most established safety management systems. Not only that, but almost all the industries follow the system, and all of them are also well-documented.
ii) It is very easy to follow. Working personnel, even at the layman level, can easily be trained in the system.
iii) The checklist system allows easy compliance.
iv) It covers almost all the daily maintenance activities.
v) It includes the name of the personnel who signed the documents. Hence it helps to cultivate a feeling of responsibility among the personnel.

As mentioned above, the work permit system is one of the oldest and well-established safety management systems. Even though it has been in the industries for a very long time, still many accidents and incidents are happening in those industries. This raises serious concern over the effectiveness of the system.

Some of the drawbacks of the system are:

i) The work permit system is highly human attitude oriented. It does not provide any interlock with the compliance of the system at site.
ii) It does not cover the process parameters. There is very little mention of the process and other variable parameters in the work permit. So, if there are any changes in the condition during the course of the job, this could result in serious injury. Hence in many cases, the system is kept in conjunction with other hazard assessment techniques like Job Safety Analysis (JSA) etc.

7.16 Summary:

The various work permits discussed here are for different types of jobs that require a specific Permit to Work (PTW) before being carried out. When work permits are neither issued nor successfully implemented, workers are exposed to hazards. Numerous instances of PTW violations have been noted, necessitating appropriate regulation and management to enforce PTW and other critical variables that contribute to accident prevention. A poorly implemented PTW system is one of the root causes of some industrial accidents. Those who are responsible for carrying out the jobs and preparing PTW should have adequate training, understand the scope of the job they are preparing the permit for, and communicate every detail of the permit to those who will work under that permit. The industries like oil and gas, chemical, construction and other hazardous industries that make use of a PTW system do implement effectively of the PTW system by making it more reliable, descriptive, and simple to understand and ensure proper supervision and monitoring in every step i.e., when it is issued, in use and after use. The successful execution of PTW systems offers numerous advantages, including the elimination of incidents/accidents and enhanced production.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *What is a Work Permit?*

- ◻ a) A work permit is a formal written authority for persons, usually tradespersons, to carry out work including maintenance on a plant, a building, or an item of equipment.
- ◻ b) A permit to work informs other workers that work is being done.
- ◻ c) A permit to work is a formal means of ensuring that tradespersons know how to do the job that is required.
- ◻ d) All the above.

2. *A Safe Work Permit is required for emergency procedures.*

☐ a) True

☐ b) False

3. *No blanket Work permit shall be authorized for work that spans across a number of proprietary areas.*

☐ a) True

☐ b) False

4. *Intrinsically safe instruments can be used with the following permit?*

☐ a) Hot Work.
☐ b) Without Hot Work.
☐ c) No Permit.
☐ d) All the Options.

5. *Original copy of the work permit should be at ________________?*

☐ a) With the Issuing authority.
☐ b) Work site.
☐ c) With the Receiving authority.
☐ d) With the contractor.

6. *What are two important reasons for using work permit?*

☐ a) To communicate and control work.
☐ b) To track contractors and manage emergencies.
☐ c) To designate representatives and communicate.
☐ d) To track work hours and contractor names.

7. *Why do we use work permits in hazardous areas?*

☐ a) To identify a designated representative.
☐ b) To identify receivers.
☐ c) To identify hazards and precautions.
☐ d) To check expired certification.

8. For what conditions are work permits issued?

- ☐ a) Specific work or a specific location.
- ☐ b) General equipment at small work sites.
- ☐ c) General work at a general location.
- ☐ d) Specific tools at a general location.

9. What is listed on a work permit?

- ☐ a) OISD safety precautions.
- ☐ b) Minimum safety precautions.
- ☐ c) Maximum safety precautions.
- ☐ d) Government safety precautions.

10. Why do we use the work permit system?

- ☐ a) To monitor contractor work hours.
- ☐ b) To renew certificates.
- ☐ c) To prevent incidents.
- ☐ d) To log incidents.

11. Examples of low-risk work are:

- ☐ a) Cold work light work and non-destructive testing.
- ☐ b) Spray painting water-washing and turbine work.
- ☐ c) Sweeping, visual inspecting and minor cleaning.
- ☐ d) Brush painting, abrasive blasting and sweeping.

12. What are the receiver's main responsibilities?

- ☐ a) Being the designated main representative.
- ☐ b) Responding to operational emergencies.
- ☐ c) Filling in for the issuer when the issuer must leave.
- ☐ d) Complying with safety precautions and signing the permit.

13.An issuer has which responsibilities?

- ☐ a) Issues and receives work permits.
- ☐ b) Defines precautions and stands in for the receiver.
- ☐ c) Supervises the work crew and signs the permit.
- ☐ d) Defines safety precautions and signs the work permit.

14.What is a work permit issuer responsible for?

- ☐ a) Extending certificates.
- ☐ b) Nothing once he issues a permit.
- ☐ c) The receiver's action.
- ☐ d) Equipment or a work area.

15.Why is it important that the issuer tell the receiver about safety hazards he may find at a job site?

- ☐ a) The receiver does not read the work permit.
- ☐ b) The receiver must respond to emergencies.
- ☐ c) The receiver may not have worked in the area before.
- ☐ d) The receiver must take gas test.

16.Who goes on the joint site inspection?

- ☐ a) The issuer and gas tester.
- ☐ b) The issuer and the area foreman.
- ☐ c) The issuer and receiver.
- ☐ d) The receiver and gas tester.

17.Where must the receiver keep the work permit after it is issued?

- ☐ a) With a senior crewmember.
- ☐ b) Displayed at the job site or in his possession.
- ☐ c) In the control room.
- ☐ d) Within 75 feet of the work site.

18. *When would the issuer check to make sure equipment had been properly prepared for maintenance work?*

□ a) During the joint site inspection.

□ b) After getting countersignatures.

□ c) When the permit is closed.

□ d) After issuing a permit.

19. *Why do receivers go on to joint site inspection with the issuer?*

□ a) To start the work.

□ b) For the receiver to take gas test.

□ c) To discuss hazards and risks.

□ d) To check fire watches certificates.

20. *What do we call the person who is required to be at a job site because of a special skill he has?*

□ a) Stand-by person.

□ b) Designated representative.

□ c) Certified.

□ d) Competent person.

21. *A non-flammable material commonly used to purge process equipment is:*

□ a) Nitrite

□ b) Nitrous oxide

□ c) Nitrogen

□ d) Nitrate

22. *When preparing equipment for maintenance work the issuer must make sure it is:*

□ a) Isolated, repaired and certified.

□ b) De-energized with the power turned on.

□ c) Shut down, isolated and de-energized.

□ d) Electrified, isolated and shut down.

23. *Two common methods of cleaning process equipment include:*

- □ a) Water flushing and steaming.
- □ b) Purging and gas testing.
- □ c) Steaming and gas testing.
- □ d) Treating and clarifying.

24. *Why do we install blinds in process equipment?*

- □ a) To isolate electrical equipment.
- □ b) To prevent blindness.
- □ c) To keep liquids or gases from contacting people.
- □ d) Because it is a government requirement.

25. *Equipment is isolated to make sure it cannot be:*

- □ a) Slip, trip, or fall.
- □ b) Taken to a shop for repairs.
- □ c) Start-up, leak or cause electric shock.
- □ d) Shut down by accident.

: (1.a, 2.b, 3.a, 4.b, 5.b, 6.a, 7.c, 8.a, 9.b, 10.c, 11.c, 12.d, 13.d, 14.d, 15.c, 16.c, 17.b, 18.a, 19.c, 20.a, 21.c, 22.c, 23.a, 24.c, 25.c)

REFERENCES

1. Occupational Safety and Health Administration. (2023). *Permit-required confined spaces*. https://www.osha.gov/confined-spaces
2. Oil Industry Safety Directorate. (2023). *OISD Standard 105: Work Permit System*. Ministry of Petroleum & Natural Gas, Government of India.
3. International Labour Organization. (2022). *Safety and health at work: A vision for sustainable prevention*. https://www.ilo.org/global/topics/safety-and-health-at-work
4. Health and Safety Executive. (2023). *Safe working practices and permit to work systems*. https://www.hse.gov.uk

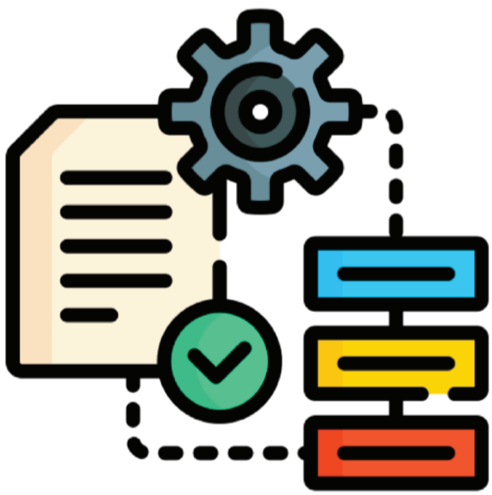
5. American Petroleum Institute. (2021). *API Recommended Practice 500*: *Classification of Locations for Electrical Installations at Petroleum Facilities.*
6. ISMS Standard – 1006. *Work Permit System*. Indian Oil Corporation Limited, Refineries Head Office, Scope Complex, Core – 2, 7-Institutional Area, Lodhi Road, New Delhi – 110 003.
7. Safety Manual (November 2020), Indian Oil Corporation Ltd, Mathura Refinery, Mathura, Uttar Pradesh – 281 005
8. Permit To Work (PTW). Document Number HSSE 13.20.01. BP Wind Energy.

* * *

Chapter – 8

Process Safety Management –

Plays a Key Role in Prevention of Accidents and Injuries



CHAPTER – 8
PROCESS SAFETY MANAGEMENT – PLAYS A KEY ROLE IN PREVENTION OF ACCIDENTS AND INJURIES

8.0 Introduction:

Process safety has been a major force in advancements made in various sectors of day-to-day life. With these advancements, the hazards associated with various activities also increased. Industries started to handle more hazardous materials at higher process parameters. With these hazardous activities we observe more and more process accidents. Examples of unexpected discharges of toxic, reactive, or flammable liquids and gasses in processes involving highly hazardous compounds have been observed for many years. Numerous industries continue to experience incidents involving extremely dangerous compounds that can be toxic, reactive, explosive, or possess a combination of these characteristics. If these extremely hazardous substances are not properly monitored, there is a chance of an unintended leak at any time, regardless of the industry using them. As a result, there is a chance of a major event or catastrophe.

Significant disasters include the 1984 Bhopal Gas Tragedy in India, which caused over 2,000 fatalities; the October 1989 Phillips Petroleum Company incident in Pasadena, Texas, resulting in 23 deaths and 314 injuries; the July 1990 BASF incident in Cincinnati, Ohio, leading to 1 death and 71 injuries; and the May 1991 IMC incident in Sterlington, Louisiana, which resulted in 8 deaths and over 120 injuries. While these significant incidents involving highly dangerous chemicals garnered national attention regarding the potential for catastrophic events, the public record has extensive information about several other less prominent releases of such compounds. Releases of hazardous chemicals persist as a substantial risk to employees.

In recent years, process safety has garnered heightened attention due to many significant mishaps. This is partly attributable to the global monitoring of the chemical sector prompted by numerous catastrophic events, including gas emissions, significant explosions, and environmental disasters. Public awareness of these and other incidents has served as a catalyst for the sector to enhance its safety record.

8.1 What is Process Safety?

Process Safety is a systematic framework for managing the integrity of operational systems and processes that handle hazardous materials, utilizing strong design principles, engineering, and operational practices. It deals with managing and preventing situations that can result in the discharge of energy or dangerous elements. Such incidents have the potential to cause serious injuries, property damage, lost productivity, and environmental degradation due to toxic effects, fire, or explosion.

We cannot depend exclusively on insights gained from significant process incidents, which occur seldom. To enhance safety barriers and avert such accidents entirely, it is essential to gather, compile, and analyse data from less severe occurrences and deficiencies in management system performance.

8.2 Process Safety Management (PSM) System:

With the goal of lowering the frequency and intensity of accidents brought on by the release of chemicals and other energy sources, the PSM system is a collection of interconnected strategies created to mitigate hazards in the process industries. These standards cover design principles, audit programs, organisational and operational procedures, and a number of additional strategies.

To keep things safe, companies need to follow a strong PSM system. This system is built on 14 key elements that work together to prevent accidents, protect workers, and keep operations stable and efficient.

Fig: 8.1: PSM Model

In this chapter, we will explain these 14 important parameters in a simple way, with real-life examples and tips to help companies improve their safety efforts and avoid problems before they happen.

1. **Process Safety Information (PSI)**

Process Safety Information (PSI) is the starting point for any good safety program. It means keeping clear and accurate records about the chemicals used, the processes followed, and the equipment involved in the work. This helps in spotting dangers early and reducing risks.

Significance:

- It gives important details about how chemicals behave and how they might react with each other.
- It makes sure that machines and equipment are strong enough to handle what is needed.
- It helps in training workers to understand the risks and how to stay safe.

Practical Example:

In one fertilizer factory, a serious accident happened because the safety records for anhydrous ammonia were incomplete. Workers did not know that ammonia reacts with certain metals. This caused a pipe to burst, releasing toxic gas and putting many people at risk.

Safe Work Practices:

- Keep updated Material Safety Data Sheet (MSDS) for every chemical you use.
- Review and update safety information regularly.
- Make sure all workers can easily find and understand this information.
- Display Material Safety Data Sheets at Storage & Operational areas.

2. **Process Hazard Analysis (PHA)**

Process Hazard Analysis (PHA) is a careful way of finding possible dangers in how a factory or plant runs. It uses methods like HAZOP, FMEA, and What-If Analysis to look for things that could go wrong and figure out how to prevent them.

Significance:

- Helps spot worst-case scenarios before they happen.
- Improves safety by fixing weak areas in the system ahead of time.
- Makes sure the company follows safety rules and legal requirements.

Practical Example:

At one petrochemical plant, a HAZOP study showed that gases could build up near storage tanks because the vents were not working properly. The company added extra safety vents and gas alarms. These changes helped avoid a possible explosion, saving lives and money.

Safe Work Practices:

- Do a PHA at least once every five years, or sooner if there are big changes in the process.
- Include a team from different departments, more eyes mean better risk detection.
- Write down the findings and make sure all safety improvements are completed and tracked.

3. **Operating Procedures**

Operating procedures are clear, step-by-step instructions that tell workers how to safely run equipment and carry out processes. These instructions should cover normal operations, startups, shutdowns, emergencies, and any unusual situations that might come up.

Significance:

- Reduces mistakes by guiding workers on exactly what to do.
- Keeps work consistent, even when different people or shifts are involved.
- Prepares teams for emergencies by clearly explaining how to respond.

Practical Example:

In one pharmaceutical industry, a batch got contaminated because workers did not follow the proper cleaning steps. After this, the company updated their Standard Operating Procedures (SOPs), added pictures to show the correct steps, and gave regular training. As a result, the risk of contamination went down a lot.

Safe Work Practices:

- Review and update procedures regularly, especially after any process changes.
- Use pictures, checklists, or digital tools to make instructions easier to follow.
- Hold regular training and practice drills to keep everyone sharp and prepared.

4. **Employee Training**

Employee training means teaching workers about the risks in their jobs and how to work safely. Regular training and testing help everyone stays alert and ready to handle dangerous as well as emergency situations.

Significance:

- Helps prevent accidents caused by mistakes or lack of knowledge.
- Makes sure workers know how to react quickly and correctly during emergencies.
- Builds confidence in handling risky tools, equipment, or chemicals.

Practical Example:

In one power plant, an untrained worker opened a high-pressure steam valve the wrong way and got badly burned. After that, the company started On-The Job training (OJT) generously, so workers could safely practice handling risky situations. Within a year, safety violations were cut in half.

Safe Work Practices:

- Create training programs that match each worker's job and duties.
- Use videos, simulations, and real-life practice to keep learning interesting and useful.
- Keep track of who is been trained and give refresher training regularly.

5. **Contractor's Safety Management**

Contractors are often hired for jobs like construction, repairs, or maintenance in factories and plants. But since they do not work there every day, they might not know the site's safety rules properly. That is why it is important to make sure contractors follow the same safety standards as regular employees.

Significance:

- Contractors may not know about specific dangers at your site.
- If safety is not managed well, one contract worker's mistake can put everyone at risk.
- Authorities also hold companies responsible for keeping contract workers safe.

Practical Example:

At one of the industries, a contractor was hired to fix a pipeline. Because he was not properly trained, he used the wrong welding method. This caused a fire and shut down the plant. After this, the company started a contractor safety program and began asking for contract worker's feedback to improve safety.

Safe Work Practices:

- Check each contractor's safety record before hiring them.
- Give every contract worker mandatory safety training before they start work.

- Set up a system to monitor and make sure contract workers are following all safety rules.
- Conduct toolbox talks before start of the jobs.

6. **Mechanical Integrity**

Mechanical Integrity means making sure that important equipment, like pipes, pressure vessels, safety valves, and alarms is always in good working condition. Regular checks, maintenance, and testing help prevent serious equipment failures.

Significance:

- Stops unexpected breakdowns that could cause dangerous accidents.
- Makes sure machines can safely handle high pressure, heat, or other tough conditions.
- Safety guidelines require regular equipment inspections.

Practical Example:

In one of the chemical plants, a pressure vessel broke down suddenly because it had corroded over time. This released dangerous gas into the air. After the accident, the plant started using IoT sensors to monitor equipment health. As a result, they had far fewer surprise breakdowns and shutdowns.

Safe Work Practices:

- Keep a list (asset register) to track when each piece of equipment needs to be inspected.
- Use smart tools like predictive maintenance sensors to catch problems early.
- Do regular testing and audits to make sure everything follows safety standards.

7. **Management of Change (MOC)**

Management of Change (MOC) is the process of checking for safety risks before making any changes, whether it is a change in equipment, chemicals, procedures, or people. Even small changes can cause big problems if not handled carefully.

Significance:

- Helps avoid new safety hazards that may come with changes.

- Makes sure everyone involved knows about the change and is trained properly.
- Keeps the company in line with safety laws and regulations.

Practical Example:

A factory changed from one type of solvent to another to save money. But the new solvent did not work well with their old pipes. This caused leaks and environmental damage. If they had used the MOC process, this risk would have been addressed and avoided.

Safe Work Practices:

- Set up a formal system to review and approve all changes.
- Always do a risk check before making any changes.
- Train workers on the new process and keep reviewing how the change is working after it is made.

8. **Pre-Startup Safety Review (PSSR)**

Pre-Startup Safety Review (PSSR) is a safety check done before starting a new process or restarting one that has been changed. It makes sure everything equipment, safety systems, and procedures, is ready and safe to use. Skipping this step can lead to serious accidents.

Significance:

- Helps make sure there are no hidden risks before starting the process.
- Checks that all safety systems are working as they should.
- Finds any gaps in training or procedures before it is too late.

Practical Example:

A petrochemical plant was preparing to start a new distillation unit. During the PSSR, the team found that an automatic shutdown system was missing, which could have caused an explosion if the unit overheated. Because of the PSSR, this issue was fixed in time, preventing a disaster.

Safe Work Practices:

- Use a safety checklist before starting any new or changed process.
- Make sure all equipment is tested and workers are fully trained.

- Practice emergency drills to see if the team can respond quickly and correctly.

9. **Emergency Planning and Response**

Even with the best safety systems, emergencies can still happen. That is why every workplace needs a strong emergency plan so that when something goes wrong, everyone knows what to do and can act fast to stay safe.

Significance:

- Helps people respond quickly during serious situations.
- Avoids panic and confusion by clearly assigning roles and responsibilities.
- Meets legal safety rules for emergency preparedness.

Practical Example:

At a chemical storage site, a gas leak caused panic because the emergency plan had not been updated. Evacuation was delayed, and many people were exposed to toxic fumes. After the incident, the company improved its plan by doing regular drills and setting up better communication systems.

Safe Work Practices:

- Create and regularly update your emergency response plan.
- Hold emergency drills with employees and local first responders.
- Set up clear and fast communication methods to use during a crisis.

10. **Incident Investigation**

Every time something goes wrong, whether it is a big accident or just a near-miss it is a chance to learn and make things safer. By investigating what happened, we can find the real cause and fix the problem, so it doesn't happen again.

Significance:

- Helps find hidden problems that may not be obvious at first.
- Improves training and safety rules based on real-life incidents.
- Meets legal requirements for reporting and safety improvements.

Practical Example:

In one chemical plant, a small fire broke out in a distillation unit. It was put out quickly, but the investigation showed the fire started because a pump overheated due to delayed maintenance. The company then changed its maintenance schedules and added a system to keep better track of maintenance tasks.

Safe Work Practices:

- Have a clear process for reporting and investigating every incident.
- Use tools like Root Cause Analysis (RCA) or Fishbone Diagrams to find the true cause.
- Follow up to make sure all safety fixes are completed and working.

11. **Compliance Audits**

Compliance audits are like regular checkups for your safety system. They help find problems early, make sure your company is following the law, and improve safety before something goes wrong.

Significance:

- Makes sure your company is following rules and regulations of statutory body and other safety authorities.
- Helps avoid fines, legal issues, or unexpected shutdowns.
- Finds weak spots and areas where things can be improved.

Practical Example:

At one petrochemical refinery, a safety audit found that several safety valves were overdue for inspection. If this had continued, it could have led to a serious equipment failure. After the audit, the company started using automatic reminders and tracking tools to keep up with inspections and fix problems quickly.

Safe Work Practices:

- Do both internal audits and outside (third-party) audits to get a full picture.
- Use audit results to make safety improvements, not just to meet rules.
- Create a plan to fix issues found in audits and follow up to make sure it is done.

12. **Trade Secrets Protection**

Companies often have secret information like special formulas or processes that give them a business edge. But while it is important to keep this information safe, it is also important that workers get the safety details they need to do their jobs safely.

Significance:

- Keeps workers informed about safety risks without exposing sensitive company secrets.
- Helps prevent accidents when working with dangerous chemicals or equipment.
- Protects the company from insider threats while still following safety rules & regulations.

Practical Example:

A chemical company was unsure whether to share certain reaction details with workers. Managers were worried that sharing too much could lead to leaks of secret formulas. In the end, they gave employees enough safety info to handle materials safely without sharing exact formulations. This kept both people and company secrets safe.

Safe Work Practices:

- Give safety information only to those who need it, based on their job.
- Store sensitive data in secure digital systems.
- Regularly check your policies to make sure they balance safety and confidentiality.

13. **Employee Participation**

Safety is not just the job of managers or safety officers; every employee plays a key role. When workers are involved in safety discussions and decisions, it builds a stronger, more alert, and more responsible safety culture.

Significance:

- Helps workers spot hazards early, before they become serious.
- Builds awareness and responsibility for safety among all team members.
- Boosts team morale by showing that everyone’s voice matters.

Practical Example:

At an oil and gas plant, employees were allowed to report unsafe conditions, acts, and practices. One of these reports helped to find a rusting pipeline before it leaked. The company then expanded the program and even asked contract workers to give ideas to improve safety practices based on their daily experiences.

Safe Work Practices:

- Let employees report hazards freely, without fear of punishment.
- Set up a safety committee with people from different departments.
- Hold regular safety meetings and encourage workers to speak up and share their ideas.
- Observe monthly safety day programme on 1st working day of every month on different themes to spread awareness on safety.

14. **Safety Culture and Leadership Commitment**

A strong safety culture starts with leaders setting the tone. When company leaders actively support and promote safety, it sends a clear message that safety matters to everyone, not just the safety team.

Significance:

- Shows that safety is a core value, not just something done to follow rules.
- Helps prevent accidents by making everyone feel responsible for safety.
- Ensures safety policies are actually followed, not just written in manuals.

Practical Example:

At a large factory, accidents were increasing because management was not involved in safety efforts. Then the CEO launched a safety campaign, held regular meetings with workers, and got personally involved. As a result, accidents dropped sharply over the next two years.

Safe Work Practices:

- Managers should take part in safety audits and meetings regularly.
- Promote a "safety-first" attitude from new hires to top-level executives.
- Set clear safety goals (KPIs) and track progress over time.

8.3 Summary:

Process safety is not just about following rules, it is about creating a culture where safety is part of everything you do. The 14 key elements we discussed above give a clear path to help companies spot risks early, prevent accidents, and build a strong, safe working environment. But creating a solid safety system takes more than just good intentions, it also takes the right guidance and expertise.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *Can Process Safety incidents cause this?*

□ a) Multiple injuries and/or fatalities.
□ b) Massive asset damage.
□ c) Environmental consequence.
□ d) Reputation impact.
□ e) All of the above.

2. *Process Safety Incidents generally are a result of an unplanned or uncontrolled release of hazardous material?*

□ a) True

□ b) False

3. *Permit to work?*

□ a) Addresses personnel safety hazards only.
□ b) Addresses process safety hazards only.
□ c) Addresses components of both personnel safety and process safety hazards.
□ d) All of the above.
□ e) None of the above.

4. *Continuous improvement in tackling personnel safety issues automatically ensures that process safety issues are addressed?*

□ a) True

□ b) False

5. *Process Safety incidents are generally caused by failure of?*

□ a) A single barrier.
□ b) Multiple barriers.
□ c) Sometimes single but sometimes multiple barriers.
□ d) None of the above.

6. A safe plant is the one in which?

- □ a) Integrity is established at the design stage.
- □ b) Technical integrity is maintained throughout the life cycle of the asset.
- □ c) Operating integrity is maintained all the time.
- □ d) All of the above.

7. Who is responsible for managing process safety and asset integrity?

- □ a) Operations and Maintenance Staff.
- □ b) Projects and Engineering Staff.
- □ c) Contracts and Procurement Staff.
- □ d) All of the above either directly or indirectly.

8. If you see any leaks or spills, what should you do?

- □ a) Walk past as it is not your job to report it.
- □ b) Report the leak immediately.
- □ c) Report only if the leak seems to be getting worse.
- □ d) Report only if the leak is big.

: (1.e, 2.a, 3.c, 4.b, 5.b, 6.d, 7.d, 8.b)

REFERENCES

1. Center for Chemical Process Safety. (2009). *Guidelines for Risk Based Process Safety*. American Institute of Chemical Engineers.
2. Occupational Safety and Health Administration (OSHA). (1992). *Process Safety Management of Highly Hazardous Chemicals*. 29 CFR 1910.119.
3. Kletz, T. (1999). *What Went Wrong?* Case Histories of Process Plant Disasters (4th ed.). Gulf Professional Publishing.
4. Mannan, S. (2014). *Lees' Loss Prevention in the Process Industries* (4th ed.). Butterworth-Heinemann.
5. Crowl, D. A., & Louvar, J. F. (2011). *Chemical Process Safety: Fundamentals with Applications* (3rd ed.). Prentice Hall.

6. International Labour Organization (ILO). (2011). *Guidelines on Occupational Safety and Health Management Systems* (ILO-OSH 2001).
7. Chola-MS Risk Services (February 11, 2025). *14 Critical Components of Effective Process Safety Management (PSM)*, Dare House No.2, N.S.C. Bose Road, Parrys, Chennai, Tamil Nadu, 600001

* * *

Chapter – 9

Road Safety – Encourages Responsible Driving Behaviour

CHAPTER – 9
ROAD SAFETY - ENCOURAGES RESPONSIBLE DRIVING BEHAVIOUR

9.1 Meaning of Road Safety:

Road safety instructs individuals on appropriate behaviour when operating vehicles or traversing roadways. Road safety measures, such as the implementation of road and highway barriers, are designed to mitigate the chance of accidents occurring. Subsequent to implementing these steps, the likelihood of accidents, injuries, and property damage is significantly diminished.

9.2 Importance of Road Safety:

There is a continual increase in the number of automobiles on the road. If you perceive the current traffic conditions as poor, they will likely deteriorate in the next few years unless individuals adhere to road safety protocols and enhance traffic awareness to provide a better experience for all.

Several causes contribute to such accidents in the country. Examples include reckless driving, noncompliance with traffic laws, and the failure to utilize helmets and seat belts.

9.3 Road Safety Rules on Road:

Road safety is a key concern. The subsequent list explains the ten main road safety measures:

i) **Helmet First**: Always wear a helmet, whether riding a bicycle or utilizing a two-wheeled vehicle.

ii) **Slow Down**: Avoid excessive speed; adhere to the posted speed limit and operate your vehicle at a safe speed.

iii) **Obey Traffic Rules**: Always observe the traffic signals. Red signifies halt, green indicates move forward, and yellow denotes reduced speed.

iv) **Stay Right**: In India, we drive on the right side of the road. When attempting to overtake another car, execute the manoeuvre from the right side.

v) **No Phones**: Avoid using your mobile phone while driving a vehicle.

vi) **Seat Belt On**: Always wear your seat belt when in a vehicle; it ensures safety.

vii) **Focus on the Road**: While driving, your attention and cognition must be only on the road.

viii) **Keep Your Distance**: Always make sure to stay a safe distance behind and in front of your vehicle.

ix) **No Drinking and Driving**: When you are older and start driving, remember this: never drink alcohol and drive, it is hazardous.

x) **Walk Smart**: While crossing the roadway, maintain discipline, adhere to a designated lane, and ensure that you look in all directions prior to crossing.

9.4 Crucial Road Safety Rules for Children:

i) **Always Hold Hands While Crossing:** Teach children the importance of holding an adult's hand while crossing roads, emphasizing the significance of designated pedestrian crossings and traffic signals.

ii) **Look Left-Right-Left:** Encourage the habit of looking both ways before crossing the street, instilling caution, and attentiveness.

iii) **Stay Visible with Reflective Gear:** Especially during low-light conditions, ensure children wear reflective clothing or accessories to enhance their visibility to drivers.

iv) **Understand Traffic Signals:** Teach the meaning of traffic signals, emphasizing the significance of obeying them meticulously.

v) **Stay on the Sidewalks:** Instruct children to use sidewalks whenever available, keeping clear of the main road.

vi) **Be Cautious Around Parked Vehicles:** Warn them about the hazards of rushing between parked cars and the importance of staying visible to drivers.

vii) **Stay Away from Stray Animals on the Road:** Educate them about the unpredictability of animals on the roads and advise keeping a safe distance.

viii) **Use Proper Safety Gear for Cycling:** For biking enthusiasts, stress the importance of always wearing helmets and other safety gear.

ix) **Board and Exit Transport Safely:** Teach them how to safely board and exit public or private transportation, emphasizing waiting for the vehicle to come to a complete stop.

x) **Educate About Stranger Danger:** Remind children about the dangers of talking to strangers or accepting rides from unknown individuals.

9.5 Better Driving Tips:

A) **Periodically Check the following:**

i) Engine oil, for the longevity of your vehicle's engine.
ii) Utilize radiator coolant to prevent engine overheating.
iii) Battery water level is essential for optimal start-up and longevity of your vehicle's battery.
iv) Maintain tyre pressure to prevent wear and prolong the lifespan of your car tyres.
v) Every day, check below your car for any leaks of water, gear oil, or engine oil.

B) **After taking your Seat on the Steering, adjust:**

i) Seat, ensuring your comfort throughout driving.
ii) REAR VIEW MIRRORS provide an excellent perspective of vehicles approaching from behind.

C) **After starting your Car, see that:**

i) The hand brake light is off; if it is on, release the hand brake.
ii) If the Oil Pressure Indicator Light is illuminated, verify the engine oil level; if it is not illuminated, it is functioning normally.
iii) The battery charger indicator light is off; if it is illuminated, the alternator may be faulty.

D) **During Monsoon, Do the following:**

i) Always operate the vehicle in low gear when crossing a flooded roadway.
ii) Check your brakes while your vehicle traverses a flooded roadway.
iii) If the brakes are slipping, gently warm them by simultaneously pushing the brake pedal and accelerator, then release as they heat up.

E) **During Monsoon, Avoid the following:**

i) Avoid opening the hood during rainfall.
ii) Prevent water from contacting the electrical circuit.
iii) Prevent water from flowing onto the fuel tank.

F) **Before Monsoon, Check the following:**

i) Replace the tyres if they are worn out.

ii) If your wiper machine is not working, oil it or fix it, if it is broken.

iii) Check the wipers. Change out the worn-out rubber.

iv) Check that the headlight's beam angle is correct.

v) Check the windshield washer reservoir's water level.

G) **How to Replace a Flat Tyre?**

i) Gently remove the nuts from the punctured wheel rim.
ii) Position the tyre jack beneath the axle or pad exclusively and elevate the wheel.
iii) Detach the loose nuts and extract the punctured tyre.
iv) Substitute it with the spare tyre and secure the bolts.
v) Lower the jack until the tyre contacts the ground, then re-secure the nuts in a cross pattern (opposite nuts).
vi) Proceed to the closest petrol station to repair the punctured tyre.

H) **After a Long Drive, Ensure that:**

i) Wheel drums should not be overheated; if they are, seek a check-up.
ii) Tyres are not exhibiting uneven wear; if they are, inspect the suspension system.
iii) When the engine is warm, avoid opening the radiator cap.

I) **Tools you should Carry on a Long Drive:**

Collection of small and large screwdrivers, set of wrenches, pliers, plug wrench, jack, lever, and wheel wrench.

J) **Spares you should carry in a Long Drive:**

Engine oil, brake fluid, a container of water, a set of hoses, loose electrical wires, points and condensers, a fan belt, a pair of bulbs, etc.

K) **Documents you should carry while Driving:**

i) PUC Certificate.
ii) Valid Permit Goods and Passenger Vehicles.
iii) Valid Motor Driving License.
iv) Valid Insurance Certificate.
v) Valid fitness certificate for Transport and Passenger Vehicles.
vi) Tax Certificate (TC Book) or One-time paid tax receipt.
vii) Registration Certificate (RC Book).

9.6 Faults Cause Road Accidents:

i) Crossing roads at intersections carelessly.
ii) Turning carelessly.
iii) Conditions are associated with excessive speed.
iv) Mis-judging distance, speed, and clearance.
v) Improper overtaking on the wrong side.
vi) Distracted or not paying enough attention.
vii) When under the influence of drugs or alcohol.
viii) Wet brakes.
ix) Too near to another car.
x) The side door was opened while driving carelessly.
xi) Shivering.
xii) Reverse carelessly.
xiii) Pulling out without being careful from the near side.
xiv) Not staying on the correct side of the road.
xv) Making a careless left turn.
xvi) Losing command.

xvii) Leaving without taking the necessary safety measures.
xviii) Interrupting.
xix) Ignoring pedestrian crossings and failing to stop.
xx) Ignorance about the kind of vehicle being used at the moment.
xxi) Further carelessness or mistakes in judgment.
xxii) Fatigue, illness, and sleep.
xxiii) Distractions from driving include using a phone, playing music, looking at a GPS etc.
xxiv) Disregarding traffic signals and signs.
xxv) Changing traffic lanes carelessly.
xxvi) Carelessly turning around on the street.
xxvii) Blinded or dazzled by another car's lights.
xxviii) Abruptly stopping.

9.7 Factors Affecting Driving:

The following are the different factors that affect driving:

Table – 9.1

Factor	Explanation	Impact on Driving
Attitude	A driver's mindset and outlook towards safety, rules, and responsibility.	Positive attitude leads to safe driving; negative or reckless attitude increases risk of violations and accidents.
Emotion	Temporary emotional states such as anger, stress, fear, anxiety, or excitement.	Strong emotions can distract attention, reduce judgment, cause aggression, or delay reactions.
Knowledge	Understanding of traffic rules, road signs, vehicle operation, and safety norms.	Lack of knowledge can result in traffic violations, unsafe manoeuvres, and poor decision-making.

Factor	Explanation	Impact on Driving
Skill	Practical ability to control the vehicle, manoeuvre, and respond to situations.	Higher skill improves control and confidence; poor skill raises accident risk.
Fatigue	Tiredness caused by lack of sleep, long driving hours, or physical exhaustion.	Slows reaction time, reduces alertness, and increases chances of microsleep or crashes.
Alcohol/Drugs	Influence of intoxicants that impair judgment, vision, coordination, and reflexes.	Major contributor to accidents due to loss of control, poor judgment, and delayed responses.
Distractions	External or internal interruptions like mobile phones, eating, loud music, or passengers.	Diverts attention from the road, delays reactions, and increases accident probability.
Physical Condition	Health status including vision, hearing, and motor abilities.	Poor eyesight, hearing issues, or medical conditions can impair safe driving.
Road/ Environmental Conditions	Weather (rain, fog, snow), road surface, and lighting.	Slippery roads, poor visibility, or bad infrastructure increase driving difficulty.
Peer/ Social Influence	Pressure or encouragement from friends, family, or society.	• Can lead to risky behaviour (speeding, showing off) or encourage to overtake which is an unsafe practice. • Proper counselling can reduce unsafe behaviours.

9.8 Aggressive Driving:

a) **Discourteous:**

i) Honking

ii) Loud Music

iii) Changing Lanes without Signalling

iv) Flashing Headlights

b) **Endangering Others and Possibly Provoking Retaliation:**

i) Blocking Crosswalks at Traffic Signals/Signs.
ii) Parking on Sidewalks.
iii) Speeding across intersections.
iv) Not yielding to pedestrians and bicyclists at crosswalks.
v) Driving on the sidewalks (Often done to avoid speed humps).
vi) Speeding through areas where pedestrians and children may be present.
vii) Weaving/Changing lanes rapidly to avoid delays.
viii) Using the Shoulder Lane to avoid delays.
ix) Merging in without observing the Rules.
x) Not yielding to vehicles that have adequately indicated their intention to merge/turn.

c) **Extremely Hazardous and Provoking Violent Retaliation from Other Drivers:**

i) Excessive speed along with other unsafe activities such as tailgating and weaving through traffic.
ii) Excessive speed in areas where construction work is going on; children are present.
iii) Jumping red lights, stop signs, and making illegal turns.

9.9 Road Rage:

This section describes the various forms of road rage, which have been categorized as hostile, violent, and lethal. Avoid being clear of this when driving.

a) **Moderate Impairment – Hostile Zone:**

i) Showing your disapproval by glaring at another driver.
ii) Accelerating the engine in protest or speeding past the offending vehicle.

iii) Blocking another motorist's path because you are upset about their actions.
iv) Following a driver who has engaged in aggressive driving.
v) To express displeasure, honk or holler at someone via the window.
vi) Pointing at another driver in a visibly offensive manner.

b) **Severe Impairment – Violent Zone:**

i) Making abrupt, menacing movements with your vehicle in retaliation.
ii) Pursuing a different vehicle due to insults or provocation.
iii) Leaving the vehicle and arguing verbally in a parking lot or on the street.

c) **Violent/Deadly Zone:**

i) Getting out of the car and beating or battering someone (fists and feet).
ii) Utilizing a weapon (such as crossbows, iron rods, bats, knives, pistols, and defensive sprays) after exiting the vehicle.

iii) Deliberately colliding with another vehicle out of anger.
iv) Trying to punish the driver by running another vehicle off the road.
v) Attempting to run down a cyclist or pedestrian who is exercising their right-of-way.

9.10 Better Driving Habits for Fuel Saving:

To save fuel, drive smoothly and steadily, maintain optimal tyre pressure, and avoid unnecessary weight. These include avoiding aggressive acceleration and braking, maintaining a constant speed, and ensuring tyres are properly inflated.

i) **Smooth Driving:** Accelerate and decelerate gradually to minimize fuel consumption.

ii) **Constant Speed:** Maintain a steady speed, especially on highways, as fluctuating speeds waste fuel.

iii) **Tyre Pressure:** Keep tyres properly inflated to reduce rolling resistance and improve fuel efficiency.

iv) **Avoid Excess Weight:** Remove other things from the car to save weight and drag and conserve gasoline.

v) **Predictive Driving:** Look ahead and anticipate traffic changes to avoid sudden stops and starts.

vi) **Smooth Braking:** Avoid hard braking, which wastes energy.

vii) **Use Cruise Control:** Utilize cruise control to maintain a constant speed, especially on highways.

viii) **Combine Trips:** Plan your route and combine trips to reduce overall driving distance.

ix) **Reduce Idling:** Turn off the engine when waiting, especially at stoplights or in traffic.

9.11 General Road Safety Guidelines:

The following general road safety guidelines to be followed in day-to-day life sincerely to avoid road accidents and inconveniences.

Dos:

i. Check the vehicle before driving.

ii. Do safe loading.

iii. Keep left on a round circle.

iv. Inspect the surroundings of the vehicle before starting.
   - ✓ Is anybody sleeping under or near the vehicle?
   - ✓ Whether helper or anybody present on footrest or back trolley?

v. Drive the vehicle after blowing the horn.
vi. Maintain the speed limit.
vii. Stop, look and go when coming from the side road to the main road.
viii. Do the reverse with blowing the horn only after getting a signal from the helper.
ix. Park at designated places only.
x. Slow the vehicle during taking turns.

Don'ts:

i) Don't Park vehicle in front of Fire Station/Fire Alarm Point/Fire Hydrant & Monitor.
ii) Don't Use mobile phones while driving.
iii) Don't Drive very close to the front vehicle, maintain a safe distance.
iv) Don't Drive side by side.
v) Don't Overtake on turning.
vi) Don't Stop or turn without a proper signal.
vii) Don't Park on the road or very close to the roadside.
viii) Don't Make crowded in the driver's cabin.
ix) Don't Overload the vehicle.
x) Don't Drive, if not feeling well, consult a doctor.

9.12 Summary:

There is more traffic than ever in the modern world. This implies that it is crucial that we know how to stay safe when driving. The main goal of road safety education is to teach people how to make wise choices when crossing roads or walking on sidewalks. Therefore, always keep in mind that following traffic laws might help you stay safe.

At the same time, when youngsters learn to navigate their surroundings on their own, road safety is essential to their wellbeing. Students can greatly lower their risk of accidents by comprehending and abiding by important safety regulations, such as using helmets and paying attention to traffic signals. Road Safety Rules emphasize the value of making educated judgments when driving, in addition to providing kids with essential knowledge.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. What does a red traffic light indicate?

□ a) Stop
□ b) Go
□ c) Slow down
□ d) Yield

2. What should you do when approaching a pedestrian crossing?

□ a) Speed up to get through quickly.
□ b) Sound your horn to alert pedestrians.
□ c) Slow down and yield to pedestrians.
□ d) Proceed without stopping.

3. What is the purpose of wearing a seatbelt in a vehicle?

□ a) To look fashionable.
□ b) To keep the vehicle clean.
□ c) To prevent motion sickness.
□ d) To enhance safety in case of a collision.

4. What is the purpose of a roundabout?

□ a) To increase traffic congestion.
□ b) To provide a place for pedestrians to rest.
□ c) To allow vehicles to flow smoothly in different directions.
□ d) To create confusion among drivers.

5. What is the purpose of using turn signals while driving?

□ a) To indicate your intentions to other road users.
□ b) To confuse other drivers.
□ c) To request the right of way.
□ d) To change lanes quickly.

6. What should you do when encountering an aggressive driver on the road?

- □ a) Engage in aggressive behaviour as well.
- □ b) Honk and yell at them.
- □ c) Maintain calm and distance yourself from them.
- □ d) Block their path to teach them a lesson.

7. What is the purpose of a pedestrian crossing?

- □ a) To provide a shortcut for pedestrians.
- □ b) To slow down traffic.
- □ c) To allow pedestrians to cross the road safely.
- □ d) To prioritize pedestrians over vehicles.

8. What should you do when your vehicle starts skidding on a slippery road?

- □ a) Slam on the brakes.
- □ b) Accelerate rapidly to regain control.
- □ c) Steer in the opposite direction of the skid.
- □ d) Panic and freeze.

9. When should you use your high beam headlights?

- □ a) In foggy conditions.
- □ b) When approaching oncoming traffic.
- □ c) In well-lit urban areas.
- □ d) In poorly lit areas to improve visibility.

10. What should you do if you witness a vehicle accident?

- □ a) Drive away and pretend you didn't see anything.
- □ b) Immediately call emergency services for help.
- □ c) Take pictures and post them on social media.
- □ d) Give your opinion about the accident to the involved parties.

ANSWERS **: *(1.a, 2.c, 3.d, 4.c, 5.a, 6.c, 7.c, 8.c, 9.d, 10.b)***

REFERENCES

1. Murphy, T. (2023). *Elevating Road Safety: The Impact of Education on Driver Behavior*. Bocsit Blog.
2. Setyowati, D. L., et al. (2023). *The Relationship Between Driving Behavior and Road Safety Education*. Malaysian Journal of Medicine and Health Sciences.
3. AAA Foundation for Traffic Safety. (2022). *Aggressive Driving and Road Rage*. https://aaafoundation.org/
4. Galovski, T., Malta, L., & Blanchard, E. (2005). *Road Rage: Assessment and Treatment of the Angry, Aggressive Driver*. American Psychological Association.
5. Federal Highway Administration. (2022). *Road Safety Fundamentals*. https://highways.dot.gov/
6. U.S. Department of Energy. (2023). *Fuel Economy Guide: Driving More Efficiently*. https://www.fueleconomy.gov/
7. National Road Safety Mission. (2023). *Road Safety Books for Kids & Youth*. https://nationalroadsafetymission.org/
8. Biwalkar S. G. & Helekar P. N. (2009). *Driving An Art. Helekar's Defensive Driving Mission*. Shri Sadashiv CHS Ltd., 41/A, 6th Road, Santacruz (East), Mumbai – 400 055

* * *

Chapter – 10

Implementation of Behaviour-Based Safety

CHAPTER – 10
IMPLEMENTATION OF BEHAVIOUR-BASED SAFETY

10.1 Working of Behaviour-Based Safety:

Behaviour-Based Safety (BBS) is a proactive strategy that aims to enhance workplace safety by modifying employee behaviour to reduce accidents and injuries. It is founded on the premise that human behaviour significantly influences workplace safety.

How BBS Works:

i) **Identifying At-Risk Behaviours:** Analyse accidents and near-misses to pinpoint behaviours that could lead to unsafe conditions.
ii) **Observing Behaviours:** Monitor employees at work to identify unsafe practices and reinforce safe ones.
iii) **Emphasizing Safe Behaviours:** Highlight and promote practices that contribute to a positive safety culture.

Key Components of BBS:

i) **Training:** Educate employees on health and safety regulations and provide necessary protective equipment.
ii) **Measuring Competence:** Evaluate employee knowledge and skills to encourage safe behaviour.
iii) **Finding Training Gaps:** Identify where additional training is needed to improve safety performance.
iv) **Encouraging Reporting:** Foster a culture where employees report hazards, incidents, and unsafe conditions without fear.
v) **Encouraging Ownership:** Motivate employees to take personal responsibility for their safety by staying alert and following safety procedures.

Example:
At-risk behaviours are those that are directly observable and within an individual's control.

For instance:

- Working at height without a safety harness.
- Failing to report machinery defects.

By identifying and addressing such behaviours, BBS creates a safer, more engaged, and more responsible workforce.

10.2 Involvement of People in Behaviour-Based Safety:

Active participation is the backbone of Behaviour-Based Safety (BBS). For the program to be effective, employees at all levels must feel ownership and responsibility for safety. The following approaches help to increase involvement:

i) **Train Employees:** Use interactive training methods such as role-playing, group activities, and case studies to keep sessions engaging. Supplement with technology-based tools like online courses and e-learning modules for wider reach.

ii) **Encourage Participation:** Promote BBS as a shared responsibility, motivating all employees to take part in observations and safety discussions.

iii) **Get Leadership Involved:** When leaders and supervisors actively participate, it sends a strong message about the organisation's commitment to safety.

iv) **Develop a Safety Culture:** Build an environment where clear policies and procedures are supported by top management and employees feel confident speaking up about unsafe acts or conditions.

v) **Provide Feedback:** Support employees with constructive feedback and invite suggestions for improvement, ensuring a two-way communication flow.

BBS is a process rooted in behavioural science, requiring employees to observe work practices, identify safe and unsafe behaviours, and give feedback that drives positive change.

10.3 Features of a Good Behavioural Safety Program:

A strong BBS program blends systematic processes with a workplace culture that naturally supports safety. The following elements define an effective program:

Key Features:

i) **Observation and Feedback:** The core of BBS, where employees observe behaviours and provide timely, constructive feedback.

ii) **Goals and Checklists:** Tools to ensure BBS activities are planned, measurable, and conducted systematically.

iii) **Defined Process:** A structured approach for identifying unsafe behaviours, analysing root causes, and implementing corrective actions.

iv) **Positive Safety Culture:** A culture where employees consistently display safe behaviours and value safety as part of daily work.

Steps to Build a Successful BBS Program:

i) Establish a dedicated BBS team to manage and promote the program.
ii) Gather and analyse HSE data to pinpoint high-risk areas.
iii) Develop key behaviour checklists to guide observations.
iv) Monitor and assess behaviours to track improvement.
v) Conduct behavioural observations in real work situations.
vi) Provide feedback to reinforce safe behaviours and address risks constructively.

When these features and steps are applied consistently, a BBS program evolves from a compliance exercise into a shared commitment, reducing unsafe behaviours and strengthening overall workplace safety.

10.4 Hurdles in Implementing Behaviour-Based Safety:

While Behaviour-Based Safety (BBS) programs can deliver significant improvements in workplace safety, their success depends on overcoming a range of practical and cultural hurdles. The following are common difficulties:

i) **Resistance to Change:**
- Employees may see BBS as extra work or fear it will be used for blame rather than improvement.

- Some supervisors may view it as interfering with productivity.

ii) **Lack of Management Commitment:**
- Without strong, visible support from leadership, the program can lose momentum.
- Inconsistent messages from management can undermine trust in the process.

iii) **Inadequate Training:**
- Poorly trained observers may misidentify behaviours or deliver ineffective feedback.
- Without clear understanding, the checklist process can become simply a "tick-box" exercise.

iv) **Data Overload & Poor Use of Data:**
- Collecting too much data without proper analysis leads to wasted effort.
- If observation results are not acted upon, employees may feel their input is ignored.

v) **Failure to Maintain Momentum:**
- Initial enthusiasm can fade without ongoing engagement activities and regular communication.
- Lack of recognition for participants can reduce motivation.

vi) **Cultural Barriers**
- In organisations, where speaking up is discouraged, employees may hesitate to report unsafe behaviours.
- Language barriers, differing work habits, or hierarchical restrictions can limit effective observation and feedback.

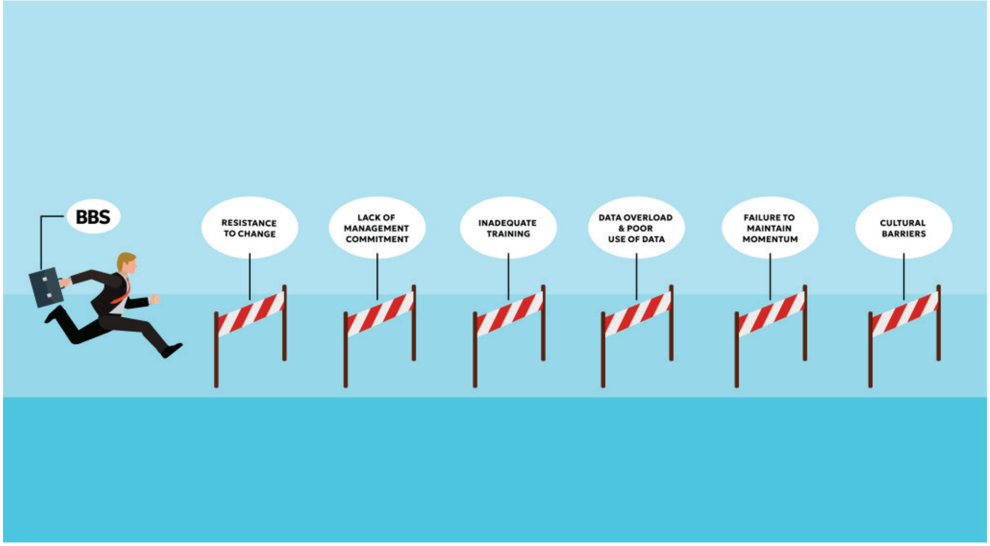


Fig. 10.1: Hurdles in Implementing BBS

Overcoming these hurdles require:

- ✓ Clear communication that BBS is about *improvement*, not punishment.
- ✓ Consistent leadership involvement and recognition of contributions.
- ✓ Practical, hands-on training for observers.
- ✓ Regular review and action on collected data.
- ✓ Continuous reinforcement through toolbox talks, posters, and success stories.

When addressed proactively, these hurdles become opportunities to strengthen the program and deepen safety ownership at all levels.

10.5 Benefits of an Effective Behaviour-Based Safety Program:

When implemented correctly, a Behaviour-Based Safety (BBS) program can produce lasting improvements in both safety performance and workplace culture. The following are key benefits:

i) **Reduction in Workplace Incidents:**
   - Proactive identification and correction of unsafe behaviours help prevent accidents before they happen.

ii) **Improved Safety Culture:**
   - Encourages employees at all levels to take ownership of safety.

- Promotes a shift from reactive problem-solving to proactive prevention.

iii) **Higher Employee Engagement:**
- Involving employees in observations and feedback builds trust and a sense of responsibility.
- Workers feel valued when their input leads to visible safety improvements.

iv) **Better Communication:**
- Observation and feedback sessions foster open dialogue between workers and supervisors.
- Creates a shared language for discussing safe work practices.

v) **Data-Driven Decision Making:**
- Behavioural observations generate measurable data on safety performance.
- Enables targeted interventions based on trends rather than assumptions.

vi) **Sustainable Safety Improvements:**
- By changing daily habits, BBS fosters long-term reductions in risk rather than short-term solutions.

vii) **Positive Organisational Reputation:**
- Demonstrating a strong commitment to safety can improve employee morale, attract talent, and enhance the organisation's public reputation.

An effective BBS program transforms safety from a compliance requirement into a shared workplace value, making safe behaviour the natural choice for everyone.

10.6 Steps for Continuous Improvement in Behaviour-Based Safety:

To ensure a BBS program remains effective and relevant, it must develop with the workplace. Continuous improvement involves regularly reviewing, refining, and reinforcing safe behaviours. The following are key steps:

i) **Regularly Review Observation Data:**
- Analyse observation records to identify trends, recurring issues, and opportunities for targeted action.

ii) **Update Behavioural Checklists:**
- Revise checklists to reflect changes in processes, equipment, and regulatory requirements.

iii) **Provide Ongoing Training:**
- Offer refresher sessions, toolbox talks, and practical workshops to keep safety knowledge update.

iv) **Encourage Two-Way Feedback:**
- Create channels for employees to share safety ideas, report concerns, and suggest improvements.

v) **Recognise and Reward Safe Behaviour:**
- Use both formal recognition (awards, certificates etc.) and informal appreciation to reinforce positive actions.

vi) **Involve All Levels of the Organisation:**
- Engage workers, supervisors, and management in BBS activities to build shared responsibility for safety.

vii) **Audit and Evaluate the Program**
- Conduct periodic audits by third party to measure program effectiveness and identify gaps.
- Adjust strategies based on audit findings.

viii) **Leverage Technology**
- Use digital tools for tracking observations, analyzing data, and delivering training modules efficiently.

The checklist for evaluating BBS activities by coordinators on a monthly basis and to be discussed in the review meeting, which is mentioned below:

Table – 10.1

Sr. No.	Activities	Week 1	Week 2	Week 3	Week 4
1.	Total site walkthroughs conducted.				
2.	Number of team members engaged in safety observations.				

Sr. No.	Activities	Week 1	Week 2	Week 3	Week 4
3.	Instances of at-risk behaviours identified and resolved.				
4.	Instances of hazardous conditions detected and rectified.				

Continuous improvement ensures that a BBS program does not become a "checklist exercise" only but remains a living, evolving process that adapts to changing risks and workplace realities.

10.7 BBS Implementation Process:

The successful introduction of Behaviour-Based Safety (BBS) relies on a well-planned approach that engages employees at all levels through a bottom-up strategy. This process ensures active participation, creates ownership, and fosters a long-lasting safety culture.

Phase 1 – Pre-Implementation Activities

Before starting full-scale implementation, several groundwork actions are essential:

i) **Management Commitment:** Secure approval and visible support from top management to provide resources and leadership backing.

ii) **Formation of the BBS Core Team:** Identify and train potential BBS observers and steering committee members. These individuals should be respected, safety-conscious, and capable of influencing others.

iii) **Initial Awareness Creation:** Organize preliminary awareness sessions to introduce the concept of BBS to all employees, explaining its purpose, benefits, and how it will function in the workplace.

iv) **Baseline Safety Assessment:** Review current safety conditions, behaviours, and incident data to establish a benchmark for measuring future progress.

v) **Integration Planning:** Coordinate with existing safety committees to ensure BBS complements ongoing safety initiatives rather than creating duplication.

Phase 2 – Implementation Strategy

Once the foundation is ready, the organisation can proceed with structured implementation:

i) **Management Participation:** All levels of management participate in BBS awareness programs to reinforce leadership alignment.

ii) **Employee Awareness Training:** Conduct a one-day awareness program for all employees to develop a common understanding of BBS principles.

iii) **Selection of Observers:** From the BBS-trained workforce, select observers representing approximately 20% of the total workforce. Form a steering committee of 8–10 members, ensuring at least two observers per section or department. In case the department is large, more observers can be nominated.

iv) **Practical Training:** Provide BBS observers and steering committee members with one-day in-plant practical training. This should cover observation measure development, consistent and accurate checks, and understanding committee responsibilities.

v) **Promotion and Communication:** Distribute posters, banners, and other communication materials across the workplace to maintain high visibility and enthusiasm for the BBS project.

vi) **Safety Compliance and PPE Verification:** Ensure adherence to safety regulations and confirm availability and proper use of PPEs and other safety equipment at work site.

vii) **Managerial Involvement:** Maintain active and continuous involvement from managers to set a positive example and sustain momentum.

viii) **Performance Reviews and Assessments:** Hold monthly meetings with observers to review observations and progress, along with quarterly external assessments to ensure effectiveness and identify improvement opportunities.

With the completion of these phases, the steering committee and BBS observers will be fully equipped to roll out the program across the site, ensuring a sustainable culture of safe behaviour and continuous improvement.

10.8 Key Considerations for Effective BBS Implementation:

i) **Address initial barriers:** Tackle gaps in employee awareness, vague definitions of risky behaviours, and inadequate analysis of incidents/near-misses that fail to identify behaviour-related causes.

ii) **Start small, scale later:** Trial BBS in one department before expanding it across the plant.

iii) **Flexible application:** Adapt the BBS approach to suit different operational needs and environments.

iv) **Act quickly after training:** Launch BBS activities immediately after training to maintain observer motivation.

v) **Respectful observation:** Observers should maintain professionalism, avoid confrontations, and respect personal boundaries.

vi) **Volunteer participation:** Invite willing employees to join the steering committee or serve as observers, with an emphasis on fulfilling responsibilities diligently.

vii) **Integrate into company systems:** Make BBS a core part of organisational safety strategy, not a standalone initiative.

viii) **Empower employees:** Give staff control and responsibility to encourage accountability and ownership.

ix) **Measure awareness levels:** Conduct safety awareness surveys before and after BBS implementation for comparison.

x) **Assess readiness:** Success speed depends on existing safety culture, injury rates, and organisational preparedness.

xi) **Define leadership roles:** A well-structured steering committee with clear duties is vital for success.

xii) **Track leadership involvement:** Monitor and quantify management's active support for behavioural safety efforts.

xiii) **Ongoing oversight:** The steering committee should continuously monitor the progress of implementation.

xiv) **Prove cost-effectiveness:** Highlight incident prevention benefits that reduce financial losses.

xv) **Phased expansion:** Roll out BBS to other departments gradually after initial results are seen.

xvi) **Self-nominated observers:** Allow trained employees to volunteer as observers, with additional hands-on training.

xvii) **Balanced committee composition:** Include senior managers, frontline leaders, and 8–10 trained observers in the training committee.

xviii) **Employee-driven with management backing:** Ensure the initiative is led by employees but supported by strong leadership commitment.

xix) **Allocate observation time:** Management must allow observers sufficient time for tours, feedback, and data analysis.

xx) **Collaboration at all levels:** Foster teamwork between shop floor employees and supervisors in the steering committee.

xxi) **Active committee engagement:** Steering committee members should be directly involved in appreciating observers, reviewing data, and guiding improvements.

xxii) **Recognition culture:** Managers and HODs should consistently acknowledge observer contributions in reducing at-risk behaviours.

Fig. 10.2: Recognition of Observer

Begin with trained employees for completing daily observation checklists. As more employees are trained, data collection on safe and at-risk behaviours will increase, feeding continuous improvement. Remember, BBS complements existing safety systems and creates a positive, non-threatening safety culture.

10.9 Challenges and Solutions in BBS Implementation:

The following are the challenges and proposed solutions for BBS implementation:

Table – 10.2

Sr. No.	Challenges	Proposed Solution
1.	**Increased workload perception:** Observers feel extra duties are stressful.	Streamline observation forms, rotate observation duties, and integrate them into routine work tasks.
2.	**Lack of personal incentive:** Observers see no direct benefit.	Recognize and reward contributions through appreciation letters, certificates, or safety awards.
3.	**Acceptance by the observe:** Concern that feedback will be taken negatively.	Train observers in constructive feedback skills and promote a no-blame culture.
4.	**Employees buy-in issues:** Workers may resist BBS.	Conduct awareness programs explaining benefits for personal safety and team well-being.
5.	**Misuse of the system:** Using BBS to avoid normal duties.	Set clear expectations and monitor work output alongside BBS participation.
6.	**Pre-existing hazards:** Unsafe conditions need attention before behaviour focus.	Prioritize immediate removal of physical hazards to build trust in the system.
7.	**Integration challenges:** Difficulty merging BBS with existing committees.	Align BBS roles with current committee functions to avoid duplication.

Sr. No.	Challenges	Proposed Solution
8.	**Resource allocation:** High demand for time and manpower.	Schedule observations during low workload periods and train multiple staff to share the load.
9.	**Administrative burden:** Too much paperwork.	Use digital checklists, mobile apps, or simplified formats to reduce documentation time (wherever feasible).
10.	**Communication barriers:** Gaps in interpersonal skills.	Offer training by experienced faculty.
11.	**Initial rollout issues:** Early-stage operational hurdles.	Pilot BBS in a small area first, then expand gradually after learning from feedback.
12.	**Confidentiality concerns:** Names discussed in committee meetings.	Use anonymous case summaries instead of naming individuals.
13.	**Direct confrontation risks:** Calling observees to explain unsafe acts in meetings.	Address issues privately and focus on behaviour, not the person. Avoid calling observees to review meetings.

10.10 Action Plan for BBS Implementation:

The following are the action plans including key points for BBS implementation:

Table – 10.3

Sr. No.	Action Plan	Description / Key Points
1.	Top management commitment	Secure a clear, visible, and ongoing commitment from senior leadership.
2.	Organisation-wide training	Provide BBS awareness training to all employees in every department.

Sr. No.	Action Plan	Description / Key Points
3.	Selection of observers	Choose observers from trained employees and provide them with advanced observation & feedback training.
4.	Form steering committee	Create an 8–10 member committee from trained employees to guide the implementation.
5.	Develop observation checklists	Prepare user-friendly and effective checklists relating to site activities.
6.	Pre-select observation areas	Identify specific departments and work areas for observation and feedback processes in advance.
7.	Create implementation timetable	Prepare a practical timeline ensuring top management involvement in key stages.
8.	Data management & communication	Document observations accurately, analyse results, and display key findings with slogans and safety messages at workplaces and main gate of industry.
9.	Periodic progress review	Hold regular review meetings to assess and refine BBS implementation.
10.	Managerial time allocation	Ensure managers allocate dedicated time for observations, meetings, data analysis, and safety awareness activities.
11.	Launch date finalization	Decide and announce the official launch date of BBS, marking it clearly in the organisational calendar.

10.11 Best Practices for Sustaining BBS Success:

To ensure long-term impact, a Behaviour-Based Safety program must be maintained, adapted, and integrated into everyday operations. The following practices help sustain the momentum:

i) **Maintain Visible Leadership Commitment:**
Leaders should regularly participate in observations, safety meetings, and recognition of safe behaviours.

ii) **Encourage Continuous Participation:**
Keep employees engaged through regular observation opportunities, interactive sessions, and peer recognition.

iii) **Refresh Training Periodically:**
Offer refresher courses, scenario-based exercises, and updates on safety procedures to keep skills sharp.

iv) **Regularly Update Observation Checklists:**
Adjust for changes in processes, equipment, and risks to keep the program relevant.

v) **Recognise and Reward Positive Behaviours:**
Acknowledge safe practices through verbal praise, awards, or team incentives to reinforce commitment.

vi) **Integrate BBS with Other Safety Systems:**
Link BBS observations with hazard identification, near-miss reporting, and safety audits for a holistic approach.

vii) **Use Data for Improvement, Not Blame:**
Analyse trends to identify systemic issues and take proactive action, avoiding a fault-finding culture.

viii) **Communicate Results Openly:**
Share observation statistics, improvements made, and success stories to keep transparency and motivation high.

Sustaining BBS success depends on active leadership, engaged employees, continuous learning, and transparent communication, all working together to strengthen the safety culture.

10.12 Similar Names of BBS used in Organisations:

- **B**rother to **B**rother **S**afety
- **B**ig **B**rother **S**afety
- **B**hai **B**andhu **S**uraksha
- **B**harat **B**ane **S**urakshit
- **B**abuji **B**ahut **S**ochke
- **B**ol **B**ol ke **S**uraksha
- **B**asic to **B**road **S**afety
- **B**hagidari se **B**ane **S**uraksha
- **B**ahut **B**ahut **S**hubhkamnaye
- **B**ecome **B**rother of **S**afety
- **B**accho se lekar **B**ado tak ki **S**uraksha
- **B**uild **B**usiness **S**afely

10.13 Role of Technology in Behaviour-Based Safety:

Technology can play a critical role in supporting BBS programs. Following are few:

- *Mobile Applications*: Mobile applications can be used to collect data and provide real-time feedback to employees and observers.
- *Wearable Technology*: Wearable technology can be used to monitor employee behaviour and provide feedback on safety practices.
- *Data Analytics*: Data analytics tools can be used to identify trends and track progress towards program goals.
- *Virtual Reality*: Virtual reality simulations can be used to train employees on safety practices in a realistic and engaging environment.

10.14 Summary:

It is important to understand that the Behaviour-Based Safety (BBS) system is not designed to identify or punish individuals who violate company policies, that role is addressed through existing disciplinary procedures. Instead, the BBS system focuses on identifying everyday behaviours that either enhance or reduce safety, as well as uncovering the underlying organisational factors contributing to these behaviours. By doing so, the BBS system serves as a valuable tool for improving the overall safety management system.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *What is the primary focus of a Behaviour-Based Safety (BBS) program?*

□ a) Identifying and eliminating hazards from the workplace.
□ b) Focusing on employee behaviours and actions to improve safety.
□ c) Implementing strict rules and regulations to enforce safe practices.
□ d) Investing in advanced safety technology and equipment.

2. *Which of the following is NOT a key element of a successful BBS program?*

□ a) Employee engagement and participation.
□ b) Data analysis and trend identification.
□ c) Top-down management directives.
□ d) Providing immediate and constructive feedback.

3. *What is a key challenge in sustaining long-term Behaviour-Based Safety programs?*

□ a) Lack of safety equipment.
□ b) Observer fatigue and loss of motivation.
□ c) Poor weather conditions.
□ d) Excessive training materials.

4. *In Behaviour-Based Safety, a "critical behaviour checklist" is primarily used to:*

□ a) Record disciplinary actions.
□ b) Monitor unsafe acts for punishment.
□ c) Observe and reinforce safe behaviours during routine tasks.
□ d) Track equipment maintenance.

5. Which leadership characteristic is most crucial for successful BBS implementation?

□ a) Strict discipline.

□ b) Technical knowledge.

□ c) Delegation of safety tasks only to supervisors.

□ d) Visible and active commitment.

6. Behaviour-Based Safety observations should ideally be conducted:

□ a) Only when accidents occur.

□ b) During high-risk maintenance shutdowns.

□ c) Routinely and across all operations.

□ d) Only when management is present.

7. What is the most effective method to ensure observer engagement in a BBS program?

□ a) Rotating observer roles and recognizing contributions.

□ b) Assigning daily observation targets.

□ c) Offering monetary bonuses only.

□ d) Making observations compulsory without explanation.

8. Which of the following is not a recommended BBS implementation step?

□ a) Identifying at-risk behaviours.

□ b) Blaming workers for unsafe acts.

□ c) Providing positive reinforcement.

□ d) Creating observation and feedback systems.

9. A successful BBS program primarily measures:

□ a) Number of fines issued.

□ b) Compliance with PPE policies only.

□ c) Frequency and quality of behavioural observations.

□ d) Volume of safety manuals distributed.

10. What is a common reason BBS programs fail after initial success?

- □ a) High injury rates.
- □ b) Excess training.
- □ c) Lack of continuous leadership support and engagement.
- □ d) Overemphasis on equipment.

: (1.b, 2.c, 3.b, 4.c, 5.d, 6.c, 7.a, 8.b, 9.c, 10.c)

REFERENCES

1. Carra, S., Bottani, E., Vignali, G., Madonna, M., & Monica, L. (2024). *Implementation of Behavior-Based Safety in the Workplace: A Review of Conceptual and Empirical Literature*. Sustainability, 16(23), 10195. https://doi.org/10.3390/su162310195
2. Riaz, W. (2023). *What's Behavior-Based Safety (BBS)? Process, Training, and Examples*. HSE Blog. https://www.hseblog.com/behavior-based-safety-bbs/
3. The Safety Master Pvt. Ltd. (2023). *BBSM Case Studies: Real-Life Examples of Successful Safety Improvements*. https://www.thesafetymaster.com/bbsm-case-studies-real-life-examples-of-successful-safety-improvements/
4. QHSE Alert. (2025). *Behavior-Based Safety 2025: Trends and Innovations*. https://qhsealert.com/behavior-based-safety-2025-trends-and-innovations/
5. SBN Software. (2025). *How Can Technology Enhance Behavior-Based Safety Initiatives?* https://sbnsoftware.com/blog/how-can-technology-enhance-behavior-based-safety-initiatives/
6. Kaila H. L. Dr. (2017). *Behaviour Based Safety in Organizations Saving Life Before the Accident* (Second Edition). I. K. International Publishing House Pvt. Ltd., New Delhi.
7. ISMS Standard – 1009. *Behaviour Based Safety*. Indian Oil Corporation Limited, Refineries Head Office, Scope Complex, Core – 2, 7-Institutional Area, Lodhi Road, New Delhi – 110 003

* * *

Chapter – 11

Behaviour-Based Safety Observation Process

CHAPTER – 11
BEHAVIOUR-BASED SAFETY OBSERVATION PROCESS

11.0 Introduction:

BBS Observation is a structured and planned proactive two-way safety conversation with people at their workplace to achieve positive change in people's behaviour towards safety in order to:

- Acknowledge and reward safe, constructive behaviour.
- Recognize and address risky behaviour.
- Engage with employees about any safety-related concerns or issues.

A schedule for BBS Observation by individuals in the plant is prepared in advance. The individual and the line management where the BBS Observation is scheduled for a particular day should plan the visit in such a way that any major/critical activity being performed in that area is properly covered in the observation process.

11.1 Objectives:

The objectives of BBS observation are mentioned below:

- To inculcate world-class safety culture through positive changes in people's behaviour towards voluntary adherence to safe practices.
- To focus on unsafe acts and manmade unsafe conditions.
- To prevent incidents and injuries by minimizing Unsafe Acts and Unsafe Conditions.

11.2 Benefits:

The following are the benefits of BBS observation:

- Showcase your dedication to safety as a leader.
- Encourage safe and constructive conduct.
- Increase awareness of safety.
- Encourage people to take responsibility for and be dedicated to safety.
- Address risky behaviours in a proactive, productive manner.
- Keeping property loss and injury at bay.
- Establish guidelines and protocols.
- Test understanding of standards/procedures.
- Verify adherence to guidelines and protocols.
- Determine the safety system's advantages and disadvantages.

11.3 Definitions:

- **Apex Committee:** A management team chaired by the top executive (Plant Head) and supported by various members who govern and oversee the plant's safety program.
- **Zone Head:** Area head of various process units who shall monitor the compliance with audit schedule and audit findings.
- **Zonal Committee:** The committee at the zonal level comprises the Zonal Head and the BBS observers of all the process units under that zone.
- **BBS Observers:** A team of two members constituted by the Apex committee to conduct a daily BBS visit to the designated unit area.

11.4 Constitution, Roles & Responsibilities:

11.4.1 Apex Committee:

Apex committee is a management team chaired by the top executive (Plant Head) and supported by various members who govern and oversee the plant's safety program.

Constitution:

The constitution of the Committee is as follows:

- Chairman: Plant Head
- Secretary: General Manager (Technical)

- Joint Secretary & Coordinator: Fire & Safety Head
- Members: All other functional General Managers and Dy. General Managers

Tenure: Tenure of the committee will be permanent. However, the members will be revised every year after transfer/promotion.

Roles & Responsibilities:

To meet on a monthly basis to evaluate the advancement of the BBS implementation program. The Joint Secretary & Coordinator will present the progress status of the BBS implementation program during the meeting.

The committee will:

- ✓ Review and approve the Zonal Head Committee and the BBS observers list.
- ✓ Monitor compliance with the BBS observation schedule.
- ✓ Monitor compliance with audit observations.
- ✓ Review the audit observation(s) and identify suggestion(s) for areas of improvement.

11.4.2 Steering Committee:

Zonal heads are area heads of various units who shall monitor compliance with the audit schedule and audit findings. Zonal heads are designated by the Apex committee.

The steering committee is a committee composed of Zonal Head and the BBS observers in that zone.

- ✓ This committee will be constituted yearly by the Apex Committee.
- ✓ The committee will meet on a weekly basis to assess the advancement of the BBS observations within the designated area.

Roles & Responsibilities:

The principal role of the BBS steering committee is to continually mentor, supervise, and instruct observers within their assigned area.

The following are the key responsibilities of this team:

i) Reviewing whether the observation checklist is adequate or requires updates.
ii) Assessing if a single observation by an observer each day is sufficient.

iii) Evaluating the progress of safe behaviour percentages across plants and determining if it meets expectations.
iv) Ensuring monthly meetings of the BBS steering committee are conducted consistently.
v) Verifying that observers are carrying out daily observations.
vi) Confirming that observers are regularly compiling observation data.
vii) Overseeing that data analysis is performed every seventh day across all plants.
viii) Ensuring that BBS progress charts and safety messages are displayed prominently at all plant locations.
ix) Circulating monthly progress reports for awareness and reference.
x) Tracking the closure of actions arising from survey reports across plants.
xi) Addressing concerns or challenges faced by individual observers.
xii) Promoting the BBS project effectively through banners, posters, and other communication channels.
xiii) Recognizing and appreciating the efforts of observers through the steering committee.
xiv) Confirming that top management is actively leading, supporting, and reviewing the implementation process.
xv) Arranging quarterly visits by an external observer to assess progress and effectiveness.
xvi) Monitoring the quality and consistency of feedback provided by observers to employees.
xvii) Ensuring that new observers receive proper induction training before starting field observations.
xviii) Periodically reviewing and updating BBS-related training materials to reflect lessons learned and new safety trends.
xix) Encouraging cross-plant sharing of best practices and success stories to inspire improvement.
xx) Ensuring that observation and feedback activities are aligned with the overall corporate safety objectives.

Examples of Zonal Heads of an Industry, like an Oil Refinery:

Table - 11.1

ZONE NO.	ZONE NAME	ZONE HEAD
1.	Main Process Unit	Dy. General Manager (Production)-I
2.	Oil Moving Station	Dy. General Manager (Production)-II/ Chief Production Manager
3.	Power Plant	Dy. General Manager (Power & Utility)
4.	Central Stores	Dy. General Manager (Materials)
5.	Quality Control	Dy. General Manager (Quality Control)
6.	Workshop	Dy. General Manager (Mechanical)
7.	Fire Station	Dy. General Manager (Fire & Safety)
8.	Administrative Building	Dy. General Manager (A&W)

11.5 Guidelines for BBS Observation Process:

Scheduled BBS Observations will be performed and documented by those employees who are designated as observers preferably in pairs.

11.5.1 The BBS Observation:

1) **Observation Categories:**

The following observation categories have been created to aid in the identification of hazardous acts and behaviours:

i) **Personal Protective Equipment (PPE):** *PPE must be given priority against workplace hazards.* Are individuals using suitable PPE? Is it being utilized correctly and kept in satisfactory condition? Examples include helmets, gloves, goggles, earplugs, etc.

ii) **Housekeeping:** *A clean workplace is a safe workplace.* Is the work area clean, tidy, and well-maintained? Are walkways clear and unobstructed? Are there no spills, waste, or misplaced materials that could cause hazards?

iii) **Using Tools:** *The right tool for the right job prevents accidents and equipment damage.* Are appropriate tools being selected and used correctly? Are they in good condition and suitable for the job? Are any unsafe "homemade tools" in use?

iv) **Body Positioning / Protecting:** *Safe body positioning reduces strain and injury risk.* Are individuals avoiding the line of fire, unstable positions, or awkward postures? Are they positioning their bodies to minimize injury risk, including following ergonomic principles in both office and operational/maintenance environments?

v) **Material Handling:** *Safe handling techniques protect workers from musculoskeletal injuries.* Are proper body mechanics (lifting, pulling, pushing, etc.) being followed? Are heavy materials handled with appropriate techniques? Is mechanized equipment (e.g., crane, forklift, hydra-crane) being used where necessary instead of manual handling?

vi) **Communication:** *Clear communication prevents misunderstandings and ensures coordinated action.* Is effective communication established? Are both verbal and non-verbal interactions promoting safety rather than creating risks?

vii) **Following Procedures:** *Procedures exist to control hazards and maintain safety.* Are established protocols, Standard Operating Procedures (SOPs), and Work Permit requirements clearly understood and strictly followed? Are all permit conditions being fulfilled?

viii) **Visual Focusing & Attentiveness:** *Awareness and focus are key to preventing accidents.* Do individuals modify unsafe behaviours when a Leader or Manager is nearby (e.g., adjusting PPE, selecting proper tools, holding handrails, coiling loose hoses, fastening seatbelts)? This often shows awareness of correct practices, which for some reason were not being applied prior to observation.

ix) **Using Mobile Phone at Work:** *Distraction is a hidden hazard.* Is the rule prohibiting mobile phone use in the plant area being followed? Mobile phones can cause distractions and act as potential ignition sources.

x) **Road Safety:** *Safe driving protects both employees and assets.* Are road safety rules adhered to, including prohibitions against over speeding, unsafe overtaking, and wrong-side driving?

2) **Tips for Effective BBS Observation Process:**

The following are some of the tips for effective observation and the common questions that can be asked:

a) **Role & Responsibilities of Observers:**

i) Employees designated as observers will carry out and record scheduled BBS observations.

ii) Observations shall be conducted at the defined frequency within the work environment.

iii) The observation team's primary task is to focus exclusively on how people work at their respective workplaces.

iv) Non-safety discussions should be avoided during the observation rounds.

v) Observations may cover all relevant areas, such as plant facilities, material loading/unloading zones, offices (on-site/off-site), canteens, and other operational locations.

vi) While the emphasis is on observing work behaviours, unsafe or hazardous conditions must also be noted.

vii) Each observation round should last between 15 to 30 minutes.

viii) Observers will follow the seven-step BBS Observation process to:

- Reinforce safe actions and behaviours.
- Discuss unsafe acts and their potential consequences.
- Address any related safety issues.

ix) The BBS Observation method is unique because it directly acknowledges both safe and at-risk behaviours.

x) Discussions should aim to improve workplace safety by recognizing good practices, correcting unsafe habits, and addressing any challenges employees face.

b) **Tips for Conducting Effective BBS Observations:**

i) Avoid taking notes while directly interacting with employees during observations.

ii) Focus attention on what people are doing rather than on objects or equipment alone.
iii) Begin by making employees feel comfortable; building rapport takes time and should not be rushed.
iv) Ask thoughtful, open-ended questions instead of delivering long explanations or lectures.
v) Aim to guide employees toward personally recognizing the importance of improving their own safety performance.
vi) Keep discussions purposeful and engaging but never force them.
vii) Observe without interrupting work unnecessarily to avoid disrupting productivity.
viii) Maintain a positive tone, recognize safe behaviours as much as (or more than) pointing out unsafe ones.
ix) Be culturally sensitive and adapt your approach to the work environment and team dynamics.
x) Follow up on prior observations to show commitment and consistency in safety improvement.

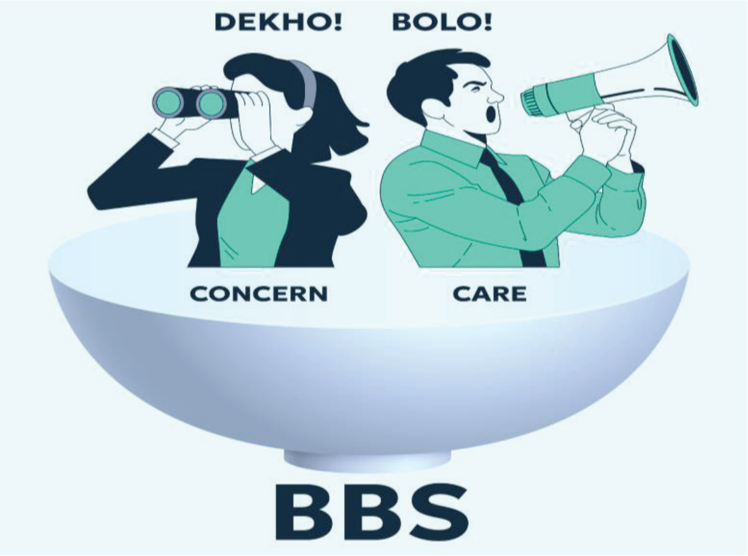


Fig. 11.1: BBS Observation Process

c) **Keep in Mind while Conducting BBS Observations:**

i) Avoid reducing BBS Observations to a simple checklist of tasks.

ii) Observe employees in action before initiating any safety-related discussion.
iii) Recognize and commend behaviours that demonstrate compliance with safety protocols and regulations.
iv) Keep conversations open, honest, and straightforward, never confrontational or adversarial.
v) Ensure discussions promote mutual learning between the observer and the employee.
vi) Encourage employees to share any safety concerns. Document these discreetly (after the conversation and away from the employee's view) to show that follow-up will take place. Share the follow-up outcome with the employee and keep their supervisor informed.
vii) Remain objective and unbiased, focus on observable facts rather than assumptions or personal opinions.
viii) Acknowledge employees for valuable contributions during the observation process.
ix) Do not use observation findings as a basis for disciplinary action unless the behaviour is clearly inappropriate. Any disciplinary measures should be based on direct supervision, supported by evidence, and considered alongside the employee's performance history.
x) Record unsafe behaviours during the BBS Observation wrap-up. Combine these with other observation data for trend analysis and organisational learning. Share key findings within the team or area where the observation was conducted to support safety improvements.

d) **Questions to ask Employees during BBS Observations:**

i) How would you describe the safety experience at this site?
ii) Is there any area that you feel requires more safety attention?
iii) Which part of your job concerns you most in terms of safety, and why?
iv) What do you believe your supervisor expects from you regarding safety?
v) In your opinion, why are safety rules and procedures sometimes violated?
vi) Which rules or procedures do you find difficult to follow, and why?
vii) Are there any tools or equipment you find difficult or hazardous to use? What makes them so?

viii) Which areas of safety have your supervisors emphasized, and how have they done so?

ix) Who, in your view, is most responsible for promoting and maintaining good safety performance at this site?

x) What safety training have you received for your job, and when/how was it provided? Do you feel you need additional training?

xi) Have you ever bypassed or taken shortcuts with safety practices? If so, what led you to do this?

xii) Have you contributed for developing safety measures, ideas, or rules and procedures?

xiii) Have you ever submitted a safety suggestion? What motivated you, and what was the outcome?

xiv) How do you assess your supervisor's or management's efforts in the safety program?

xv) Which aspect of the safety program do you like the most, and why?

xvi) If you were responsible for running the safety program, what changes would you make, and why?

xvii) When you have a safety problem, whom do you approach?

xviii) Where do you see the highest potential for serious injury in your area?

xix) Which aspects of the operation do you think are most likely to cause problems?

xx) How would you describe your safety meetings? Are they worthwhile and do they encourage two-way communication?

e) **Questions addressed to Supervisory Employees:**

i) Tell me about the safety program at your site.

ii) What changes have you seen in site safety in the past year or two?

iii) What does management expect of you with respect to safety? How are these expectations communicated to you?

iv) How often do you discuss safety with your manager, and on what occasions?

v) Does your manager tell you what they think of your group's safety performance? What about your personal performance and contribution?

vi) Does your manager observe you? How often, and how do you benefit from this activity?

vii) Which rules and procedures do your employees find difficult to follow? Why?
viii) Why are rules and procedures violated?
ix) What do you think your employees believe you expect of them regarding safety?
x) What are our employees' safety needs?
xi) What is the injury experience of our employees?
xii) How do we measure employees' safety performance?
xiii) What part of safety do you emphasize (e.g., hazards/risks awareness, PPE compliance)? How and why?
xiv) What area, job, activity, or piece of equipment needs safety attention? Why?
xv) What assignments or jobs do you think your employees worry about most regarding safety? Why?
xvi) What approach do you use to help employees become more familiar with rules and procedures?
xvii) Do you give pre-job safety instructions? What do you say? Do you check for compliance?
xviii) How often do you watch people work?
xix) How much time do you spend in the field?
xx) What are you doing to achieve incident-free performance?
xxi) Do you ever try to anticipate the next injury? Where and how do you think it will occur?
xxii) Can you use disciplinary measures to correct safety violations? Have you ever done so? When?

11.6 Seven-Step Observation Process:

i) **Observe** the work being performed, decide how best to approach the employee, and stop any hazardous behaviour in a safe manner.

ii) **Acknowledge and comment** on safe acts or behaviours observed first.

iii) **Address** unsafe or at-risk behaviours by:

- Discussing what was observed.
- Examining the potential consequences (possible harm) of the unsafe act.

- Encouraging the employee to suggest safer methods for completing the task.

iv) **Obtain** agreement from the employee to work safely moving forward.

v) **Invite** the employee to share or discuss any other safety concerns in the workplace.

vi) **Thank** the employee for their time, cooperation, and commitment to safety.

vii) **Follow up** on agreed actions and provide feedback, ensure any safety concerns raised are addressed, corrective actions are implemented, and updates are shared with the employee and relevant supervisors.

11.7 Problems in Observing and Giving Feedback:

When conducting safety observations, the following common issues should be avoided:

i) **Improper checklist handling:** The observer hands over the checklist to the observee to fill out, instead of completing it themselves.

ii) **Lack of feedback:** Observations are made, but no discussion or feedback is given.

iii) **Disagreements:** The observer and observee may not agree on all points observed.

iv) **Authoritarian approach:** The observer dominates the conversation and does not allow the observee to speak.

v) **Incomplete documentation:** The comments section is not filled in properly.

vi) **One-sided criticism:** Feedback focuses only on faults without recognising safe behaviour or good practices.

vii) **Time constraints:** Observation is rushed or skipped due to other work commitments.

viii) **Resistance to feedback:** The observee does not accept comments in a constructive manner.

ix) **Overreaction:** The observer overemphasises certain issues, leading to a negative impression.

x) **Unclear focus:** The observer is unsure whom to observe when many people are working in the same area.

11.8 Reasons Observers may Fail:

In addition to common observation and feedback issues, the following challenges can cause an observer's efforts to be ineffective:

i) **Aggressive response from observee:** The observee reacts with anger or defensiveness.

ii) **Public feedback:** Feedback is given in front of other employees instead of privately.

iii) **Protocol violations:** The observer does not follow the established observation procedures.

iv) **Communication gap:** Differences in communication styles or language hinder understanding.

v) **Inappropriate feedback delivery:** Feedback is poorly timed, unclear, or not constructive.

vi) **Lack of rapport:** No trust or comfort is established between the observer and observee.

vii) **Role confusion:** The observer is unclear about their responsibilities.

viii) **Impatience:** The observer rushes interactions or shows frustration.

ix) **Loss of objectivity:** The observer becomes personally involved, compromising fairness.

x) **Poor follow-up:** Feedback is given but not revisited to ensure improvement.

xi) **Avoiding one-on-one dialogue:** The observer maintains a sense of superiority and avoids direct engagement.

xii) **Failure to stress safety culture:** The observer does not communicate the importance of safe work practices.

xiii) **Multiple employees on one checklist:** Observations for several people are recorded together, reducing clarity.

xiv) **Weak feedback skills:** The observer is not skilled in delivering effective, balanced feedback.

xv) **Overlooking positive behaviours:** The observer focuses only on unsafe acts and fails to acknowledge safe practices, missing opportunities to reinforce good habits.

Note: Any person, whether from management or the general workforce, can serve as a BBS observer, provided they have received proper and formal training.

11.9 Strategies for Approaching Observee:

The 11-P strategies while approaching Observee are mentioned below:

Table - 11.2

Sr. No.	Strategy		Remark
1.		PARIKRAMA	Take an observation round of your unit/plant area.
2.		PRASHAN	Put a question to observee whether he/she is safe.
3.		PRASHANSHA	Praise his/her safe behaviours to reinforce.

Sr. No.	Strategy		Remark
4.		PARIVARTAN	Convert his/her at-risk behaviours to safe.
5.		PRASHIKSHAN	Educate/re-train him/her for his/her at-risk behaviours.
6.		PRATIGYA	Take an oath not to repeat at-risk behaviours.
7.		PRACHAR	Ask an observee to observe another co-worker.
8.		PRARTHNA	Repeatedly requesting for safe behaviours.
9.		PROMISE	Seek promise from him/her: I care for you; do you care for me?

Sr. No.	Strategy		Remark
10.		PURSUE	Follow-up on his/her at- risk behaviours.
11.		PURUSKAR	Spot recognition for a changed behaviour.

11.10 BBS Observation Card:

The BBS observation card, which will be used by the observer, is attached as *Appendix–10.*

11.11 Sample Calculation:

A sample calculation of observations (10 – Behaviour Category) at a work site is mentioned below:

Table – 11.3

Sr. No.	Behaviour Category	No. of Observations	Safe Behaviour	At-Risk Behaviour	Corrected Behaviour	Correction of At-Risk Behaviour (%)	Safe Behaviour after Correction (%)
1.	PPE	272	220	52	46	88.46	97.79
2.	Housekeeping	243	188	55	54	98.18	99.59
3.	Using Tools	143	109	34	30	88.24	97.20
4.	Body Positioning /Protecting	123	98	25	23	92	98.37
5.	Communication	120	90	30	28	93.33	98.33

Sr. No.	Behaviour Category	No. of Observations	Safe Behaviour	At-Risk Behaviour	Corrected Behaviour	Correction of At-Risk Behaviour (%)	Safe Behaviour after Correction (%)
6.	Following Procedures	100	82	18	15	83.33	97
7.	Material Handling	96	91	5	4	80	98.96
8.	Visual Focusing	86	80	6	4	66.66	97.67
9.	Using Mobile Phone at Work	46	38	8	8	100	100
10.	Road Safety Behaviours	39	32	7	7	100	100
	Total:	1268	1028	240	219	89.02 (Average)	98.49 (Average)
Remarks:							

Above table shows a Total 1268 Nos. observations noted, out of which 1028 Nos. were safe behaviours, and 240 Nos. were at-risk behaviours. Out of 240 at-risk behaviours, 219 were corrected. Hence, safe behaviours after correction comes out to be 98.49% (Average), which is an excellent score for the work site.

11.12 Record Keeping:

All scheduled BBS Observations must be documented. Above sample observations shall be entered in the on-line portal immediately after the observation, where the on-line system is available.

11.13 Summary:

Behaviour-Based Safety (BBS) observation is a proactive and preventive approach to workplace safety. It focuses on systematically observing and analysing employee behaviours during work activities to identify safe practices, reinforce positive actions, and address unsafe habits before they lead to incidents.

Rather than concentrating only on unsafe conditions, equipment faults, or regulatory compliance, BBS targets the human element, the choices and actions that often determine safety outcomes. By engaging employees in constructive feedback, recognising safe behaviours, and coaching on risk reduction, BBS builds a safety-conscious culture where individuals take personal responsibility for their actions.

The ultimate goal is to minimise workplace incidents and injuries by promoting lasting behavioural change and encouraging everyone to act safely, not because they must, but because they want to.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. What should an observer do when they observe unsafe behaviour?

- ☐ a) Immediately report the worker to management.
- ☐ b) Stop the behaviour and provide constructive feedback.
- ☐ c) Ignore the behaviour and continue observing.
- ☐ d) Document the behaviour and move on.

2. What is the role of the observer in a BBS program?

- ☐ a) To be a safety inspector.
- ☐ b) To identify and address unsafe behaviours in a positive and constructive manner.
- ☐ c) To document all safety violations.
- ☐ d) To replace the role of the supervisor.

3. What is the ultimate goal of a BBS program?

- ☐ a) To reduce the number of safety incidents.
- ☐ b) To create a safety culture where employees are actively involved in preventing accidents.
- ☐ c) To eliminate all unsafe behaviours.
- ☐ d) To comply with safety regulations.

4. What is the importance of data collection in a BBS program?

- □ a) To track the number of safety violations.
- □ b) To identify trends and patterns in unsafe behaviours and implement effective interventions.
- □ c) To document all safety observations.
- □ d) To replace the need for safety training.

5. What is a key benefit of using BBS observations?

- □ a) It allows for quick and easy identification of unsafe conditions.
- □ b) It empowers employees to take ownership of their safety and the safety of others.
- □ c) It eliminates the need for safety training.
- □ d) It replaces the need for safety inspections.

6. Which of the following is an example of safe behaviour?

- □ a) Working without proper personal protective equipment (PPE).
- □ b) Taking shortcuts on safety procedures.
- □ c) Using equipment correctly and following safety protocols.
- □ d) Ignoring safety warnings.

7. What is the primary focus of Behaviour-Based Safety (BBS) observations?

- □ a) Identifying and correcting unsafe equipment.
- □ b) Documenting all workplace incidents.
- □ c) Observing and addressing worker behaviours that impact safety.
- □ d) Implementing new safety regulations.

8. Which of the following is a core principle of BBS observation?

- □ a) Focusing on blame and punishment.
- □ b) Focusing on positive reinforcement and constructive feedback.
- □ c) Ignoring minor unsafe behaviours.
- □ d) Documenting all unsafe conditions.

9. What is the purpose of a BBS observation checklist?

- □ a) To document all safety violations.
- □ b) To provide a structured approach for observing and recording behaviours.
- □ c) To assign blame for unsafe actions.
- □ d) To replace safety training programs.

10. When observing worker behaviours, what is the most important thing to focus on?

- □ a) The worker's performance record.
- □ b) The equipment being used.
- □ c) The worker's actions and their potential impact on safety.
- □ d) The supervisor's instructions.

: (1.b, 2.b, 3.b, 4.b, 5.b, 6.c, 7.c, 8.b, 9.b, 10.c)

REFERENCES

1. Riaz, W. (2023). *What's Behavior-Based Safety (BBS)? Process, Training, and Examples*. HSE Blog. https://www.hseblog.com/behavior-based-safety-bbs/
2. SBN Software. (2025). *How to Conduct Effective Behavior-Based Safety Observations*. https://sbnsoftware.com/blog/how-to-conduct-effective-behavior-based-safety-observations/
3. Carra, S., Bottani, E., Vignali, G., Madonna, M., & Monica, L. (2024). *Implementation of Behavior-Based Safety in the Workplace: A Review of Conceptual and Empirical Literature*. *Sustainability*, 16(23), 10195. https://doi.org/10.3390/su162310195
4. The Safety Master Pvt. Ltd. (2023). *Behavior-Based Safety Metrics: Measuring Success and Continuous Improvement*. https://www.thesafetymaster.com/behavior-based-safety-metrics-measuring-success-and-continuous-improvement/

5. Spigener, J., Lyon, G., & McSween, T. (2022). *Behavior-Based Safety 2022: Today's Evidence*. *Journal of Organizational Behavior Management*, 42(4), 336–359. https://doi.org/10.1080/01608061.2022.2048943
6. Kaila H. L. Dr. (2017). *Behaviour Based Safety in Organizations Saving Life Before the Accident* (Second Edition). I. K. International Publishing House Pvt. Ltd., New Delhi.
7. ISMS Standard – 1009. *Behaviour Based Safety*. Indian Oil Corporation Limited, Refineries Head Office, Scope Complex, Core – 2, 7-Institutional Area, Lodhi Road, New Delhi – 110 003

* * *

Chapter – 12

Safety Culture – A shared Commitment within Organisation

CHAPTER – 12
SAFETY CULTURE - A SHARED COMMITMENT WITHIN ORGANISATION

12.1 Safety Culture:

Safety Culture pertains to individuals and their collaborative efforts. While a universally agreed-upon definition of safety culture is lacking, two fundamental aspects are constantly identified in all definitions.

i) It pertains to individuals' values, attitudes, beliefs, and behaviours. In an organisation with a robust safety culture, initiatives promote safety as the primary issue.

ii) This pertains to the dissemination of values, attitudes, beliefs, and behaviours.

Organisations with a strong safety culture spread this principle throughout all levels, from senior management to the operational floor, influencing every activity conducted within the organisation.

12.2 Importance of Safety Culture:

The safety culture can directly influence safe performance. If an individual perceives safety as insignificant, even momentarily, it will likely lead to workarounds, shortcuts, or unsafe judgments, particularly when the risk appears little rather than obviously hazardous.

12.2.1 Why is it Important?

A good safety culture helps an organisation to maintain safe operations. By having everyone, from operators to managers, take safety seriously, remaining watchful and avoiding compromises, means that operations are conducted in as safe a manner as reasonable, given the risk of the licence holder's operation. This can significantly reduce the risks of accidents occurring.

By contrast, a poor safety culture means not everyone takes safety seriously, is not watchful, is complacent, and compromises too readily. This may mean that there are workers or operations that are at risk of having a higher number of incidents and accidents. In organisations with a poor safety culture, incidents, especially near-misses, are not reported or acted upon adequately, and instructions are not properly followed.

This is neither efficient nor effective in the long run. For example, if incidents are not reported and lessons are not learnt, they will continue to occur. This may result in an undue risk to workers and the public. Safety culture is therefore an important aspect to ensure safety is integrated into an organisation's operations.

12.2.2 Where did it Come From?

The notion of safety culture originated in the early 1980s. The Chernobyl nuclear disaster intensified the emphasis on safety culture within mainstream safety management. The summary assessment from the International Atomic Energy Agency about Chernobyl indicated that "formal procedures must undergo thorough review and approval, supported by the establishment and preservation of a nuclear safety culture." Since then, the concept of safety culture has been embraced by many industries, not just nuclear power, including healthcare, aviation, oil and gas, chemical, energy, and mining, etc. Over the years, this has resulted in new methods being developed to help assess safety culture, such as safety culture surveys and questionnaires.

12.2.3 Use in Operations:

An important first step to improve safety culture is to learn more about it.

There are several important lessons that should be noted when trying to improve an organisation's safety culture. Firstly, many organisations try initially to assess their current safety culture (also referred to as safety climate). This is done through surveys and questionnaires, selective interviews of employees, and observing employees generally. These methods give decision-makers a good overview of the organisation's safety culture. Another important lesson is that it can take time to improve an organisation's safety culture because people's attitudes and behaviours take time to change.

Ultimately, modifications to safety culture typically start with incremental adjustments at the local level. A robust reporting system for incidents and events, along with equitable and just responses, significantly enhances the overall culture of the organisation. Subsequently, substantial wholesale transformations in civilizations arise from these localized alterations. Consequently, it is imperative to prioritize the establishment of these foundational elements of a secure culture, advocating for a bottom-up strategy rather than a top-down one.

12.3 Principles of Safety Culture:

The following are the essential principles of an effective safety culture:

- Safety culture includes what people *do* (safety-related behaviours), *feelings* (individual and collective values, attitudes, and perceptions), and *organisation's resources* (policies, procedures, and systems). These three aspects are interconnected and thus not mutually exclusive. Any intervention regarding safety culture must take into account all three dimensions.
- Upon collecting data (from surveys, discussions with employees, etc.), it is imperative to convey the findings to the participants and implement necessary actions.
- Safety culture interventions must not only examine the attitudes and behaviours of front-line personnel but also scrutinize and confront supervisors and leaders.
- Instead of attempting to directly affect safety culture, it may be beneficial to concentrate on a particular subject (such as procedures, weariness, or competence).
- Establishing a strong safety culture requires significant time and work, potentially spanning several years, and is not a singular endeavour.

12.4 Hudson model for Safety Culture:

The Hudson model frequently referred to as the "Hudson Ladder" or "Safety Culture Maturity Model," is a structure for understanding and advancing the progress of safety culture in organisations. It illustrates safety culture growth as an evolutionary process, moving from a "pathological" state to a "generative" state. The model classifies different levels of safety culture maturity, each with specific descriptions and strategies to safety management in organisations.

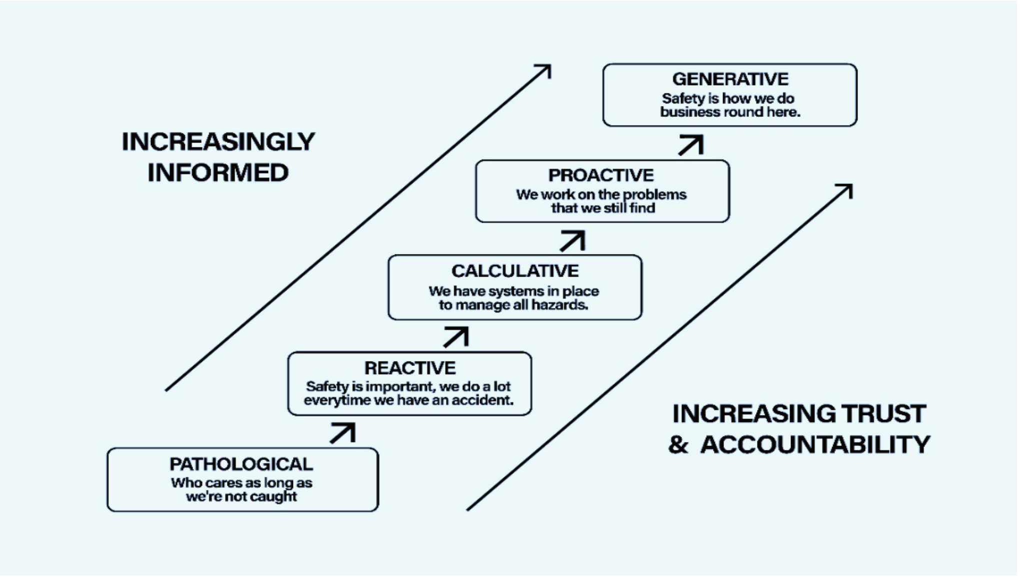


Fig. 12.1: Hudson Model for Safety Culture

The details of Hudson model are mentioned below:

1. Pathological: *"Who cares as long as we are not caught."* At this level, the organisation makes little to no investment in improving safety behaviour.
2. Reactive: *"Safety is important, we do a lot every time we have an accident."* Here, the organisation tends to make safety developments only after things have gone wrong.
3. Calculative: *"We have systems in place to manage all hazards."* At this stage, the organisation pays consideration to health and safety and has strong minded which safety rules are important. However, it is still driven by self-interest.
4. Proactive: *"We work on the problems that we still find."* Here, safety has a high priority for the organisation, which has a proactive approach on safety, works on safety consciousness, and continuously implements safety developments.

5. Generative: *"Safety is how we do business round here."* At this level, safety is fully combined into the functioning processes of the organisation and fully trained in the employees' behaviour.

According to Hudson, the hypothetical model defines an organisation's principles as the common set of values, beliefs, attitudes and working procedures that regulate people's behaviours.

12.5 Factors Affecting Safety Culture:

The different factors affecting Safety Culture are mentioned below:

- **Safety Attitudes:**
  The attitudes of employees are a significant component of a healthy safety culture. Education and engagement can mitigate adverse views.
- **Safety Climate:**
  Safety climate is a key factor in safety behaviour in the workplace.
- **Safety Management:**
  Safety management practices, such as training, communication, policy-making, and preventive planning, can help employees become more safety conscious.
- **Organisation:**
  The organisation needs to have a safety structure, commitment, and competence.
- **Communication:**
  Effective communication is essential in establishing a safety culture.
- **Employee Involvement:**
  Employees need to be involved in their organisation's safety as well as health initiatives to be owners of the safety culture.
- **Management:**
  Management establishes safety strategies, objectives, and initiatives. Leadership utilizes interpersonal skills to affect the behaviours of individuals and groups.
- **Human Factors and Ergonomics:**
  These are important for the success of a design or task. They can improve safety and productivity and reduce employer costs.

12.6 Barriers of Effective Safety Culture:

The following are some of the barriers of effective safety culture:

i) Prioritizing profit over safety: If productivity is paramount and safety is regarded as an expense rather than an investment.
ii) A culture of fear where incidents are hidden by those trying to avoid warnings.
iii) Dominant corporate culture obstructs risk acknowledgment, resulting in detrimental safety decisions.
iv) Non-compliance with standards, norms, and procedures by both management and employees.
v) Critical safety information is not being communicated to decision-makers, or the messages are being diluted.
vi) Misguided assumptions regarding the high level of training and competence of new hires and contractors.
vii) Disregarding insights gained from mishaps and near-misses on safety-critical protocols.

Overcoming these barriers calls for a top-down approach by senior management that starts with demonstrated leadership in committing to safety standards, which promotes a safety climate in the workplace, laying the groundwork for a practical safety culture with standards and protocols which, as the final step in the process, are adopted by business's employees.

12.7 Indicators of Poor Safety Culture:

Indicators of a poor safety culture may include:

i) Prevalent, habitual divergences from protocols.
ii) Noncompliance with the organisation's safety management system.
iii) Management decisions that seemingly prioritize output or cost over safety.
iv) Absence of experiential learning.
v) Resistance to disseminating safety information.

12.8 Ways to Create an Effective Safety Culture:

Enhancing safety culture is not an instantaneous process. Developing a safety culture requires a solid foundation, time, and a commitment to safety. A thorough safety and health program must include the following components:

i) Support and engage in the program.
ii) Readiness to reveal safety and health concerns.
iii) Education and Accessibility to Safety and Health Information.
iv) Liberty from the worry of revenge.
v) Authorization to terminate a task deemed risky.
vi) Incentive to reveal their accounts.

12.9 Factors to Create a Strong Safety Culture:

Establishing a safety culture is a paramount objective for contemporary firms, but for many, it remains an aspirational aim rather than a tangible strategy.

Safety culture is characterized by a collective set of beliefs, attitudes, and behaviours around safety that are exhibited throughout all tiers of the business. Safety culture goes beyond mere compliance with regulations, fostering a collective responsibility among all individuals to ensure that colleagues come home safely each day.

Alongside focusing employee well-being, fostering a culture of safety yields numerous additional advantages with beneficial downstream effects. For example, diminishing the frequency of events may lead to improved workplace morale, increased productivity and efficiency, and reduced employee turnover.

Organisations must surpass mere compliance, stimulating their ambitions with proactive strategies and practices. In light of this, key measures for fostering a culture of safety are outlined below.

a) **Leadership Commitment:**

The paramount aspect in establishing a culture of workplace safety is exhibiting leadership commitment. The safety culture is influenced by leadership; so, if management exhibits satisfaction, the workforce is likely to mirror that attitude. Leadership establishes the atmosphere, cultivating commitment and facilitating the mitigation of opposition to change.

What are the practical indications of leadership commitment?

- Management prioritizes being present on the plant floor and engages in regular discussions regarding worker safety.
- Leaders incorporate safety into every meeting and are attentive to ongoing enhancement.
- Management exemplifies safe behaviours, such as wearing suitable PPE like hard helmets in the plant area or addressing observed fall hazards.

Leaders must transcend mere encouragement and safety mantras. They must genuinely embody their principles, prioritizing safety above all else, even if it necessitates a reduction in production.

b) **Avoid Blame Game:**

A strong safety culture necessitates a deliberate transition beyond assigning blame and engaging in finger-pointing. Individuals are more inclined to conceal safety mishaps and near-misses when they anticipate punitive effects.

They are also less inclined to report hazards and safety observations due to the fear of being held accountable, which directly contradicts the concepts of "behaviour-based safety," involving observation and feedback.

c) **Culture of Openness:**

The reverse of assigning blame is fostering a culture of transparency, wherein individuals feel secure in reporting situations and expressing their opinions. A psychologically secure atmosphere is one in which individuals feel at ease expressing their thoughts and are aware that their contributions are esteemed.

To cultivate this culture, a concerted effort is required to:

- Admit the mistakes.
- Proactively solicit recommendations through open-ended inquiries regarding individuals' observations and their positions on specific matters.
- Give appreciation when someone provides input, including critical comments, or identifies potential hazards.
- Establish explicit expectations regarding the significance of promptly reporting incidents.

- Transform your disposition from anger to curiosity in response to accidents and near-misses, even if they resulted from risky behaviour.

It is important to note that stressing zero events may have the opposite effect. When this is the objective, individuals may be reluctant to report incidents, despite the necessity for additional data regarding the episodes and their contributing circumstances.

d) **Prioritize Safety:**

A safety culture prioritizes employee well-being over production objectives. All employees should be authorized to halt an unsafe operation, confident that management would support them and rectify the issue.

Organisations must emphasize systems and controls to facilitate ongoing enhancement of workplace safety. Allocating funds for safety enhancements is crucial for expressing concern for employees and prioritizing their safety above everything else.

e) **Above Basic Requirements:**

Numerous organisations choose a safety approach run on baseline compliance, concentrating solely on fulfilling the minimum standards to evade regulatory sanctions. This method alone will be insufficient to establish an effective safety culture.

Organisations must proactively exceed compliance to foster an environment where all individuals are committed to safety.

Key proactive practices to emphasize include:

- Defining preferred safe behaviours.
- Incorporating observation into the daily routine of all individuals.
- Promoting prompt hazard identification and reporting.
- Utilizing employee feedback and addressing issues to demonstrate management's genuine commitment to safety.

f) **Establishing HSE System:**

The safety culture relies on managerial involvement and the implementation of accountability across the entire Health, Safety, and Environment (HSE) framework. Metrics and evaluation are essential elements of this, enabled by technology.

In an effective safety culture, leaders are accountable for both lagging indicators, such as incident rates and lost workdays, and leading indicators. Leading indicators are metrics that signify activities related to prospective safety performance, including the volume of overdue corrective actions or the count of identified hazards. Employee feedback, such as impression surveys, can provide essential insights into areas necessitating significant improvement.

g) **Sustaining Safety Culture:**

Maintaining a safety culture necessitates a feedback mechanism that ensures ongoing enhancement and averts regression into previous behaviours. The framework for this process, adhering to the "Plan-Do-Check-Act" methodology, is necessitated as follows:

- Formulating explicit safety protocols and promoting prompt reporting.
- Facilitating continuous training and skill enhancement initiatives.
- Administering HSE compliance schedules.
- Performing safety inspections and health, safety, and environmental audits.
- Concluding findings and executing remedial measures.
- Evaluating safety parameters and discussing them in management meetings.
- Modifying procedures, documentation, or controls in response to performance evaluations.

A strong safety culture is essential for incident prevention and fostering an efficient, productive staff, hence enhancing corporate sustainability.

12.10 Summary:

A key conclusion emphasizes the enhancement of safety management, particularly safety culture: An organisation with an appropriate culture will attract the proper personnel and technology to achieve safe and effective performance.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. How can workers best contribute to a positive safety culture in the workplace?

- □ a) They should know how to complete work quickly if things go wrong.
- □ b) They should report unsafe conditions after an accident has occurred.
- □ c) They should report any unsafe conditions as soon as possible.
- □ d) They should know the location of the first aid kit and accident book.

2. What is one way to contribute to the safety culture of your organisation?

- □ a) Take part in safety training.
- □ b) Attend safety meetings.
- □ c) Volunteer for safety committees.
- □ d) Review safety incidents.

3. It is acceptable to override safety procedures if it speeds up tasks.

- □ a) True
- □ b) False

4. Safety training is necessary only for new employees.

- □ a) True
- □ b) False

5. What should you do if you witness unsafe behaviour?

- □ a) Ignore it.
- □ b) Report it to your supervisor.
- □ c) Confront the individual immediately.
- □ d) Take a photo and post it on social media.

6. Emergency exits should be kept clear at all times.

□ a) True

□ b) False

7. What should you do if unsure about safety procedures for a task?

□ a) Proceed without clarification.

□ b) Skip the task.

□ c) Ask a coworker.

□ d) Consult your supervisor.

: (1. c, 2.c, 3.b, 4.b, 5.b, 6.a, 7.d)

REFERENCES

1. Winkelmann, N. (2025). *A Framework for Strengthening Safety Culture*. Professional Safety Journal, ASSP. https://www.assp.org/docs/default-source/psj-articles/ f1win_0725.pdf
2. Caburao, E. A. (2024). *Culture of Safety: A Comprehensive Guide*. SafetyCulture. https://safetyculture.com/topics/culture-of-safety/
3. Hudson, P. (2001). *Safety Culture and Leadership*. Safe Work Australia. https://www.safeworkaustralia.gov.au/resources-and-publications/ video-and-audio/safety-culture-and-leadership-professor-patrick-hudson
4. Ortega, N., Paes, D., Feng, Z., Sutrisna, M., & Yiu, T. W. (2025). *Investigating the Factors that Define and Influence Safety Culture: Perspectives from Expert Professionals*. *Architecture, Structures and Construction*, 5(13). https://link.springer.com/article/10.1007/s44150-025-00130-w
5. Tahir, H. B. (2025). *Positive and Negative Indicators of Health and Safety Culture*. HSE Blog. https://www.hseblog.com/positive-negative-indicators-health-safety-culture/

6. Guide: Understanding Safety Culture (2013). The State of Queensland (Department of Justice and Attorney-General). Workplace Health and Safety Queensland www.worksafe.qld.gov.au
7. Ambrož Milan (2015). *Safety Culture and the Company Survival Strategy*. Faculty of Organisation Studies in Novo Mesto, Slovenia
8. Safety Culture Definition and Enhancement Process (2008). Civil Air Navigation Services Organisation. www.canso.org/cansomembers
9. Health and Safety Culture (2014). RMIT Centre for Construction Work Health and Safety. www.rmit.edu.au/research/health-safety-research

* * *

Chapter – 13

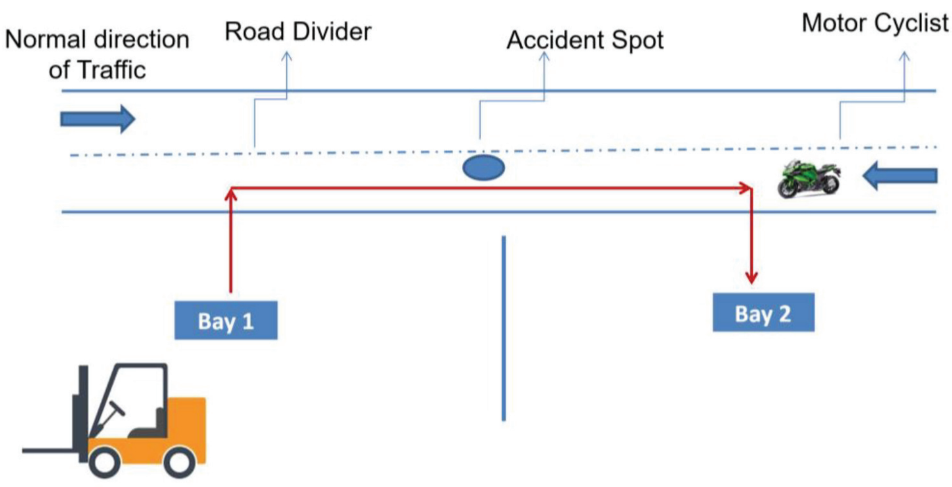
Case Study

CHAPTER – 13

CASE STUDY

A case study is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. It is an established research design that is used extensively in a wide variety of disciplines. The below mentioned case studies were collected from web sites of different industries and Oil Industry Safety Directorate (OISD).

Case Study No.- 1
❖ **Description:** ABC is a large manufacturing unit. A large, welded structure was being transported from Bay-1 to Bay-2 (see below diagram) approx. 500 m. using a forklift truck. The operator tried the structure with a lift platform in a raised position and was approaching Bay-2 along the main road (inside plant) in reverse gear. The path followed by the forklift is shown in a red coloured arrow. Before reaching its destination, it met with an accident with an in-coming motorcycle as shown in the diagram.
❖ **Reason:** Using Forklift on the wrong side, in reverse gear and on the main road.



Unsafe/Undesired Behaviour	**Antecedent**	**Consequence**
• Loaded Forklift • Reverse Gear • Not following the right direction	• Inadequate training • Lack of supervision • Poor planning • Inadequate safety signs	• Accident/Incident • Injury • Unsafe Culture development

Reinforcement	
Positive: • Training on Road Safety • Regular safety inspections • Clear safety guidelines • Display of Safety Posters/Banners • Posting of traffic marshal • CCTV coverage	**Negative:** • Penalty System for violations • Incident reporting • Performance evaluations • Increased supervision

<table>
<tr><th colspan="6">Case Study No.- 2</th></tr>
<tr><td colspan="6">❖ Description:
You just checked into a hotel, round the corner to head towards your room and you saw a guy standing on a step ladder placed inside the water pool.</td></tr>
<tr><td colspan="6">❖ Reason:
Unsafe behaviour from a combination of inadequate training, a rushed attempt to reach a height quickly, and a lack of awareness about electrical safety protocols.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><th colspan="2">Unsafe/Undesired Behaviour</th><th colspan="2">Antecedent</th><th colspan="2">Consequence</th></tr>
<tr><td colspan="2">● Standing on the step ladder kept inside the water pool
● Using ladder improperly</td><td colspan="2">● Inadequate access
● Inadequate training
● Poor planning
● Lack of supervision</td><td colspan="2">● Fall risk
● Potential injury
● Electrocution</td></tr>
<tr><th colspan="6">Reinforcement</th></tr>
<tr><td colspan="3">Positive:
● Ladder safety training
● Recognition for safe practices
● Regular safety inspections
● Clear safety guidelines</td><td colspan="3">Negative:
● Penalties for unsafe behaviour
● Incident reporting procedures
● Performance reviews on compliance
● Increased supervision in high-risk areas</td></tr>
</table>

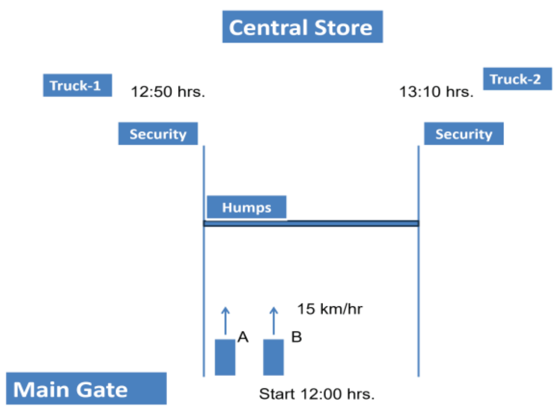
Case Study No.- 3

❖ **Description:**

Two loaded trucks started the journey at around 12:00 hrs. from Main Gate to Central Store through plant roads @ 15 km/hr. Truck-1 followed all types of traffic rules including speed limit and reached Central Store at 12:50 hrs. before lunch time (13:00 hrs. to 14:00 hrs.) and unloaded material and returned. Truck-2 did not follow traffic rules, stopped by security for counselling & penalty (as per system) and reached Central Store at 13:10 hrs. and could unload material only after lunch break (after 14:00 hrs.) and returned late.

❖ **Reason:**

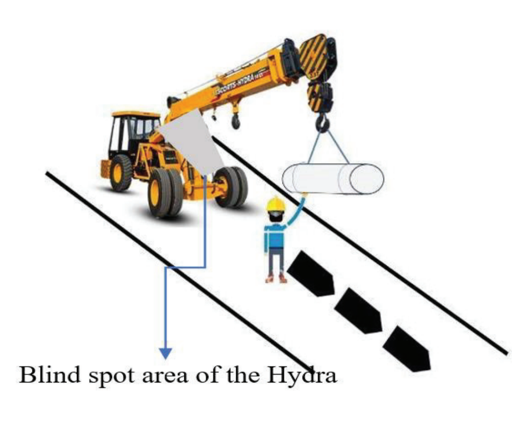
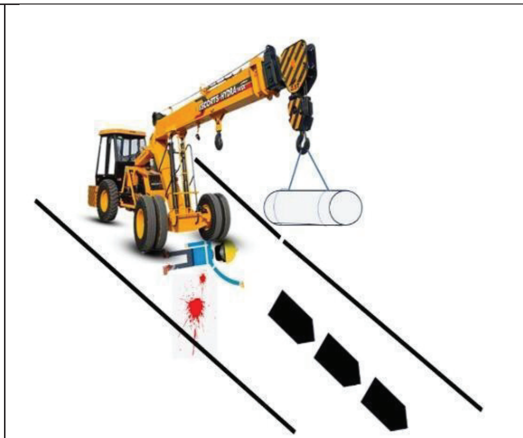
Not following Road Safety guidelines.



Unsafe/Undesired Behaviour	Antecedent	Consequence
• Ignoring traffic rules • Speed violations	• Lack of enforcement • Poor driver training	• Delayed unloading • Increased operational inefficiency

Reinforcement

Positive:	Negative:
• Road safety training • Recognition for safe practices • Regular safety inspections • Display of Safety Guidelines/ Posters/ Slogans	• Penalties for unsafe behaviour • Incident reporting procedures • Performance reviews on compliance

<table>
<tr><th colspan="6">Case Study No.- 4</th></tr>
<tr><td colspan="6">❖ Description:
At a plant, material was being shifted using a hydra. The rigger was holding the lifted pipe in- front of the hydra. As he was moving, he tried to come in the shade of the hydra boom. He tripped and fell, and the hydra ran over him. He sustained serious injuries and later succumbed to the injuries.</td></tr>
<tr><td colspan="6">❖ Reason: Unsafe position of the rigger and poor work standards.</td></tr>
<tr><td colspan="3">
</td><td colspan="3"></td></tr>
<tr><th colspan="2">Unsafe/Undesired Behaviour</th><th colspan="2">Antecedent</th><th colspan="2">Consequence</th></tr>
<tr><td colspan="2">● Rigger standing in front of moving crane
● Seeking shade under the crane boom
● Lack of clear communication and safe distancing</td><td colspan="2">● Lack of training
● Poor risk assessment
● Insufficient supervision</td><td colspan="2">● Fatal injury to rigger
● Workforce morale impact
● Operational delays and increased costs</td></tr>
<tr><th colspan="6">Reinforcement</th></tr>
<tr><td colspan="3">Positive:
● Training and certification
● Recognition programs
● Safety equipment provision
● Regular safety meetings</td><td colspan="3">Negative:
● Strict enforcement of safety protocols
● Incident reporting system
● Performance reviews
● Increased supervision</td></tr>
</table>

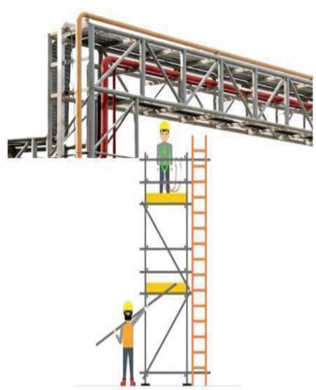
Case Study No.- 5

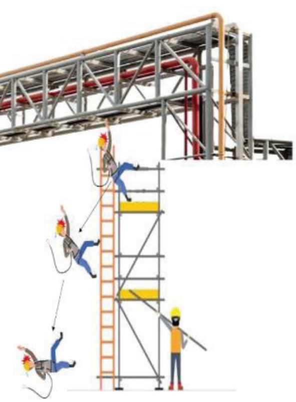
❖ **Description:**

In one of the petroleum refineries, some personnel were engaged in insulation work along a pipe rack. The scaffold on which the personnel were working was completely erected. The ladder of the scaffold was a bit away from his workplace. At the same time, there was another incompletely erected scaffold nearer to the workplace. The worker tried to take a shortcut by climbing to that incomplete scaffold and coming down using its ladder. Unfortunately, the pipe which the worker tried to hold was not fitted properly. The worker fell from about 6 m. height and succumbed to the injuries.

❖ **Reason:**

The worker tried to take a short-cut using the unsafe scaffold.

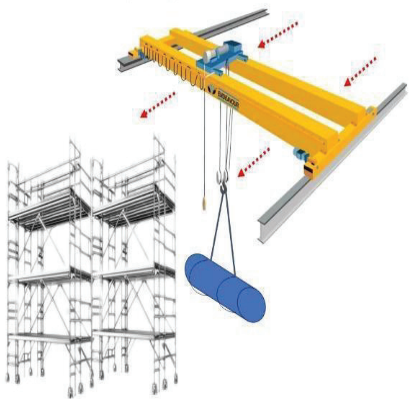
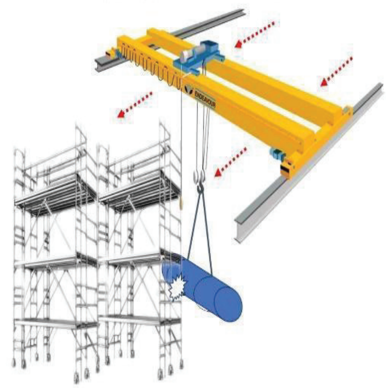


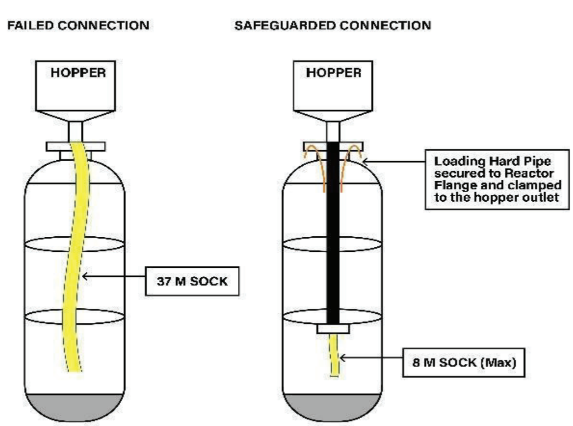


Unsafe/Undesired Behaviour	Antecedent	Consequence
• Shortcut climbing • Holding unstable pipe • Ignoring safe ladder	• Improper ladder • Insufficient training • Lack of supervision • Poor risk assessment	• Fatal fall • Work stoppage • Workforce morale impact

Reinforcement

Positive:	**Negative:**
• Scaffold inspections • Safety training • Recognition for safe practices • Enhanced communication	• Penalties for shortcuts • Incident reporting • Performance evaluations • Increased supervision

<table>
<tr><th colspan="6">Case Study No.- 6</th></tr>
<tr><td colspan="6">❖ Description:
At a construction site, pipe erection was going on inside a compressor house. A 12” pipe was being erected using the recently installed EOT crane. The pipe was kept lifted using the EOT crane and the crane was kept in an energized condition. Due to a fault with the connector, the crane started moving on its own, dragging the pipe along with it. The pipe hit many structures on its way including a scaffold. The crane was last stopped.</td></tr>
<tr><td colspan="6">❖ Reason:
The crane was kept in energized condition.</td></tr>
<tr><td colspan="3"></td><td colspan="3"></td></tr>
<tr><th colspan="2">Unsafe/Undesired Behaviour</th><th colspan="2">Antecedent</th><th colspan="2">Consequence</th></tr>
<tr><td colspan="2">● Leaving crane energized
● Lifting pipe unsupervised
● Improper checking of the crane</td><td colspan="2">● Inadequate equipment inspection
● Lack of operator oversight
● Insufficient maintenance</td><td colspan="2">● Structural damage
● High-risk incident</td></tr>
<tr><th colspan="6">Reinforcement</th></tr>
<tr><td colspan="3">Positive:
● Equipment maintenance checks
● Operator training programs
● Safety performance incentives
● Regular safety audits</td><td colspan="3">Negative:
● Penalties for unsafe operation
● Incident investigation procedures
● Performance reviews on compliance
● Enhanced monitoring of operations</td></tr>
</table>

Case Study No.- 7
❖ **Description:** During the loading phase of a catalyst change out of the VGO (3 bed) reactor at one of the Oil Refinery, a technician entered the reactor to commence sock loading of the catalyst in the bottom bed. Loading of the required layers of ceramic balls had previously been completed and the target was to load $4M^3$ of catalyst to bring the level up to the first thermo-couple. Thus, providing a working platform to enable installation of the thermo-couple. Upon reaching the bottom layer of ceramics, the technician requested that his lifeline be pulled tight to support his weight and tied off. He then asked for the loading hopper slide valve to be opened to start loading. Shortly after loading of the catalyst was under way, the flexible loading sock that was being used to convey the catalyst from the loading hopper to the bottom of the bed-3 became detached from the loading hopper. The loading sock had become overfilled with a catalyst and a large portion of it fell to the bottom of bed-3 where the technician was working. The loading sock struck the technician on the back of his neck. Whilst being restrained by his lifeline and unable to roll with the blow, the force of the loading sock broke his neck resulting in a fatal injury.
❖ **Reason:** Falling of loading sock due to overloading.


Unsafe/Undesired Behaviour	Antecedent	Consequence
• Entering reactor without adequate safety measures • Requesting lifeline adjustment during loading • Using a faulty loading sock	• Insufficient training • Lack of inspection • Inadequate risk assessment	• Fatal injury • Workforce morale impact

Reinforcement	
Positive: • Safety training updates • Regular equipment inspections • Incident learning sessions • Recognition for safety compliance	**Negative:** • Disciplinary action for non-compliance • Mandatory reporting of near-misses • Performance reviews tied to safety • Increased supervision during loading

Case Study No.- 8
❖ **Description:** There was an incident in the Sour Water Stripper (SWS) Unit of Sulphur Block in an Oil Refinery in the morning hours. The incident happened in the area of a stripped water sample collection point near Stripped Water Cooler. In the night shift of the earlier day, the field operator of the production department had gone to collect the routine samples around 05:15 hrs. He was found lying on the floor near the Stripped Water Cooler at about 06:10 hrs. He was brought to First Aid Centre and subsequently sent to Refinery Hospital where he was declared dead at 07:00 hrs.
❖ **Reason:** i) The immediate cause of the fatality was inhalation of high concentrated H_2S gas leading to loss of sense of smell followed by immediate comatose state. ii) The concentration of H_2S in the area was due to the escape of H_2S from the draining point of LCV, which remained open throughout the night shift. This coupled with the foggy weather resulted in poor dispersion & high localized concentration of H_2S in the vicinity of stripped water sample points.

Unsafe/Undesired Behaviour	Antecedent	Consequence
• Inadequate monitoring of personnel • Failure to conduct safety checks • Lack of timely response	• Poor communication of sample collection protocols • Insufficient training on safety procedures • Inadequate staffing during night shifts	• Fatal Injury • Workforce morale impact

Reinforcement	
Positive: • Enhanced safety training • Regular health assessments • Emergency response drills • Recognition for adherence to protocols	**Negative:** • Investigate safety compliance • Penalties for negligence • Mandatory incident reporting • Increased supervision during shifts

Case Study No.- 9		
❖ **Description:** At an electrical substation, a temporary power supply was arranged by the Electrical Maintenance department from Module No. XX in MCC No. YY for Pump No. ZZ. The original panel of this pump was AA which was under replacement. After providing the temporary connection, the electrical engineer with two casual workers were trying to put back the module for giving the supply, an arc flash occurred. All three personnel sustained burn injuries on face and hand.		
❖ **Reason:** While inserting the module, it was not getting into the slot due to some problem with the flapper and its sliding system. Due to this, they were trying to adjust the guide at the module end to align the flapper at the bus bar end with screwdriver, which accidentally came in contact with the bus bar and the body of the chamber which resulted in a phase to earth fault and flashover took place.		
		
Unsafe/Undesired Behaviour	**Antecedent**	**Consequence**
• Improper handling of electrical connections • Inadequate safety precautions during installation • Lack of proper protective equipment	• Insufficient training • Poor planning • Inadequate risk assessment	• Burn injuries to personnel • Workforce morale impact

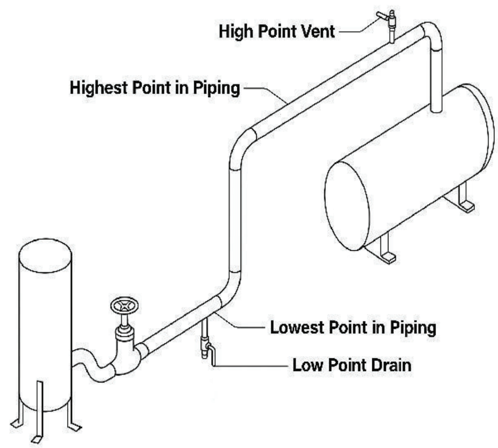
Reinforcement	
Positive: ● Electrical safety training ● Regular equipment inspections ● Safety gear provision ● Reward for safe practices	**Negative:** ● Penalties for safety violations ● Incident investigation protocols ● Performance evaluations on compliance ● Enhanced oversight during operations

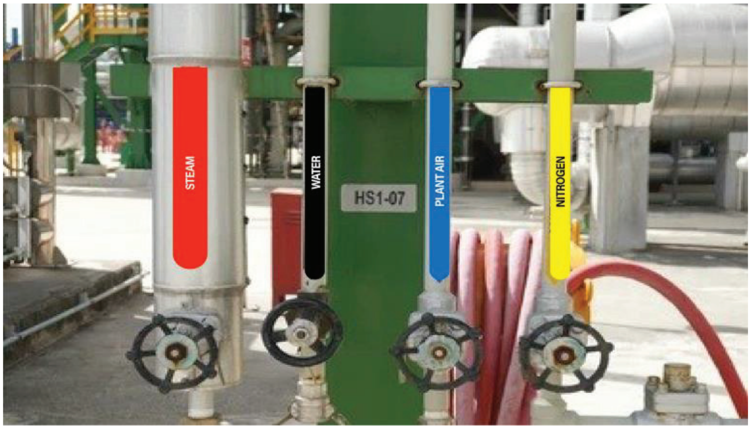
Case Study No.- 10
❖ **Description:** Contract workers were lifting the tube bundle of heat exchanger along with the dummy cell for putting it on the wooden log support for testing purposes using a crane. During this job, while the bundle was lifted about 1ft. from the ground, one of the outriggers of the crane caved into the ground. As a result, the crane got imbalanced, and the heavy load was dropped down.
❖ **Reason:** The incident has occurred due to the punching shear of the RCC slab, owing to settlement of soil in pockets below the RCC slab, which could not be observed from the top.


Unsafe/Undesired Behaviour	Antecedent	Consequence
• Improper crane operation • Lack of secure load lifting procedures • Insufficient ground assessment for crane stability	• Inadequate training • Poor risk assessment operation • Lack of proper ground preparation	• Dropped load and potential injuries • Damage to equipment and surroundings

Reinforcement	
Positive: • Crane operation training • Regular ground assessments • Recognition for safe lifting practices • Implementation of safety checklists	**Negative:** • Penalties for unsafe practices • Incident reporting requirements • Performance reviews on safety compliance • Increased supervision during lifts

Case Study No.- 11
❖ **Description:** A person was engaged in isolation of High Point Valve (HPV). He was wearing a PVC suit. While isolating the line, there was a spillage of chemicals from the valve. He immediately came out of the work area and removed the PVC suit. The chemical which spilled on the suit fell on his head and face causing injury.
❖ **Reason:** Quick removal of PPE by the person without cleaning the spilled chemical.

<table>
<tr>
<td colspan="2">
</td>
<td colspan="2"></td>
</tr>
<tr>
<th>Unsafe/Undesired Behaviour</th>
<th colspan="2">Antecedent</th>
<th>Consequence</th>
</tr>
<tr>
<td>• Improper isolation
• Rapid PPE removal
• Inadequate decontamination</td>
<td colspan="2">• Insufficient training
• Poor risk assessment
• Lack of communication</td>
<td>• Chemical exposure</td>
</tr>
<tr>
<th colspan="4">Reinforcement</th>
</tr>
<tr>
<td colspan="2">Positive:
• Proper PPE training
• Emergency decontamination drills
• Regular safety audits
• Recognition for safety adherence</td>
<td colspan="2">Negative:
• Penalties for improper PPE usage
• Incident investigation protocols
• Performance evaluations based on safety
• Increased supervision in hazardous areas</td>
</tr>
</table>

Case Study No.- 12
❖ **Description:** Shutdown jobs were under progress at one of the Oil Refinery. During the shutdown, an inside cleaning job was going on at the PRU vessel. A Worker was asked to provide Air hose inside the vessel for the comfort of the workers. But the person who was engaged for the hose connection, put the Nitrogen hose by mistake. This resulted in depletion of oxygen level inside the vessel and thereby the person working inside the vessel got asphyxiated.
❖ **Reason:** The immediate cause of the incident was, use of Nitrogen hose instead of Air by contract workers.


Unsafe/Undesired Behaviour	Antecedent	Consequence
• Improper connection • Miscommunication • Safety protocol neglect	• Insufficient training • Inadequate risk assessment • Poor labelling	• Asphyxiation Fatal accident

Reinforcement	
Positive: • Proper hose labelling • Training on gas safety • Regular safety drills • Recognition for safe practices	**Negative:** • Penalties for safety violations • Incident reporting requirements • Performance reviews on compliance • Increased monitoring of confined spaces

Note:

1. **Specialized/Ladder Safety training** in Behaviour-Based Safety (BBS) is generally considered as **positive reinforcement**.

   Positive reinforcement occurs when something desirable (such as knowledge, skills, or recognition) is provided to encourage the repetition of safe behaviours. In the case of safety training, employees receive education and practical knowledge that enhances their ability to work safely. By providing employees with the tools and information they require to perform safely, the training reinforces the desired behaviour of following safety protocols.

   Effective safety training motivates people to accept safer work practices by enhancing their understanding of safety's significance, equipping them with the skills to recognize dangers, and empowering them to take appropriate steps to prevent incidents. Additionally, if the training includes positive feedback and recognition for improved safety practices, it strengthens the reinforcement of these behaviours.

   In contrast to **negative reinforcement** (which typically involves consequences) for unsafe behaviour, safety training focuses on empowering employees with the knowledge and confidence to make safer choices, making it a form of positive reinforcement in BBS.

2. **Recognition for safe practices** in Behaviour-Based Safety (BBS) is **positive reinforcement.**

   When employees are recognized for following safety procedures or engaging in safe behaviours, it reinforces those behaviours by providing positive feedback. The recognition serves as a reward, which increases the likelihood that the employees will continue to perform these safe behaviours in the future.

   This form of appreciation may encompass praise, prizes, or public acknowledgment, all of which contribute to cultivating a culture in which employees feel valued for their efforts in sustaining a safe work environment. By reinforcing safe actions in a positive way, recognition motivates workers to keep up their safe practices, contributing to long-term improvements in safety and overall behaviour.

In contrast, negative reinforcement involves avoiding something undesirable, such as punishment or penalties, to encourage safer behaviour, but recognition is specifically aimed at encouraging positive actions. Therefore, recognition for safe practices is a clear form of positive reinforcement in BBS.

3. **Regular safety inspections** in Behaviour-Based Safety (BBS) are typically a form of **negative reinforcement.**

   Negative reinforcement occurs when a behaviour is encouraged by removing or avoiding something unpleasant. During routine safety inspections, personnel understand that these evaluations are conducted to ensure adherence to safety regulations. The idea is that employees will work safely and follow safety protocols to avoid the negative consequences of failing the inspection or being cited for unsafe practices.

   While safety inspections themselves may not directly provide positive rewards, they serve as a preventive measure. Employees may be motivated to follow safety rules and improve their practices to avoid the penalties or issues that could arise from failing an inspection, such as reprimands or unsafe conditions being reported.

   However, if the safety inspections are used to provide positive feedback or recognition for employees who are performing well (e.g., praise for consistently maintaining safety standards), they can also be part of positive reinforcement. But primarily, regular safety inspections are more closely associated with negative reinforcement, since they focus on ensuring compliance and discouraging unsafe behaviours by making employees aware of potential consequences.

4. **Clear safety guidelines** in Behaviour-Based Safety (BBS) are generally considered **positive reinforcement.**

   When safety guidelines are clear and well-communicated, they provide employees with the knowledge and structure they need to make safe choices. The clarity helps to **reinforce positive behaviours** because employees understand what is expected of them and what the safe practices are. This comprehension fosters adherence and enhances safety, as personnel are more inclined to comply with regulations that are clear and attainable.

The **positive reinforcement** aspect comes from the fact that these clear guidelines support safe behaviour and help employees avoid mistakes or unsafe actions, reinforcing the idea that following safety protocols is the right and expected behaviour.

While clear safety guidelines themselves are not a "reward" in the traditional sense, they create an environment where positive behaviours (safe practices) are more likely to be exhibited because employees are informed and confident about the expectations. This leads to safer behaviour, which is the ultimate goal of BBS.

Thus, **clear safety guidelines** contribute to reinforcing **positive behaviour** and can be seen as a form of **positive reinforcement**.

5. **Penalties for unsafe behaviour** in Behaviour-Based Safety (BBS) are considered **negative reinforcement**.

   Negative reinforcement occurs when an undesirable behaviour (unsafe behaviour, in this case) is followed by a consequence, such as a penalty, in an attempt to reduce or eliminate that behaviour in the future. The idea is that employees will change their behaviour to avoid the negative consequence (the penalty), thereby increasing safety compliance. The penalty serves as a deterrent, pushing employees to avoid unsafe actions to prevent being punished.

   However, it is important to note that while penalties can discourage unsafe behaviour, **punishment** alone is not as effective for long-term behaviour change in BBS. Positive reinforcement—rewarding safe behaviours—is generally considered a more effective strategy for encouraging and sustaining safe practices in the workplace.

   Thus, penalties are typically a **form of negative reinforcement but** should ideally be used alongside positive reinforcement to foster a safer environment.

6. **Incident reporting procedures** in BBS are seen as a **positive reinforcement** or **negative reinforcement**, depending on how the process is framed and implemented.

   i) **Positive Reinforcement**: If the incident reporting process is framed as a proactive step where workers are encouraged and rewarded for reporting near-misses or hazards, it becomes positive reinforcement. In this scenario, employees are motivated to report incidents because they feel supported, and the system rewards the behaviour, helping prevent accidents and improving overall safety culture.

ii) **Negative Reinforcement**: On the other hand, if incident reporting is tied to punitive actions or if employees feel pressured to report only to avoid consequences (such as reprimands or disciplinary action), it can lean more towards negative reinforcement. In this scenario, employees may be driven by the wish to evade punishment rather than the aspiration to enhance safety.

To ensure the procedure's efficacy, it is crucial to foster an environment that encourages incident reporting, allowing staff to report hazards and incidents without fear of retribution. This fosters a culture of safety and proactive conduct in the workplace.

7. **Performance reviews on compliance** procedures in Behaviour-Based Safety (BBS) can also be considered **positive reinforcement** or **negative reinforcement**, depending on how the review process is structured and the outcomes tied to performance.

i) **Positive Reinforcement**: If performance reviews focus on acknowledging and rewarding employees for consistently following safety procedures and complying with safety standards, this is a form of positive reinforcement. Employees are recognized for their efforts, which encourages them to continue adhering to safety protocols as well as fosters a culture of safety. Rewards or recognition can be motivating and help reinforce the desired behaviours.

ii) **Negative Reinforcement**: If performance reviews focus on penalizing employees for failing to comply with safety procedures, it can be seen as negative reinforcement. In this case, employees may be motivated to comply with safety standards to avoid negative consequences, such as reprimands, warnings, or other forms of punishment. While this can result in compliance, it may not create a long-term commitment to safety and might encourage compliance out of fear rather than a genuine desire to contribute to a safer environment.

Ideally, in a Behaviour-Based Safety context, **positive reinforcement** is the more effective approach. It helps build intrinsic motivation to follow safety protocols and enhances employee engagement with safety initiatives, resulting in long-term improvements.

8. **Increased supervision in high-risk** areas within a Behaviour-Based Safety (BBS) framework can be viewed as **negative reinforcement** or **positive reinforcement**, depending on the approach and the intent behind the supervision.

   i) **Negative Reinforcement**: If the increased supervision is primarily aimed at monitoring employees to ensure compliance with safety procedures and is linked to consequences for not following protocols, it can be seen as negative reinforcement. In this scenario, workers may alter their behaviour to avoid punishment or negative outcomes (e.g., reprimands or disciplinary actions), which is characteristic of negative reinforcement. Employees are motivated to perform safely because they want to avoid supervision-related consequences rather than out of a proactive commitment to safety.

   ii) **Positive Reinforcement**: On the other hand, if the increased supervision is used to **support and guide** employees in high-risk areas—offering assistance, providing feedback, and reinforcing good safety behaviours—it can be considered positive reinforcement. This approach focuses on helping workers perform safely by providing a presence that encourages safe practices and offers encouragement. When employees receive positive feedback for adhering to safety standards, it reinforces those behaviours, making it a form of positive reinforcement.

   In most cases, increased supervision in high-risk areas is more likely to be **negative reinforcement**, if it is associated with monitoring for mistakes or compliance issues. However, if supervisors are actively involved in coaching and providing positive feedback, it can lean towards positive reinforcement. The key difference lies in whether the focus is on preventing undesirable behaviours (negative reinforcement) or reinforcing and encouraging desirable behaviours (positive reinforcement).

Summary:

A strong case study conclusion should summarize key findings, reiterate the problem or question addressed, and offer actionable recommendations or insights. It should be brief and leave a lasting impression on the reader, highlighting the study's significance and potential implications.

Self Help Exercise: Time to Stop and Think

Multiple Choice (Tick the correct answer) / Fill in the Blanks:

1. *You can rely on your nose to detect the presence of H_2S.*

□ a) True

□ b) False

2. *Hydrogen sulphide is extremely flammable.*

□ a) True

□ b) False

3. *Exposure to H_2S can weaken and corrode pipes, leading to a leak or exposure incident.*

□ a) True

□ b) False

4. *Burning hydrogen sulphide does not produce sulphur dioxide, another poisonous gas.*

□ a) True

□ b) False

5. *What does a broken white line on the road indicate?*

□ a) You may change lanes if it is safe to do so

□ b) No passing allowed

□ c) Stop your vehicle

□ d) Road is closed ahead

6. What should you do before entering a main road from a smaller road or driveway?

- □ a) Stop and check for approaching traffic or pedestrians
- □ b) Speed up quickly and merge without looking
- □ c) Rely on other drivers to stop for you
- □ d) Honk your horn and proceed

7. What is the purpose of grounding in electrical systems?

- □ a) To provide a path for current to flow.
- □ b) To protect against electric shocks.
- □ c) To reduce electrical resistance.
- □ d) To increase energy efficiency.

8. Which of the following is a common cause of electrical fires?

- □ a) Overloading circuits.
- □ b) Proper grounding.
- □ c) Regular maintenance.
- □ d) Low voltage.

9. What should you do if you experience an electrical shock?

- □ a) Pour water over the affected area.
- □ b) Apply a burn ointment immediately.
- □ c) Remove the person from the electrical source.
- □ d) Do nothing; it will subside on its own.

10. What should you do before performing electrical maintenance?

- □ a) Wear rubber gloves only
- □ b) Switch off the circuit breaker and verify zero voltage
- □ c) Keep the system powered to save time
- □ d) Spray water to cool equipment

11. What is the purpose of using insulated tools in electrical work?

□ a) To reduce the chance of electrical shock
□ b) To improve speed
□ c) To prevent rust
□ d) To increase conductivity

12. Which of the following conditions are responsible for over 70% of scaffold accidents?

□ a) Plank or support slipped or gave way.
□ b) Employee slipped or was hit by a falling object.
□ c) Missing or damaged guardrails.
□ d) All of the above.

13. Cross bracing can be used to climb onto scaffolding.

□ a) True
□ b) False

14. What are the hazards of working at height?

□ a) Height.
□ b) Unprotected edge.
□ c) Fragile roof or degraded material.
□ d) All of the above.

15. Below are categorized as special PPEs for working at height.

□ a) Safety helmet.
□ b) Hand gloves and goggles.
□ c) Full-body harness with connector and anchorage.
□ d) High visible vest.

16. How to prevent falls of material from height?

□ a) By providing the toe-boards.
□ b) By securing the loose material.
□ c) By using a hand tools strap and tools bag.
□ d) All of the above.

17. How to restrict the movement of people under working at height?

- ☐ a) By providing the caution board.
- ☐ b) By barricading the area.
- ☐ c) By deputing a watch man to alert the people.
- ☐ d) All of the above.

18. What does MSDS stand for in chemical safety?

- ☐ a) Material Safety Data Sheet.
- ☐ b) Mandatory Safety Documentation Standard.
- ☐ c) Chemical Hazard Assessment Report.
- ☐ d) Material Storage and Disposal System.

19. Which of the following is an example of a chemical hazard?

- ☐ a) Slippery floors.
- ☐ b) Loud noise.
- ☐ c) High temperature.
- ☐ d) Toxic fumes.

20. What is the purpose of using Personal Protective Equipment (PPE) in chemical handling?

- ☐ a) To improve communication.
- ☐ b) To enhance productivity.
- ☐ c) To prevent chemical reactions.
- ☐ d) To minimize exposure and protect against hazards.

21. What should you do if a chemical spill occurs in the laboratory?

- ☐ a) Ignore it and continue working.
- ☐ b) Inform your colleagues and continue working.
- ☐ c) Immediately clean it up using appropriate procedures.
- ☐ d) Report it to your supervisor and evacuate the area.

22. What does the "flammable" symbol on a chemical container indicate?

- □ a) The chemical is highly corrosive.
- □ b) The chemical is explosive.
- □ c) The chemical can catch fire easily.
- □ d) The chemical is radioactive.

23. What is the purpose of a fume hood in a laboratory?

- □ a) To store chemicals safely.
- □ b) To provide a comfortable working environment.
- □ c) To prevent chemical spills.
- □ d) To remove harmful fumes and gases.

24. What should you do if you accidentally inhale toxic fumes?

- □ a) Ignore it and continue working.
- □ b) Wash your face with water.
- □ c) Immediately seek fresh air and medical assistance if necessary.
- □ d) Report it to your supervisor and continue working.

25. What should you do before using a chemical for the first time?

- □ a) Store it in a secure location.
- □ b) Read and understand the label and MSDS.
- □ c) Mix it with other chemicals to enhance its properties.
- □ d) Dispose of any excess chemicals.

ANSWERS

: (*1.b, 2.a, 3.a, 4.b, 5.a, 6.a, 7.b, 8.a, 9.c, 10.b, 11.a, 12.d, 13.b, 14.d, 15.c, 16.d, 17.d, 18.a, 19.d, 20.d, 21.d, 22.c, 23.d, 24.c, 25.b*)

REFERENCES

1. Oil Industry Safety Directorate (OISD). (2025). *Case Studies on Industrial Safety Incidents*. Ministry of Petroleum & Natural Gas, Government of India. https://www.oisd.gov.in/en-in/CaseStudies
2. OHSE Canada. (2025). *Case Studies in Incident Investigation*. https://ohse.ca/case-studies-in-incident-investigation/
3. Griffin, C. (2024). *Behavior-Based Safety Essentials for Upstream Oil and Gas*. Veriforce. https://veriforce.com/blog/behavior-based-safety-essentials-for-upstream-oil-and-gas
4. OHSE Canada. (2025). *Case Studies and Best Practices in Safety Training*. https://ohse.ca/case-studies-and-best-practices-in-safety-training/
5. DuraLabel. (2025). *3 Ways to Reinforce Training and Improve Safety*. https://resources.duralabel.com/articles/3-ways-to-reinforce-training-and-improve-safety

* * *

Chapter – 14

Conclusion

CHAPTER – 14
CONCLUSION

In today's dynamic industrial environment, ensuring the safety of workers is not merely a statutory requirement but a moral responsibility and a critical factor in operational excellence. This book has explored the multifaceted approach of Behaviour-Based Safety (BBS) and its key role in building and sustaining a proactive safety culture within organisations. Through comprehensive discussions, practical tools, real-life case studies, and analytical insights, it has attempted to provide a clear roadmap for industries aiming to reduce unsafe behaviours and achieve long-term safety excellence.

The concept of BBS emphasizes observing, understanding, and positively influencing worker behaviours that could potentially lead to accidents or incidents. While traditional safety systems focus primarily on unsafe conditions, BBS bridges the gap by highlighting human factors, such as decision-making, attention to detail, situational awareness, and peer influence. As the book outlines, factors like job pressure, fatigue, inadequate knowledge, overconfidence, and hurry contribute significantly to unsafe acts. Recognizing these root causes and addressing them through education, observation, feedback, and reinforcement forms the main objective of BBS.

Throughout the chapters, this book has also emphasized the importance of supporting systems like near-miss reporting, hazard identification and risk assessment (HIRA), job safety analysis (JSA), toolbox talks, work permit systems, process safety management (PSM), and road safety etc. These systems are not standalone; rather, they complement and reinforce the BBS framework. The interconnection between these safety processes ensures a holistic and integrated approach to managing risk, enhancing compliance, and promoting employee engagement in safety programs.

One of the standout discussions in the book has been the role of digitization in HSE (Health, Safety, and Environment) systems. With the beginning of digital tools, industries are now better equipped to monitor, report, analyse, and act upon safety-related data in real-time. From mobile apps for hazard reporting to dashboards for trend analysis, digital transformation has brought in transparency, traceability, and efficiency in safety practices. As industries are moving towards Industry 4.0, integrating BBS with digital HSE systems will significantly enhance decision-making and compliance monitoring.

The practical application of BBS has been illustrated through various case studies in the book. These examples not only demonstrate the challenges faced during implementation but also highlight the tangible benefits that can be achieved, including reduced incident rates, increased employee participation, and an overall improvement in workplace morale. By showcasing real-life scenarios, the book intends to inspire safety professionals and leadership teams to adopt BBS in a structured and sustained manner.

Another key takeaway is the emphasis on sustainability of BBS. Implementing BBS is not a one-time event but a continuous process that requires regular training, feedback, leadership commitment, and periodic review. Cultural change, especially in safety, takes time and consistency. A sustainable BBS program becomes implanted in the organisation's culture, where safety becomes a shared value rather than a set of rules to follow.

Furthermore, the inclusion of chapter-wise Questions & Answers is aimed at reinforcing the understanding of key concepts and promoting self-assessment. This feature not only benefits professionals but also serves as a valuable resource for students, fire & safety trainees, and academic researchers who wish to understand industrial safety practices deeply.

In conclusion, Behaviour-Based Safety is not just a technique but a philosophy that empowers individuals at all levels to take ownership of their safety and that of their colleagues. Its successful implementation can drastically reduce human error, prevent injuries, and foster a positive safety culture. This book hopes to serve as a guide and reference for industries, practitioners, and learners alike, encouraging them to view safety as an ongoing journey rather than a destination.

By embracing BBS and integrating it with modern safety tools and cultural transformation efforts, organisations can move closer to the ultimate goal, zero harm, zero accidents/incidents, and a workplace where every employee & contract worker feels safe, valued, and responsible.

* * *

ABBREVIATIONS

ABC	Antecedent Behaviour Consequences
BBS	Behaviour Based Safety
A&W	Administration and Welfare
BARC	Bhabha Atomic Research Centre
CL_2	Chlorine
CO	Carbon Mono-oxide
CCTV	Closed-Circuit Television
CBD	Continuous Blow-Down
CGM(T)	Chief General Manager (Technical)
CLE	Civil Engineer
DGM(PN)	Deputy General Manager (Production)
DGM(MN)	Deputy General Manager (Maintenance)
DGM(P&U)	Deputy General Manager (Power & Utilities)
DGM(A&W)	Deputy General Manager (Administration & Welfare)
DGM(F&S)	Deputy General Manager (Fire & Safety)
DMEL	Deputy Manager (Electrical)
DMFS	Deputy Manager (Fire & Safety)
DMCL	Deputy Manager (Civil)
DMIS	Deputy Manager (Information Systems)
DMIT	Deputy Manager (Instrumentation)
DMIP	Deputy Manager (Inspection)
EOT	Electric Overhead Traveling
ELCB	Earth Leakage Circuit Breaker
E-I-C	Engineer In Charge
ELE	Electrical Engineer
FEMA	Failure Mode and Effects Analysis
FPS	Fire Permit Signatory
FIR	First Information Report

F&S	Fire & Safety
FSO	Fire & Safety Officer
GM	General Manager
GM(T)	General Manager (Technical)
GSI	Gas Safety Inspector
HOD	Head of the Department
Hi-Po	Hi-Potential
HSE	Health, Safety & Environment
HIRA	Hazard Identification and Risk Assessment
HAZID	Hazard Identification
HAZOP	Hazard Operability
HPV	High Pressure Valve
H_2S	Hydrogen Sulphide
ISO	International Organisation for Standardization
IT	Information Technology
ISO	Information System Officer
ITE	Instrumentation Engineer
IPE	Inspection Engineer
JSA	Job Safety Analysis
KPI	Key Performance Indicator
LOTO	Lock-Out Tag-Out
LEL	Lower Explosive Limit
LCV	Level Control Valve
MSDS	Material Safety Data Sheet
MSCM	Management Safety Committee Meeting
MSD	Monthly Safety Day
NM	Near-miss
NH_3	Ammonia
OH&S	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
OHSAS	Occupational Health and Safety Assessment Specification
OISD	Oil Industry Safety Directorate
OWS	Oily Water Separator
PPE	Personal Protective Equipment

PVC	Poly Vinyl Chloride
PRU	Propylene Recovery Unit
PESO	Petroleum and Explosives Safety Organisation
PTW	Permit to Work
PSM	Process Safety Management
PPM	Parts Per Million
RSM	Refinery Shift Manager
Regd. No.	Registration Number
Reqd.	Required
SOV	Safety Observation Visit
SCBA	Self-Contained Breathing Apparatus
SO_2	Sulphur Di-Oxide
SOP	Standard Operating Procedure
SSCM	Sectional Safety Committee Meeting
SWS	Sour Water Stripper
SELE	Senior Electrical Engineer
SFSO	Senior Fire & Safety Officer
SCLE	Senior Civil Engineer
SISO	Senior Information System Officer
SITE	Senior Instrumentation Engineer
SIPE	Senior Inspection Engineer
TLV	Threshold Limit Value
UEL	Upper Explosive Limit
USA	Unsafe Act
USC	Unsafe Condition
VGO	Vacuum Gas Oil

* * *

APPENDIXES

APPENDIX – 1

Near-miss Format for Contractor Employees

Name of Company……………….

Date: …………..

Date of Incident: ………………………..…. Time of Incident: ……………………..

Unit/Plant: ………………………. Exact Location of Incident: ……………………..……

Brief Description of Incident: ……………………………………………………..……

…………………………………………………………………………………………..…

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………..

Recommendations: ……………………………………………………………………….

……………………………………………………………………………………………...

Name: …………………………. Pass No./Safety Card No.: ……………………………

Name of Company: ……………………………..………………Phone No.: …………

(Signature)

For fill up by F&S Department:

Near-miss Report No.: ………………………Received on Date: ……………………..

Recommendation by F&S: ………………………………………………………………

……………………………………………………………………………………………..

Concerned Department HOD: …………………………………………………………

Details of Action Taken: …………………………………………………………………

Date of Compliance: ……………………………………………………………………..

(Signature of F&S Official)

* * *

APPENDIX - 2

Format No.: …………

Company: XYZ	**COLD WORK PERMIT**	Sl. No.: ....

Work Clearance From: ………Hrs. of Date: …………. To: ……….. Hrs. of Date: …………...
Issued To (Department/Section/Contractor): …………………………………………………
Exact Location of Work (Area/Unit/Equipment No. etc.): …..…………………………………
………………………………………………………………………………………………….....
Description of Work: ……………………………………………………………………………...
………………………………………………………………………………………………….....

Sign. of Permittee: ……………………….

THE FOLLOWING ITEMS SHALL BE CHECKED BEFORE ISSUING THE PERMIT

[Tick mark in the appropriate box. Checklist items marked with asterisk (*) shall be complied by receiver]

Sr. No.	**Item**	**Done**	**Not Reqd.**	**Sr. No.**	**Item**	**Done**	**Not Reqd.**
1.	Equipment/ Work Area inspected			6.	Equipment water flushed.		
2.	Surrounding area was checked, cleaned and covered.			7.	Equipment properly steamed/purged.		
3.	Equipment blinded/disconnected/closed/ isolated/wedge cleaned.			8.	Proper ventilation and lighting provided.		
4.	Equipment properly drained and depressurized.			*9.	Area cordoned off and caution boards/tags provided.		

5.	Equipment electrically isolated and tagged vide Permit No..................			10.	Gas test: HCs/ Toxic etc. HCs = %LEL Toxic Gas = ppm		

Remarks:

1. The activity has the following expected residual hazards (Tick the relevant items):

Lack of Oxygen		Toxic Gases		Pyrophoric Iron		Corrosive Chemicals		Others, specify	
H_2S Gas		Combustible Gases		Steam Condensate					

2. Following additional PPE to be used in addition to standard PPEs (Helmet, Safety Shoes, Hand Gloves, Boiler Suit) - (Tick the relevant items):

Face Shield		Dust Respirator		Lifeline		Compressed Air Set		Others, specify	
Goggles		Fresh Air Mask		Safety Harness		Earmuff			

3. Additional precautions, if any: ………………………………………………………………….
   ………………………………………………………………………………………………………

FIRE PERMIT SIGNATORY (FPS)/ GAS SAFETY INSPECTOR (GSI)/(ISSUER)	PERMITTEE (RECEIVER)
Signature: …………………………………… Date: ………………………………………. Name: …………………………………….. Designation: ………………………………… Tel. No.: ………………………………………	Signature: …………………………………. Date: ……………………………………… Name: …………………………………….. Designation: ……………………………… Tel. No.: ……………………………………

Closing of Work Permit:

Receiver: Certified that the subject work has been completed/stopped and area cleaned.			**Issuer:** Verified that the job has been completed and area cleaned and is safe from any hazard.		
Date & Time	Name & Designation	Signature	Date & Time	Name & Designation	Signature

Clearance Renewal:

Date	Time		Gas Test Reading	Additional precautions, if any. Otherwise mention "NIL"	Issuer		Receiver	
	From	To			Name & Designati on of GSI/FPS	Signatur e of GSI/FPS	Name & Designatio n of Permittee	Signature of Permittee

General Instructions:

1. The work permit shall be filled up carefully and accurately in clear handwriting ensuring that complete information is provided in all the sections/subsections and none of the columns is left blank. Sketches should be provided wherever possible to avoid miscommunication.
2. Appropriate safeguards and required Personal Protective Equipment (PPE) shall be determined by careful analysis of the potential hazards and the operations to be performed prior to starting the work.
3. Requirement of standby personnel from Production/Power & Utility/Maintenance/Contractor/Fire & Safety etc., if any shall be mentioned in the additional requirement.

4. In case of a fire alarm all work must immediately be stopped. In case of Emergency Sirens, all work must be stopped, and all non-essential personnel must leave the work site and proceed to designated areas.
5. For the renewal of work clearance, the issuer shall ensure that the conditions are satisfactory for the work to continue. If the conditions have changed, it may be necessary to issue a new permit or amend the existing permit.
6. This permit shall be valid for a period of 8 hours only, unless it is renewed/extended. This clearance on the same permit can be renewed/extended up to a maximum of seven calendar days.
7. Original permits must always be available at the work site.
8. On completion of the work, the permit shall be closed and returned to the issuer.
9. The permit shall be issued in duplicate. Original permit (Yellow colour) shall be issued by receiver/executor and duplicate (White colour) shall be retained by issuer.
10. Enclose important Dos and Don'ts duly signed with each permit.
11. The Safety Toolbox talk must be ensured by the receiver before start of the work and record for the same shall be maintained.
12. Obtain a separate permit for "Working at Height," if required.

* * *

APPENDIX – 2A

DOs AND DON'Ts FOR COLD WORK

(Attach with all Cold Work Permit)

Cold Work Permit No.: ……………………………..

DOs:

1. Ensure the availability of valid work permits before starting the work.
2. Ensure that work permit conditions are fully complied with at site.
3. Equipment should be properly isolated from all sources of energy before the start of the work.
4. Ensure that walkways and passages are free from all slips/trips and fall hazards.
5. All draining of Oil should be in closed OW&S system and the draining of oil on floor will make the work area and area around the work unsafe.
6. Ensure proper illumination of the workplace while working after dark.
7. Ensure use of non-sparking tools in Hydrogen/LPG/Flare etc. service lines/equipment and areas such as in LPG Storage & Handling, Hydrogen Unit, Gantry area etc.
8. Executors should ensure the quality of hand tools and their healthiness.
9. Always the first wedge opens the flanges.
10. Use of proper PPEs must be ensured during Cold Work by the executor. The use of Safety Helmet and Safety Shoes is mandatory for all works inside the Plant area.
11. While carrying out Cold Work inside confined space, proper ventilation, and illumination to be ensured before the start of the job.
12. Electric cables should be free from joints with sound insulation. Portable electrical equipment should have no loose connections.
13. All portable/mobile electrical equipment should be connected with ELCB.
14. The executor should ensure that the lifting machines (Crane, Hydra), tools & tackles are properly tested and SWL and date of testing is displayed on equipment.
15. Barricading of the area below lifting machines (Crane, Hydra), chain pulley blocks etc. should be ensured before starting of the job.
16. Gas tests should be carried out before issuing Cold Work permits, wherever required.
17. Remove all scraps and unused material from site on completion of work.
18. Executors should know nearest Fire Alarm point, Fire Order, Fire Station Phone number, First Aid centre phone number, nearest Safety Shower, Escape Route & Location of designated Assembly Point and Siren Code before start of the work.

DON'Ts:

1. Never stand or work under suspended loads.
2. Never enter the work area without a safety helmet and safety shoes.
3. Don't wear loose/synthetic clothes while at work.
4. Don't make shortcuts at work.
5. Don't use lamps of more than 24 Volt while working in confined space.
6. Don't run a machine without putting back the guard on its exposed moving part.

	Receiver	**Issuer**
Signature:		
Name & Designation:		
Date:		

* * *

APPENDIX - 3

Format No.: ……………

Company: XYZ	**HOT WORK / ENTRY INTO CONFINED SPACE/ VEHICLE ENTRY PERMIT** (Strike out which is not applicable)						Sl. No.: ________ Permit Regn. No. ________ Previous Permit Regn. No._____ Registered by: _____ (Signature) Name: ________ Date: ________
PERMIT TYPE	NORMAL		SHUT DOWN		BLANKET		Please tick (√) the permit required type.

Work Clearance From: ……... Hrs. of Date: ………..…. To: …..…… Hrs. of Date: …..……...
(Valid for the shift unless renewed)
Issued To (Department/Section/Contractor): ……………………………Work Order No.: ……………
Exact Location of Work (Area/Unit/Equipment No. Etc.): ……………………………………………….
Description of Work: ……………………………………………………………………………………..
………

Sign. of Permittee: ………………….
Name: ………………………….. Date: ……………….

THE FOLLOWING ITEMS SHALL BE CHECKED BEFORE ISSUING THE PERMIT

[Please put the tick [√] in the appropriate box. Checklist items marked with asterisk (*) shall be complied by the receiver. For a hot job in confined space, Sl. No.: B13 shall be ticked for "Done" only]

SN	Item	Done	Not Reqd.	SN	Item	Done	Not Reqd.
A	**General Point**			2.	Proper means of exit/escape provided.		
1.	Equipment/Work Area inspected			3.	Standby personnel provided from Process/Maintenance/Contractor/Fire & Safety Dept.		
2.	Surrounding area was checked, cleaned and covered.			4.	Checked for Oil & Gas trapped behind the lining in Equipment.		
3.	Sewers, manholes, CBD etc. and hot surfaces nearby covered.			*5.	Shield provided against spark		

4.	Considered hazard from other operations and concerned persons alerted.			*6.	Portable equipment/nozzle properly grounded.		
5.	Equipment blinded/ disconnected/closed/ isolated/wedge cleaned.			*7.	Attendant at man way provided for entry ned space (2 Persons)		
6.	Equipment properly drained and depressurized.			*8.	Adequate communication provided to stand by the person.		
7.	Equipment properly steamed/purged.			*9.	Trained Attendant provided with rescue equipment/ SCBA.		
8.	Equipment water flushed.			10.	Space adequately cooled for safe entry of people.		
9.	Free access for approach of fire tenders has been maintained.			11.	Continuous inert gas flow arranged.		
10.	Iron sulphide removed/kept wet.			12.	Check for earthing/ ELCB of all temporary electrical connections being used for welding.		
11.	Equipment electrically isolated and tagged vide Permit No......................			*13.	Gas cylinders are kept outside the confined space.		X
12.	Gas test: HCs/Toxic etc. HCs = %LEL Toxic Gas = ppm			*14.	Checked spark arrestor on mobile equipment.		
*13.	Running water hose/ fire extinguisher provided. Fire water system available.			15.	Welding machine checked for a safe location.		

*14.	Area cordoned off and caution boards/tags provided.			16.	Permit taken for working at height vide permit no.		
B	**For Hot Work/ Confined Space Entry**			**C**	**For Vehicle Entry**		
1.	Proper ventilation and lighting provided.			*1.	Approved type spark Arrestor on the mobile equipment/ vehicle provided.		

Remarks:

4. The activity has the following expected residual hazards (Tick the relevant Items):

Oxygen Deficiency		Toxic Gases		Pyrophoric Iron		Corrosive Chemicals		Others, Please Specify	
H_2S Gas		Combustible Gases		Steam Condensate					

5. Following additional PPE to be used in addition to standard PPE (Helmet, Safety Shoes, Hand Gloves, Boiler Suit) - (Tick the relevant items):

Face Shield		Dust Respirator		Lifeline		Compressed Air Set		Others, Please Specify	
Goggles		Fresh Air Mask		Safety Harness		Ear Muffler			

6. Additional precautions, if any: ____

Fire Permit Signatory (Issuer): Signature:…………Date:……….. Name: ……………………………… Designation: ……..Tel. No.: ……	**Gas Safety Inspector (GSI):** Signature:…………Date:………… Name: ………………………………… Designation: ……... Tel. No.: ……..	**Permittee / Receiver:** Signature:………… Date:……………. Name: …………………………………… Designation: …………Tel. No.: ……..
# Functional GM Signature & Date: ……………….	**Concerned Area HOD/RSM**** Signature & Date: …………………	**Permittee HOD**** Signature & Date: …………………….

** Required in case: A) Hot Work/Vessel Entry/Vessel Box Up/Excavation/Vehicle Entry permit is needed beyond 17:00 Hrs./round the clock/Sundays & Holidays. B) Job requires Road cutting.

Required in case: Job requires Dyke cutting & Blanket Permit (Where clearance renewal is not required).

Closing of Work Permit:

Receiver: Certified that the subject work has been completed/stopped and area cleaned.			**Issuer:** Verified that the job has been completed and area cleaned and is safe from any hazard.		
Date & Time	Name & Designation	Signature	Date & Time	Name & Designation	Signature

General Instructions:

1. Work Permit shall be filled up carefully and no column shall be left blank. Provide sketches, if required.
2. Appropriate safeguards and PPEs shall be determined by analysis of the potential hazards prior to starting the work.
3. In case of a fire alarm, all work must immediately be stopped. In case of Emergency Sirens, all work must be stopped, and all personnel must move to the nearest Assembly Point.
4. Only certified vehicles/engines and permitted types of electrical equipment are permitted in operating areas.
5. Welding machines should be kept at non-hazardous and ventilated areas.
6. Gas test is mandatory. No hot work shall be permitted unless the explosimeter reading is Zero.
7. Vessel entry, where no hot work is to be carried out, shall be permitted, if combustible gases are up to 5% of lower explosive limit (LEL). The Oxygen level shall be at least 19.5% vol. and the concentration of toxic gases below the Threshold Limit Value (TLV).
8. When a person is entering confined space, minimum two trained attendants will be deputed at the manhole or entry point.
9. For renewal of work clearance, the issuer shall ensure that the conditions are satisfactory for the work to continue. If the conditions have changed, it should be necessary to issue a new permit or amend the existing permit.
10. Permit shall be considered issued for job after "Clearance Renewal" is signed. This clearance on the same permit can be renewed/extended for plant shutdown, where permit can be issued for a maximum period of 15 days. Blanket permits may be issued for a maximum period of 30 days.
11. During the registration period of the permit, if the job is not done, the receiver shall enter the prescribed register at Fire Station in advance about the discontinuity of the job.
12. This permit must be available at the work site at all times.
13. On completion of the work, the permit must be closed and submitted to F&S as a record by the receiver.
14. Hot work shall include welding, grinding, gas cutting, burning, open flame, soldering, shot blasting, chipping, riveting, drilling, camera flashing, power tools, IC engines, mixer machines, use of certain non-explosion proof equipment, vehicle entry or any other activities which may generate heat or spark.
15. The permit shall be issued in triplicate. Permittee shall retain pink copy, first copy shall be retained with F&S and second copy shall be retained with issuing authority, all these copies shall however bear the Fire Station Registration Number.

16. Permit issuing authority, RSM & F&S personnel or any authorized job and even cancel the permit on safety norms violation any time.
17. Enclose important Dos and Don'ts duly signed with each permit.
18. All precautions given in permit must be clearly adhered by the permittee.
19. Daily Toolbox talk/safety briefing to be ensured by the permittee before start of the job. A register on toolbox talk shall be kept at site as record and signed by personnel associated with the work.
20. Pre-use check of portable gas testers must be done to ensure its operability by GSI before the gas test.

Clearance Renewal:

Date	**Time (Hrs.)**		**Gas Test Values for HCs, Toxic, O2 etc. (Mention Name of Toxic Gases ________)**	**Additional precautions, if any, otherwise mention "NIL"**	**Signature of GSI/FPS with name & designation**	**Signature of Permittee with name & designation**	**Signature of RSM/HOD (**)**	**Endorsement by F&S (**)**
	From	To						
			Gas Test HCs = %LEL Toxic Gas = ppm O2 = %					
			Gas Test HCs = %LEL Toxic Gas = ppm O2 = %					

Note:

(**) When Work Permit has been issued for Normal Working Hours, but work is anticipated to be extended beyond Normal Working Hours, concerned area HOD/RSM shall endorse permission with signature and endorsed by F&S also.

* * *

APPENDIX – 3A

DOS AND DON'TS FOR HOT WORK

(Attach with all Hot Work Permit)

Hot Work Permit No.: ……………………………..

DOs:

1. Ensure the availability of valid work permit and clearance before starting of the work.
2. Ensure that work permit conditions are fully complied with at site.
3. Area should be free from all flammable and combustibles and the OWS manways, drains where there is likelihood of the presence of hydrocarbons during the work should be covered and sealed.
4. In case of gas welding/cutting cylinders should be kept in an upright position and these should be easily identifiable with its colour.
5. Hose connections of the gas cylinder should be checked before starting the hot job. The hoses must be free from all cuts and kinks and distinct in colour (Maroon for acetylene and black for Oxygen).
6. Use of proper PPEs must be ensured during hot work by the executor.
7. In the case of welding/cutting/gauging etc. it should be ensured that sparks are arrested at site only, especially while carrying out hot work at height.
8. Executors should ensure use of flashback arrestors in gas cylinders while using oxy-acetylene sets. Use welding lighters only to light the welding torch.
9. While carrying out hot work inside confined space, proper ventilation and illumination should be ensured before the start of the job.
10. Electric cables should be free from joints with sound insulation. Portable electrical equipment should have no loose connection.
11. All portable/mobile electrical equipment should be connected with ELCB.
12. The executor should ensure that the lifting machine (Crane, Hydra), tools & tackles are properly tested and SWL and date of testing are displayed on equipment.
13. Barricading of the area below the lifting machine (Crane, Hydra) should be ensured before starting the job.
14. Gas tests should be carried out before issuing hot work permits and the work area must be free from hydrocarbons.
15. Executors shall ensure that all vehicles entering inside the battery area have a CCE approved spark arrestor on exhaust. The vehicle shall move on designated routes only.

16. Executors should know nearest Fire Alarm point, Fire Order, Fire Station Phone number, First-aid centre phone number, nearest Safety Shower, Escape Route & Location of designated Assembly Point and Siren Code before start of work.
17. Executors should ensure the quality of hand tools and their healthiness.
18. Ensure valve cap on cylinders during storage and transportation, if shrouds are not provided.

DON'Ts:

1. Never stand or work under suspended loads.
2. Never enter the work area without a safety helmet and safety shoes.
3. Don't wear loose/synthetic clothes while at work.
4. Don't make shortcuts on work.
5. Don't use a lamp of more than 24 Volt while working in a confined space.
6. Don't use electrode holders as cable connections for extension of welding cable.
7. Never keep acetylene cylinders in horizontal condition, even if they are empty.
8. Never use a grinder without a wheel guard on abrasive wheels.

	Receiver	**Issuer**
Signature:		
Name & Designation:		
Date:		

* * *

APPENDIX – 3B

DOS AND DON'TS FOR ENTRY INTO CONFINED SPACE

(Attach with all Entry into Confined Space Work Permit)

Entry into Confined Space Work Permit No.: ………………………..

DOs:

1. Check for a valid work permit "Entry into Confined Space" before entry into confined space.
2. Ensure that the confined space is positively isolated from the source of energy and has been made free from harmful gases.
3. Proper ventilation and illumination of space must be ensured.
4. Wherever forced ventilation is used, the gas test should be carried out after a minimum 10 minutes of stopping of the eductor/fan/blower.
5. A thorough gas test must be carried out before issuing permits to ensure that there is no pocket of gas available inside and the place is safe for performing the particular job inside a confined space. For entry of a person the concentration of toxic gases should not exceed TLV, and oxygen must be minimum 19.5% by volume.
6. Use suitable respiratory protection for entry in the confined space having oxygen deficiency or having toxic gases more than their TLV.
7. Attendants should be available all the time at man way entry of confined space till the work is in progress inside. The permit should be available with him, and he shall maintain attendance in prescribed form (***Appendix – 3D***).
8. Attendants must be in constant contact with people working inside and know the actions to be taken for rescue/emergency handling, if so required.
9. The low voltage light limited to 24 Volt should be allowed inside confined space. All electric connections shall be provided with ELCB.
10. Wherever possible lifelines with safety harnesses should be used for entry into confined space.
11. Special precautions are required for entry into the inert gas atmosphere. It requires controlled conditions inside confined space as well as mandatory use of compressed breathing air supply to people going inside with alternate air supply arrangement.
12. Keep at least 2 access/exit for each confined space, wherever possible. The access should be unobstructed, approachable, and free from all emergency use.
13. Use required PPEs and personal gas monitors while entering inside. Use of safety helmets and safety shoes is mandatory for all where there is likelihood of accumulation of gas during the work such as in sewers, OWS lines etc.

14. The person in confined space should pass the warning signal to stand by the person in case of any suffocation/difficulty for help.
15. Carry out regular gas tests of confined spaces, where there is possibility of generation due to nature of work being performed inside such as removal of sludge, hot works etc.

DON'Ts:

1. Do n't use light of more than 24 Volt inside confined space.
2. Do n't give any other responsibility to stand by a person, which may cause his absence.
3. Do n't obstruct the man ways from any side of confined space.

	Receiver	**Issuer**
Signature:		
Name & Designation:		
Date:		

* * *

APPENDIX - 3C

Format No.: …………

Company: XYZ	**PRE ENTRY CHECKLIST FOR CONFINED SPACE** (To be filled up and complied before each entry into confined space. The compliance shall be followed by 'Confined Space Entry Permit')	Sl. No. ……….

Associated Permit:

Hot Work/Vehicle entry Permit	☐	Cold Work Permit	☐
Confined Space Entry Permit	☐	Radiography Permit	☐
Excavation Permit	☐	Working at height permit	☐
Electrical isolation/Energisation Permit	☐		

A. Exact location of Work (Unit/ Area/ Equipment No.): ……………………………….
…………………………………………………………………………………………………

B. Description of Work: …………………………………………………………………..…
…………………………………………………………………………………………………

C. Expected date and time of Entry: ……………………………………………………….
Expected date of Completion: …………………………………………………………..

D. Maximum No. of entrants allowed:

E. Name of trained attendant for entry (Training validity 1 years):

Sr. No.	Name	Trained on	Sr. No.	Name	Trained on
1.			2.		
3.			4.		

F. Name of trained entrants for entry (Training validity 1 years):

Sr. No.	Name	Trained on	Sr. No.	Name	Trained on
1.			2.		
3.			4.		
5.			6.		
7.			8.		
9.			10.		
11.			12.		
13.			14.		
15.			16.		

G. Communication facility provided, and procedure established: Yes ☐ (must be "yes" only)
H. Rescue Procedure established: Yes ☐ (must be "yes" only)
I. All electrical equipment is of intrinsically safe/ FLP type: Done ☐ To be done ☐ Not required ☐
J. Safety signs, boards and barriers are available: Done ☐ To be done ☐
K. Debriefing and key point tipping to authorized entrants: Done ☐ To be done ☐
Name and designation of Permittee / Entry engineer: Signature with Date: ………………………………………………………………………………..
L. Checklist to be filled up by Permit Issuer (GSI):

Sr. No.	Item	Required	Not required	Done	Sr. No.	Item	Required	Not required	Done
I.	ENERGY ISOLATION				**V.***	PPE			
1.	Pumps or lines blinded, disconnected or blocked				1.	Full Body harness with lifeline provided.			
2.	Positive isolation of electrical source, with LOTO.				2.	SCBA / airline available at site			
3.	Other sources such as air, water, steam, & gas blinded/ disconnected /blocked.				3.	Retrieval equipment available at site.			
II.	VENTILATION				4.	Dust respirator provided			
1.*	Mechanical (must be air eductor or FLP type for				5.	Protective clothing, hand gloves, footwear, safety			

	inflammables)					helmet, ear protection			
2.	Natural ventilation only				6.	Eye / face protection			
III.	Portable gas tester checked for healthiness	**X**	**X**		**VI.***	Hoisting equipment			
IV.	Continuous gas monitoring required				**VII.***	Resuscitator inhalator			

M. Gas testing reading after opening of man way:

1. Flammable………………….. % LEL 2. Oxygen………..% by volume

3. H_2S………… PPM 4. CO………..……..……. PPM 5. Any other gas………………PPM

Note: Checklist marked with (*) shall be complied by the Executor.

N. Subsequent gas tests after preparation of equipment:
(To be continued till the equipment is safe for entry)

Date	Time	Flammable (%LEL)	Oxygen (% by volume)	H_2S in PPM	CO in PPM	Any other gas (in PPM)

The control measures and precautions appropriate for the safe entry and execution of the work in the confined space have been implemented and the persons required to work in the confined space have been advised of and understand the requirements.

ISSUER	**RECEIVER**
Date………. Time ……. Signature:…………	Date………… Time ………. Signature:………
Name…………………. Designation………	Name………………….…...Designation…………

(*) Points shall be complied by entry engineer/receiver and checked by issuer.

Note:

1. Pre entry confined space checklist shall be used before every Confined Space entry permit.
2. No Confined Space permit shall be issued, till the requirements of the checklist are complied.

* * *

APPENDIX - 3D

Format No.: ………..

ATTENDANCE SHEET FOR PERSONS INSIDE CONFINED SPACE

(To be maintained by Attendant at man way of confined space)

Date: ………………..

Equipment No………… Confined Space Permit No………… Valid up to………….

Sr. No.	Name of person Entering	Date of Entry	Time of Entry (in Hrs.)	Time of Exit in Hrs. (mention date, if changed)	Sign of Attendant

NOTE:

1. This attendant sheet shall be filled and maintained at man way of confined space by stand-by person for all entries in confined space.
2. This will be an integral part of the permit system. E-I-C shall ensure that the stand-by person has been imparted training for the job, and he knows the job. He should remain in touch with persons working inside confined spaces during the job period.

* * *

APPENDIX - 3E

Format No.:………………….

Company: XYZ	**CONFINED SPACE BOX-UP CLEARANCE** (Required only for boxing up of those confined spaces, where entry permit has been obtained for carrying out the work)	Sl. No.: …….

Boxing up clearance From: ……..…Hrs. of Date…….……To.…….. Hrs. of Date………..……
Issued to (Department/ Section/ Contractor): ………………...………………………………..
Location of work (Area/ Unit/ Equipment No. etc.): ……………….……………………………

All the work in above confined space has been completed and equipment may be checked for boxing up.

Sign. of Permittee: ……………………

THE FOLLOWING ITEMS SHALL BE CHECKED BEFORE ISSUING THE CLEARANCE

(To be checked with valid permit for confined space)

Sr. No.	**Item**	**Done**	**Not Reqd.**	**Sr. No.**	**Item**	**Done**	**Not Reqd.**
1.	Equipment/ Work Area inspected			5.	Space is free from all persons		
2.	Surrounding area checked, cleaned and covered			6.	Illumination and ventilation have been removed in my presence after checking and manhole cover has been engaged.		
3.	Space is free from all unwanted materials such as scraps/ debris, surplus items, leftover			7.	The safety sign for "safe entry" has been removed from man way		

	tools & tackles and combustible materials.						
4.	Space is free from all combustible material.			8.	Danger signs to caution all against entry have been displayed at man way.		

Additional precautions, if any:…………………… ……………..……………………………

Gas Safety Inspector (GSI):	Permittee/ Receiver:
Signature: ……………………………………	Signature: …………………………………
Name: ………………………………………..	Name: …………………………………….
Designation: ………………Tel No.: …………	Designation: …………..Tel No.: …………..

COMPLETION OF WORK:

The boxing up of equipment has been done safely. Area at man way is cleared of all unwanted materials and freely accessible.

Permittee/ Receiver Signature: ……………………………………

Name: ……………………………………

Designation.: ……………………………………

The equipment has been checked; the boxing up of equipment has been done. The equipment/area is free from all unwanted materials and freely approachable for safe operation of equipment.

GSI Signature: ……………………………………

Name: ……………………………………

Designation.: ……………………………………

NOTE:

1. This clearance is required for boxing up only those confined spaces, where the permit for entry into confined space has been obtained for carrying out the hot work.
2. The boxing up clearance for equipment shall be applied by site engineer in duplicate and issued by GSI after checking. While checking inside confined space, GSI shall have a valid permit for entry as per procedure. After completion of work the original copy of clearance shall be returned to issue. Duplicate copy shall be retained by site engineer.
3. The close clearances shall be retained by the issuer.

* * *

APPENDIX – 4

Format No.: ....

Company: XYZ	**EXCAVATION PERMIT**					Sl. No.: .... Permit Regd. No.:………. Registered by:……. (Sign.) Name: ………………. Date: ………………….
PERMIT TYPE	NORMAL		SHUT DOWN		CONSTRUCTION	*Please tick the permit type required.*

1A. Asset Custodian Dept.: …………………………………………			Date: ……………
1B. Exact Location of Excavation: ……………………………………………………… (Attach marked up drawing)			
☐ In Plant Area	☐ Tank Dyke	☐ Along Pipe Way	☐ Along Cable Way
☐ Across Road Footpath	☐ In Open Ground	☐ Across Drainage Flume	☐ Others

1C. Size of Excavation (Approx)	...............m. Deep, ...m. Wide, ...m. Long
1D. Purpose: …………………………………………………………………………… ……………………………………………………………………………………………	
2A. Commencing Date: .... Time: .... Expiry Date: .... Time:	
2B. Executing Department: .... Name of Contractor:	
2C. Name of Permittee with Design. .... Signature ....Phone No.:	
3. Permission is granted as described above:	
3A. Excavation Clearance is obtained and attached ☐ Sl. No.:	

4. Associated Permits/ Safety Requirements:		
☐ Cold Work Permit	☐ Hot Work Permit	☐ Confined Space Permit (Depth. 1.3 m)
☐ Hand Excavation Only	☐ Provide Warning Sign	☐ Provide flashing light (FLP in case of hazardous area)
☐ Barricade	☐ Provide Shoring	☐ Batter the sides to 45 degrees or less
☐ Provide Fire Extinguisher	☐ Provide means of Access	☐ Excavated soil 1 m. min away from edge
☐ Body Harness/ Lifeline	☐ Gumboot/Safety Shoes	☐ Any other (Specify): ....
Mechanical Excavation allowed only for:		

Permit Issuer (GSI) Name & Designation:	Signature: .... Date: ....
HOD of Issuing Dept. For Road Cutting Name & Designation:	Signature: .... Date: ....
DGM of issuing Dept. For Dyke cutting Name & Designation:	Signature: .... Date: ....

5. Excavation Renewal (Shift wise):

Renewed up to Date Hours	Requested by (Name & Sign)	Additional Precautions, if any	GSI Signature	Permittee (Name & Design)

6. Excavation Closure:	
Excavation site restored to normal/ safe condition	☐ Yes
Backfilled: ☐ Yes No ☐	Properly compacted: ☐ Yes ☐ No
Re-asphalted/repaired with concrete: Yes☐ No☐	Facilities/Supports restored: Yes ☐ No ☐
Remarks:	
Executor/Permittee: Name:	Signature: .... Date: ....
Agree that excavation restored to our satisfaction.	
Remarks:	
GSI / FPS: Name:	Signature: .... Date: ....

Notes:

1. The permit must be obtained one day in advance. Keep the excavation clearance attached with a permit.
2. The permit must be available at site all the time during the work.
3. The permit shall be in triplicate. Original in pink colour shall be for permittee, first copy (white) for issuer and second copy (green) for Fire Station.
4. The permit shall be issued normally for a period not exceeding 7 days with renewal in each shift. However, for shut down units/facilities, it can be issued for a maximum period of 15 days with renewal in each shift and for construction activities a maximum period of 30 days.
5. PPE such as Safety Helmet, Safety Shoes, Boiler Suit, and Hand Gloves is mandatory for work.
6. The daily safety toolbox talk including key point tipping to contractor personnel shall be carried out by permittee before commencement of work and the record of same shall be maintained.

* * *

APPENDIX – 4A

DOs AND DON'Ts FOR EXCAVATION WORK

(Attach with all Excavation Work Permit)

Excavation Work Permit No.: ………………………….

DOs:

1. Ensure that clearance has been obtained from various departments in prescribed form for all excavation works.
2. Ensure that Excavation Permit and Clearance has been obtained for excavation work and the same is valid.
3. All excavations and open trenches must be barricaded around the opening. Warning lamps can be used for operating areas and roads during darkness (use FLP type fixtures in hazardous areas).
4. There must be sufficient and safe means of access and escape for excavated sites.
5. Excavation areas should be free from fumes/gases heavier than air because it may cause asphyxiation or poisoning. All excavation of depth more than 1.2m. or more should be treated as Confined Space and permit for entry into confined space should be obtained.
6. Excavation to a depth of 1m. or more shall be cut stepped back to give a suitable slope or securely held by bracing so as to avoid the danger of side to collapse.
7. All trenches 1.2m. or more in depth shall at all times be equipped with at least one ladder for each 100 feet length of excavation or fraction thereof. All such ladders shall be extended from bottom of the trench to at least 1m. above the surface of the ground.
8. Barricading of 1m. height (with red & white band/self-glowing caution boards) should be carried out for excavation beyond 1.5m. depth.
9. All cuttings shall be carried out from top to bottom.
10. Special precautions are required for using mechanical excavators inside the plant as it requires a Hot work permit to operate the same in operating areas of the plant (except on roads).
11. Practice of giving permission to cut half the road and utilizing half the road for movement of vehicles should be avoided, unless the conditions mentioned in Sl. No. - 4 (Don'ts) is complied.
12. Use suitable PPEs as per job requirement mentioned in the work permit.
13. Inform all incidents to your supervisor and Fire Station immediately.

DON'Ts:

1. Under no circumstances under cutting to be carried out.

2. Excavated earth shall not be dumped within 1m. of the edge of the excavation or depth of the trench whichever is more.
3. Excavated earth should not be dumped on nearby pathways/approaches, on product/steam line, in front of emergency facilities such as Fire hydrants/monitor, Fire Alarm points, Inlet of foam pourers etc. and on OWS manhole covers.
4. No vehicle should be allowed to go too close to the edge of the excavation because it may cause side collapse. Maintain at least 2m. distances from the edge of the excavation. Adequate and well anchored stop blocks should be provided on the surface to vehicles being driven reversed into the excavation.
5. No mechanical excavation is to be carried out up to a depth of 1.5m. from the ground level in operating areas. In such cases manual excavation is required to be carried out up to a depth of 1.5 M from the ground level.
6. No one should be allowed to move on edge of excavation.

	Receiver	**Issuer**
Signature:		
Name & Designation:		
Date:		

* * *

APPENDIX – 4B

Format No.: ....

Company: XYZ	**EXCAVATION CLEARANCE** (THIS IS NOT AN EXCAVATION PERMIT)	Sl. No.: .... Regd. No.:…………………… Previous Permit Registration No. (if any): …………………………. Registered by: …………… (Sign) Name: ………..…. Date: …………

Exact Location of Work (Area/Unit/Equipment No.): …………...………………………..
Description of Work: …………………………………………………………………………..
…………………………………………………………………………………………………….

(Sketch of the area of Excavation is enclosed)

Permission solicited From: ……. Hrs. of Date: ……… To: …….. Hrs. of Date: …………..
Signature of Executor: ……………………..
Name & Designation of Executor: ………………………………………………………………

---

1. Underground Power Cable: ☐ Existing ☐ Not Existing
   Permission Given: ☐ Yes ☐ No
   Precautions, If any: ……………………………………………………………………………
   Signature: …………………………………... Date: ………………. Area: DMEL/SELE/ELE

---

2. Underground Telecommunication Cable: ☐ Existing ☐ Not Existing
   Permission Given: ☐ Yes ☐ No
   Precautions, If any: ……………………………………………………………………………
   Signature: …………………………… Date: ………… Area: DMEL/SELE/ELE (Telecom)

---

3. Underground Fire Water Line: ☐ Existing ☐ Not Existing
   Permission Given: ☐ Yes ☐ No
   Precautions, If any: ………………………………………………………………………………
   Signature: …………………………………... Date: ………………. Area: DMFS/SFSO/FSO

---

4. Underground Oil/ Sewer Line, Drinking Water Line,
   Above Ground Open Drain: ☐ Existing ☐ Not Existing
   Permission Given: ☐ Yes ☐ No
   Precautions, If any: ……………………………………………………………………………
   Signature: …………………………………... Date: ………………. Area: DMCL/SCLE/CLE

---

5. Underground Computer Cable: ☐ Existing ☐ Not Existing
Permission Given: ☐ Yes ☐ No
Precautions, If any: ……………………………………………………………………………
Signature: ………………………………… Date: ………………… Area: DMIS/SISO/ISO

6. Underground Product Line, Utility Line: ☐ Existing ☐ Not existing
Permission given: ☐ Yes ☐ No
Precaution, if any……………………………………………………………………………
Signature …………………………………… Date ……………………..……….. Area: GSI

7. Underground Instrument Cable: ☐ Existing ☐ Not existing
Permission given: ☐ Yes ☐ No
Precaution, if any………………………………………………………………………………
Signature ………………………………….. Date …………………… Area: DMIT/SITE/ITE

8. Underground Cathodic Protection Cable: ☐ Existing ☐ Not existing
Permission given: ☐ Yes ☐ No
Precaution, if any……………………………………………………………………………
Signature …………………………………….. Date ……………….... Area: DMIP/SIPE/IPE

Instructions:

1. The excavation clearance is required for all excavations including road and dyke cutting. Obtaining this clearance is a prerequisite for EXCAVATION PERMIT.
2. This clearance shall be obtained for a maximum period of 15 days, except at construction sites, non-operational areas, where it shall be for a maximum period of 1 month.
3. This clearance shall be kept attached with Excavation Permit at site.
4. The clearance shall be issued in triplicate, original (pink) for permittee, first copy (white) for issuer and second copy (Yellow) for Fire Station. The clearance shall be initiated by the executor.
5. On issue, original copy will be with executor, duplicate copy with Fire Station and triplicate copy with area in charge/GSI (Gas Safety Inspector).
6. The clearance by area in charge/GSI shall be given just before clearance by shift FSO and registration at Fire Station. Finally, shift FSO will also check that clearances from all other departments have been received.
7. This clearance shall be considered issued after registration at the Fire Station.

8. When the job is completed, the receiver shall collect all the copies and enclose them with a closed copy of Excavation Permit before handing over to permit issuer. The permit issuer in turn after closing the permit will return the same to the Fire Station.
9. For cutting of road in addition to this clearance, format for Road Closure and Excavation Permit shall be required. The Road Closure Format shall be filled in and submitted to the Fire Station by the executor at least one day before starting the work.
10. All road cuttings shall be properly barricaded with precautionary signs and alternate routes shall be displayed at the site by the executor.
11. Duly signed "Dos and Don'ts during Excavation Work" shall be an integral part of the excavation permit. All points mentioned in "Dos and Don'ts" must be complied at site.

* * *

APPENDIX - 4C

Format No.: ……….

Company: XYZ	**FORMAT FOR ROAD CLOSURE**
1A. Exact Location of road blockade	…………………………………………………. (Attach marked up drawing)
1B. Purpose:………………………………………………………………………………..	
1C. Commencing Date. ……………………….. Date of completion……………………	
1D. Executing Dept……………………….. Contractor………………………..….	
1E. Permit for the job to be executed has been obtained: Yes ☐ No ☐	
1F. Name of executor ……………………………. Signature …………………………. Telephone No.:………………………..	
2. Permitted with following precautions: ……………………………………………………… ……………………………………………………………………………………………… ………………………………………………………………………………………………	
2A. Name of Issuer (GSI)……………………………. Signature …………………………. Telephone No.: ……………………	
3. Permission is granted as described above with following safety precautions: Display of Speed limit ☐ Use traffic cone & barricading tape ☐ Mark alternate route ☐ Display other safety signs ☐ Display red light during night (FLP type in hazardous area) ☐ Display of safety sign ☐ Any other requirement (Specify) ………………………………………………………………	
Shift Officer of F&S Dept. Name…………………………………..	Signature………………………. Date…………………………….

Important Notes:

1. Permission for road blockade should be obtained in duplicate. Original (in pink colour) shall be with executor and duplicate (white in colour) at Fire station.
2. The permission shall be obtained at least one day before commencement of work.
3. The information about road blockade shall be sent by DGM (F&S) to Area in charge, RSM, DGM of affected facilities, DGM (A&W), DGM (PN), DGM (P&U), DGM (MN), GM (T) and to other concerned officials in prescribed format.

4. The duly filled and signed format must reach Fire Station one day before the commencement of job during general shift hours.
5. Provision of road blockades, diversion of traffic, display of safety signs etc. as per procedure shall be arranged by the executor with the consent of the shift officer.

* * *

APPENDIX -4D

Format No.: …………

<table>
<tr><td>Company:
XYZ</td><td colspan="2">FORMAT FOR INFORMATION ABOUT MAIN ROAD CLOSURE</td></tr>
<tr><td colspan="2">From: DGM (F&S)</td><td>To: Area in charges, DGM (PN), DGM(P&U) DGM(A&W), Executor</td></tr>
<tr><td colspan="2">Your Ref:</td><td>Date of issue:</td></tr>
<tr><td colspan="2">A. Road closure permission given for Road No.</td><td></td></tr>
<tr><td colspan="2">B. Location of Road</td><td></td></tr>
<tr><td colspan="2">C. Duration of closure</td><td>From :…………… To: ……..……..…</td></tr>
<tr><td colspan="2">D. Alternate route</td><td></td></tr>
<tr><td colspan="3">Sketch of road to be cut and alternate route:</td></tr>
<tr><td colspan="3">Note:
1. All drivers using the route shall be advised to exercise caution and use alternate routes by their controlling departments.
2. This information can be circulated through mail.</td></tr>
<tr><td colspan="3">Signature of DGM (F&S)
Date: ………………….</td></tr>
<tr><td colspan="3">Copy: RSM
Concerned DGMs
Concerned GMs
CGM(T) – For information please.</td></tr>
</table>

* * *

APPENDIX - 5

Format No.: ....

Company: XYZ	**PERMIT FOR WORKING AT HEIGHT** (REQUIRED FOR WORKING AT HEIGHTS OF 2 METERS & ABOVE) This permit authorizes for provision of safe access/platform/working arrangement at height for carrying out the job. However, depending on the nature of work, separate permits must be obtained.	Sl. No. ....

From: …….…. Hrs. of Date: ……………… To: ………….. Hrs. of Date: …………………..
Name of the Agency/Contractor: …………………………………………………………..
Name of Site Supervisor: ……………………………………………………………………….
Job Order No.: ……………………………Location of Work: ……………………………..
Description of Work: ………………………………………………………………………
…………………………………………………………………………………………………..

Sign. of Permittee: ……………………

(A) PERMITTEE SHALL CHECK THE FOLLOWING ITEMS FOR COMPLIANCE BEFORE SOLICITING THE PERMISSION

		YES	**NOT REQD.**
1.	Have Scaffolds Been Checked and Certified in Prescribed Form by the Scaffold Supervisor?	☐	☐
2.	Have scaffolds been tagged with green cards duly filled and signed by the scaffold supervisor?	☐	☐
3.	Is the scaffold rechecked and rectified weekly?	☐	☐
4.	Is scaffold erected on firm ground and sole plate & base plate have been used?	☐	☐
5.	Are the hanging baskets used for proper construction, tested and certified for the purpose?	☐	☐
6.	Is the work platform made free of hazards of all traps/trips/slips and fall?	☐	☐
7.	Have cat ladders, crawling boards etc. been used for safe working on a sloping roof?	☐	☐
8.	Has edge protection provided against fall from roof/elevated space?	☐	☐

(B) THE FOLLOWING ITEMS SHALL BE CHECKED FOR RISK ASSESSMENT BY ISSUER AND COMPLIED BY PERMITTEE BEFORE SOLICITING THE PERMISSION

9. Is the platform provided with Toe board, Guard Rail & area below barricaded? ☐ ☐
10. Checked whether safety harness & necessary arrangement for tying the lifeline? ☐ ☐
11. Have precautions listed below for safe working at height for sources of energy such as electricity. ☐ ☐
12. Is proper means of access to the scaffold including use of standard aluminium ladder provided? ☐ ☐
13. Is the raised work surface properly illuminated? ☐ ☐
14. Are the workers working near unguarded shafts, excavations, or hot lines? ☐ ☐
15. Checked for provision of collective fall protection such as safety net. ☐ ☐
16. Additional PPE Recommended:………………………………………………………….

ADDITIONAL PRECAUTIONS REQUIRED, IF ANY: ………………………………………..
…………………………………………………………………………………………………..

Fire Permit Signatory / Gas Safety Inspector (Issuer)	**Permittee (Receiver)**
Signature:………………………………… Name: …………………………………….. Designation: …………….. Tel. No.: ………	Signature: ………………………………… Name: ……………………………………….. Designation: …………….. Tel. No.: ……..…
Concerned Area HOD/RSM** Signature & Date: ………………………...	**Permittee HOD**** Signature & Date: ………………………...

** Required in case Permit is needed beyond normal working hours (8:00 Hrs. to 17:00 Hrs.)/ Round the Clock/ Sundays & Holidays.

Closing of Work Permit:

<table>
<tr><td colspan="3">Receiver: Certified that the subject work has been completed/stopped and area cleaned.</td><td colspan="3">Issuer: Verified that the job has been completed and area cleaned and is safe from any hazard.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Date & Time</td><td>Name & Designation</td><td>Signature</td><td>Date & Time</td><td>Name & Designation</td><td>Signature</td></tr>
</table>

Clearance Renewal:

Date	Time		Additional precautions, if any. Otherwise mention "NIL"	Issuer			Receiver		
	From	To		Name of GSI/ FPS	Designation. of GSI/ FPS	Signature of GSI/ FPS	Name of Permittee	Designation. of Permittee	Signature of Permittee

Instructions:

1. This permit will be issued in Triplicate. Green Copy (Original) and White Copy (Triplicate) will be for permittee. Issuing authority will retain White Copy (Duplicate). In the case of Project, the ORIGINAL shall be retained by Permittee. The DUPLICATE copy will be with Project Safety and TRIPLICATE copy will be with PMC Safety. This permit shall be valid for a period of 8 hours only, unless it is renewed/extended. This clearance on the same permit can be renewed/extended to a maximum of 7 calendar days.
2. After the completion of the job, copies of the work permit should be returned to the ISSUER.
3. Items applicable must be ticked (√).
4. All works in height shall be discontinued during rain/high wind/floods.
5. Stop all jobs in case the scaffold is sagging unduly. Report to EIC.

6. Metallic tubular scaffolding and standard aluminium ladders are only to be used.
7. Use of safety harness is mandatory for all while working at a height of 2m. and above.
8. All works must stop on instruction from permit issuing authority and officers of F&S Dept. Or whenever an unsafe condition is detected.
9. The permittee shall obtain permission from the respective disciplines.
10. Permittee to ensure the compliance of safety precautions required mentioned in permit.
11. Use of an approved type of safety harness along with a lifeline is must for working at height.
12. The permit must be available at site during work.
13. Use of safety helmets and shoes is mandatory for all work sites.
14. The Permittee shall ensure that all working personnel have taken Safety Training before the start of work.
15. Sketches should be provided, if required.

* * *

APPENDIX - 5A

Format No.: ……………

Company: XYZ	**PRE ERECTION CHECKLIST FOR SCAFFOLDS** (To be filled up and complied before erection of scaffold at site, before giving permit to start the erection)	Sl. No………..

Type of scaffold to be erected:

Independent scaffold ☐ Independent tied scaffold ☐ Mobile scaffold ☐

Quick fix scaffold ☐ Birdcage scaffold ☐ Truss scaffold ☐

System scaffold ☐ Slung scaffold ☐ Drop scaffold ☐

Any other (specify):……………………………………………………………………………

A. Exact location of work: (Unit/ Area/ Equipment No.): …………………………………
……………………………………………………………………………………………………..

B. Description of work to be performed: …………………………..………………………
……………………………………………………………………………………………………..

C. Expected date and time to start erection…...……………………………………………
Expected date of completion………………………………………………………………

D. Maximum No. of persons allowed on scaffold after erection: …………………………..

E. Associated Permit:

Hot Work/Entry into Confined Space Permit ☐ Cold Work Permit ☐

Confined Space Entry Permit ☐ Radiography Permit ☐ Excavation Permit ☐

Electrical isolation/Energisation Permit ☐ Working at height Permit ☐

F. For the scaffold sufficient quantity of materials are available at site:

Sr. No.	**Items**	**Yes**	**No**	**Not Required**	**Sr. No.**	**Items**	**Yes**	**No**	**Not Required**
1.	Scaffold pipes*			**X**	2.	Scaffold couplers *			**X**
3.	Deck boards*				4.	Base plate*			**X**
5.	Sole plate				6.	Toe board#			
7.	Reveal pin				8.	Standard aluminium ladder (as per IS/ BS)#			

9.	Mettle Wire to fix ladder #				10.	Tags (RED & GREEN)*			X
11.	Toe board clip #				12.	Joint pin			
13.	Approved full body safety harness with lanyard/ lifeline **				14.	Double fork type lanyard with energy absorber##			
15.	Fall arrester				16.	Safety Net*			

(*) Compulsory for all scaffolds, used for working at height by persons.

(#) Compulsory for scaffolds of height 1.8 m. and above.

(##) Compulsory during scaffold erection, repair, modification & dismantling and when ladder is not in use.

(**) Compulsory for 2 m. and above.

G. Name of trained scaffold supervisor (Training validity- 1 years):

1………………………..………………….. 2.……………………………………………

H. Quality of scaffold materials available at site:

Sr. No.	**Items**	**Yes**	**No**	**Sr. No.**	**Items**	**Yes**	**No**
1.	Are scaffold tubes not damaged/ deformed? *			2.	Are scaffold boards / sole plates damaged/ deformed? **		
3.	Are couplers a suitable type and free from defects?			4.	Are base plates free from defects?		
5.	Are standard metal wires available for tying ladders?			6.	Are Standard aluminium ladder (s) free from defects, deformity, and temporary repairs.		

* Refer drawing No. ……………………….. ** Refer drawing No.……………………

Name and designation of site engineer/E-I-C: …………………………………………..

Signature with Date: ……………………………………………………………………

I. Safety Check by Issuer:									
Sr. No.	**Items**	**Yes**	**No**	**Not Required**	**Sr. No.**	**Items**	**Yes**	**No**	**Not Required**
1.	Area inspected for erection of scaffold and found surface consolidated / hardened			X	2.	Is safety harness (s) with lanyards available and in good condition?			
3.	Are other PPE such as fall arresters available?				4.	Is Safety Net available?			
5.	Is 100% safety briefing given by Site engineer before start of work?			X	6.	Are scaffold materials properly stacked at site, without obstruction approach routes?			
7.	Are warning signs, barricading tapes available at site?				8.	Is a medical certificate for persons working at a height of 2m. and above available?			
ISSUER (GSI): Date……………..Time ………………. Signature: …………………………….. Name……………..Designation………					**RECEIVER/EXECUTER (Site Engineer):** Date…………….. Time ………..……… Signature: ……………………..……..… Name…………….. Designation…...……				

Important Notes:

1. This pre-erection checklist shall be filled up by executor and issuer before starting erection of each scaffold.
2. Pre-erection checklist shall be filled up by E-I-C in duplicate and submitted to issuer for further check. On further check by the issuer, the executor shall comply with all requirements as mentioned in the checklist and sign the checklist.
3. Duplicate copy shall be returned to issuer after compliance, whereas original shall be retained by executor.
4. Check-list points marked as "NO" must be attended and addressed in this format.

* * *

APPENDIX - 5B

Format No.: ....

CHECKLIST FOR SCAFFOLD

UNIT	LOCATION/ EQUIPMENT	DATE/ INSPECTED	TYPE OF SCAFFOLD	ERECTED BY
Item	**Checkpoint**	**Condition**	**Comments**	**Action**
Foundation	Firm and even			
Standards	Vertical			
	Staggered joints			
	Right spacing			
	Not damaged			
Ledgers	Level			
	Staggered joints			
	Not loose			
	Not damaged			
Transoms	Right spacing			
	Not loose			
	Right support			
Bracing Ties	None missing			
	Not loose			
Fittings	Right fitting			
	Not damaged			
	Check couplers			
Ladders	Proper angle			
	Right length			
	Properly secured			
	Separate landing			
	Right extension			

Guardrails	Right height			
	Right length			
	None missing			
Toe-boards	Ok/Not Ok			
Others (If any)				
General Comments				
	Contractor's Supervisor/ Engineer		Maintenance Engineer/Civil/ Mechanical/Inst. Engr.	
Name				
Signature				
Date & Time				

Notes:

1. The contractor shall carry out further periodic inspections every seven days.
2. Above signatories must approve any change made to the scaffold after signing this check list.

* * *

APPENDIX - 5C

Format No.: ……..….

MEDICAL CERTIFICATE

Form for Medical Check Up for the Workman engaged by the Contractor
(Working at Heights)

Certified that I Dr. ……………………………. have examined Mr./Ms………………………… Age…………… who has signed below in my presence. The details of his examination as required are given in the enclosed medical examination report. I certify that all clinical and pathological tests were done in my hospital/dispensary under my instructions, and I find him fit. General and physical examinations of Mr./Ms…………………………………….. do not reveal any abnormality. He does not suffer from any acute/chronic skin disease or any contagious or infectious disease. He is medically fit to work at a height of 2.0 meters and more since he is free from Vertigo, Epilepsy or Fits, general giddiness, and height related disease. His B.P., Pulse, Eyesight etc. is normal.

In my opinion Mr./Ms………………………………………is physically and mentally fit for job in ………………………………………...

Signature of the workmen
Date: …………………..

Signature and Rubber stamp of medical practitioner with name

Note:

This certificate is to be given on the letter head of the registered medical practitioner who is possessing allopathic qualification as recognized by the Indian medical council. Below the signature, the rubber stamp of the medical practitioner should be affixed. The letterhead normally should contain the following:

1) Name of the Medical practitioner:
2) Qualifications:
3) Registration Number:
4) Designation:
5) Address:

* * *

APPENDIX - 6

Format No.:.................

Company: XYZ	**RADIATION PERMIT** (This permit is to be issued and registered by the Area Concern)	Sl. No. ....

From: ………….. Hrs. Date: …………….. To: ……… Hrs. Date: …………………

Permission is granted to Department/Section/Contractor: ……………………………………

Name of Radiography Agency: ……………………………………………………………………

Name of Site Supervisor (Level - 2 holder): ……………………………………………..…..

Specific Location of Work: ………………………………………………………………………

……………………………………………………………………………………………………

Name & Designation: ……………………..

Signature of Permittee: ……………………

Part – 1 (TO BE FILLED BY RADIOGRAPHY AGENCY)

RADIATION SOURCE

Type of Radiation: ☐ X-Ray ☐ Gamma Ray ☐ Ir-192 ☐ Co-60

No. of Source: .... Radiation Activity (Intensity): ....Kv/Ci

MEASUREMENT OF CONTROL ON RADIATION EXPOSURE

- * Collimator : ☐ Yes ☐ No ☐ Not Required
- * Radiation Survey Meter : ☐ Yes ☐ No
- * Film Badge : ☐ Yes ☐ No
- * Concrete Wall Barrier : ☐ Yes, ... CM. ☐ No ☐ Not Required
- * Pocket Dosimeter : ☐ Yes ☐ No
- * Alarm / Lamp : ☐ Yes ☐ No ☐ Not Required
- * Cordon off Distance : .... in Meters. Others: ....

No. of persons involved in Radiation Work: ....

Name/Signature:

Officer Inspection Dept.: ....

Name/Signature:

Radiography Site In Charge:…………..……

THE FOLLOWING ITEMS SHALL BE CHECKED BEFORE ISSUING THE PERMIT
Part – 2 (Please put tick [√] mark in the appropriate box)

Sr. No.	Item	Done	Not Req.	Sr. No.	Item	Done	Not Req.
1.	Equipment/Work area inspected	☐	☐	4.	Proper lighting provided.	☐	☐
2.	Associated permit taken for the job (specify the types and permit no.).	☐	☐	5.	Radiation survey meter available at site.	☐	☐
3.	Area cordoned off (in case of radiography) with proper symbols.	☐	☐				

1. Following additional PPE to be used in addition to standard PPEs (Helmet, Safety Shoes, Hand Gloves, Boiler Suit etc.) (Tick the relevant items):

Face Shield		Dust Respirator		Lifeline		Compressed Air Set		Goggles	
Fresh Air Mask		Safety Harness		Earmuff		Film Badge/ Dosimeter		Others	

2. Additional precautions, if any: ……………………………………………………………………
……

HOD/RSM (In case of Working beyond Office Hours)	FIRE PERMIT SIGNATORY (FPS)/ GAS SAFETY INSPECTOR (GSI)	PERMITTEE (RECEIVER)
Signature: …………………... Name: ………………………. Designation: ……………….. Tel. No.: …………………….. Date: …………………………	Signature: …………………….. Name: …………………………. Designation:…………………... Tel. No.:……………………….. Date: …………………………	Signature: …................... Name: ………………...… Designation:……...…….. Tel. No.: …………..……. Date: …………………….

Special Instructions:

1. This permit shall be valid for a period of 8 hours only, unless it is renewed/extended. The clearance on the same permit can be renewed/extended up to a maximum of seven calendar days.
2. In case of a fire alarm all work must immediately be stopped. In the case of Emergency Sirens, all work must be stopped, and all non-essential personnel must leave the work site and proceed to designated areas.
3. This permit must always be available at the work site.
4. This permit is to be made in duplicate: Blue & White colour. Blue copy is issued to Permittee/Executor. The White copy is to be retained by issuing authority.
5. On completion of job, area to be cleared and copies of permit to be returned to the issuer after closing of permit. The same shall be closed by the issuer and kept as record.
6. All the columns in the form should be filled properly. No column should be left blank.
7. Announcements to be made and removal of non-essential people are to be ensured from cordoned off areas before commencement of job. The barricading is to be done with warning tape with a display of radiation hazard symbol at site by the site radiographer after carrying out the radiation survey.
8. The radiography should preferably be carried out at the time when occupancy is least.
9. Radiation source movement within the site is to be maintained as per BARC norms.
10. The supervisor must be available at site during the radiography work.
11. Level - 2 personnel are qualified in radiation safety who will perform and/or direct industrial radiography according to established or recognized procedures and shall be responsible for the radiographic method or technique to be used and for the assessment of radiographs.
12. The distance for barricading is decided by RSO depending upon strength of radiation source, occupancy factor and radiation workload.

Closing of Work Permit:

<table>
<tr><td colspan="3">Receiver: Certified that the subject work has been completed/stopped and area cleaned.</td><td colspan="3">Issuer: Verified that the job has been completed and area cleaned and is safe from any hazard.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Date & Time</td><td>Name & Designation</td><td>Signature</td><td>Date & Time</td><td>Name & Designation</td><td>Signature</td></tr>
</table>

Clearance Renewal:

Date	Time		Additional precautions, if any. Otherwise mention "NIL"	Issuer		Receiver		
	From	To		Name & Designati on of GSI/FPS	Signature of GSI/FPS	Name & Designat ion of Permittee	Signat ure of Permit tee	Signature of RSM (In case of work beyond normal working hrs.)

* * *

APPENDIX - 7

Format No.:...........

Company: XYZ	**ELECTRICAL ISOLATION/ ENERGIZATION PERMIT**	

Section – A: Isolation Permit

Request for Isolation: Sl. No.: ………………

Date: …………………. Time: ……………………

Department/Section/Area Issuing the Permit: …………………………………………..

Equipment number to be isolated: ………………………………………………………

The above-mentioned equipment shall be de-energized and isolated from all live conductors to carry out the maintenance work by ……………………………… section/ for operational requirement.

Issuer Name:…………………………..Designation:……..………… Signature: ……………

Certificate of Isolation:

Date: …………………… Time: ……………………

Certified that Equipment No.: ……………………….. of …………………………... plant fed from S/S No.:……………..……………..SWGR No.:……………………………..Panel No.:…………………… has been electrically isolated and safe to work in all respect. Actions in respect of electrical isolation have been recorded in the electrical shift logbook/LC register.

Following isolations and other activities are done. Tick mark (√) in the appropriate box:

Sr. No.	**Isolation /Activities**	**Yes**	**No**	**Sr. No.**	**Isolation /Activities**	**Yes**	**No**
1.	Breaker/Switch fuse unit is off or racked out.			5.	All possible back feeding supplies are disconnected.		
2.	Power fuses are removed.			6.	Proper earthing done.		
3.	Control fuses/switches are removed.			7.	Danger and caution Tag provided on the supply panel.		
4.	Cable (s) discharged.						

Specific Instructions, If any: ………………………………………………………………………
…………………………………………………………………………………………….

Name of Authorized Person:…………………Designation:…………Signature:…………..

Section – B: Energisation Permit

Request for Energisation Sl. No.: …………..

Date: …………………….. Time: …………………….

Department/Section/Area Issuing the Permit: …………………………………………...

Equipment number to be energized: ……………………………………………………….

Work on above mentioned equipment has been completed and all the applicable permits closed. This equipment may be energized.

Issuer Name:………………..……….Designation:………………………Signature:……...…

Certificate of Energization:

Date: ………………………. Time: …………………….

Certified that Equipment No. ………………………….. of …………………… unit/ plant fed from S/S No.: …………………………..SWGR No.: ……………………………………..

Panel No.: ………………………….. has been electrically energized and the Danger/Caution tag removed from the supply panel. This is also recorded in the electrical shift logbook/LC register.

Name of Authorized Person:……………..……Designation:…………….Signature:………

Instructions:

The permit shall be issued in triplicate with two parts i.e. Section - A & Section – B. The original copy shall be in Pink colour, Second Duplicate and Third Triplicate will be in Light Green & White colours respectively with "COPY" embossed on the body of permit.

Section A: Isolation Permit

Section - A shall be completed by the person authorizing the work before issuing to the person responsible for the switching, isolating, testing, and earthing operations in triplicate. Original Copy (Pink colour) with duplicate (Light Green colour) shall be issued to the person responsible for the switching, isolating, testing, and earthing operations. Third triplicate (White colour) copy shall be retained by a person authorizing the work.

Section A: Certificate of Isolation

Shall be completed in duplicates by the person responsible for the switching, isolating, testing and earthing operations. The Original copy (Pink colour) shall be returned to the person authorizing the work and duplicate (Light Green colour) copy shall be retained with the person responsible for the switching, isolating, testing, and earthing operations.

Section B: Energization Permit

Shall be completed in two copies (Original and Triplicate) by person authorizing the work after completion of all repair/maintenance/testing/modification jobs. The original copy (Pink colour) shall be issued to the person responsible for the switching, isolating, testing, and earthing operations for energising the equipment. Triplicate copy (White colour) shall be retained by a person authorizing the work.

Section B: Certificate of Energization

Shall be completed in two copies (Original and Duplicate) by the person responsible for the switching, isolating, testing, and earthing operations. The duplicate copy (Light Green colour) shall be returned to the person authorizing the work and original copy (Pink colour) shall be retained by the person responsible for the switching, isolating testing, and earthing operations.

* * *

APPENDIX – 8

<table>
<tr><td colspan="2">Company:
XYZ</td><td colspan="6">JOB SAFETY ANALYSIS</td><td>New □
Revised □</td></tr>
<tr><td colspan="3">JSA No.:</td><td colspan="2">Date:</td><td colspan="3">Page:</td><td></td></tr>
<tr><td colspan="3">Unit:</td><td colspan="2">Area:</td><td colspan="3">Exact Location:</td><td></td></tr>
<tr><td colspan="4" rowspan="3">Job Title:</td><td colspan="4">Analysis Performed By:</td><td>Reviewed By:</td></tr>
<tr><td colspan="2">Name:
(Including Contractor Supervisor)</td><td>Designation:</td><td>Signature</td><td rowspan="5"></td></tr>
<tr><td colspan="2" rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td colspan="4">Title of Person who does Job</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Contractor</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Sr. No.	**Activities**	**Expected Hazards**	**Recommended Actions**	**PPE**	**Action By**
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

* * *

APPENDIX - 9

Toolbox Talk Attendance Format		
Unit/Location:……………….	Company:……………………	Date:……………………
Job Description:…………….. ……………………………….. ………………………………..	Toolbox Topic:…………….. ……………………………….. ………………………………..	Toolbox Conducted By: Name: …………………. Designation: …………..

Sign-In Sheet

Sr. No.	Name	Employee / Pass No.	Signature
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			

Remarks: ……………………………………………………………………………….…

Manager:	Supervisor:
Signature	Signature

* * *

APPENDIX – 10

BBS Observation Card							
Observer's Name:				Employee ID:			
Designation:				Plant:			
Date:		Time:		Area visited:			
Sr. No.	**Behaviour Category**	**No. of Observations**	**Safe Behaviour**	**At-Risk Behaviour**	**Corrected Behaviour**	**Correction of At-Risk Behaviour (%)**	**Safe Behaviour after Correction (%)**
1.	**PPE** (Using appropriate PPEs like hard hats, gloves, goggles, ear plugs etc.)						
2.	**Housekeeping** (Well-maintained work area, no spills, unobstructed walkways etc.)						
3.	**Using Tools and Equipment** (Using appropriate tools properly, tools in good condition etc.)						
4.	**Body Positioning & Protection when at Work** (Avoiding line of fire, imbalance etc.)						
5.	**Material Handling** (Body mechanics - lifting, pulling,						

	pushing loads etc.)						
6.	**Communication** (Verbal/ Non-verbal interactions that affect safety)						
7.	**Following Procedures** (Complying with SOPs/ Permits)						
8.	**Visual Focusing** (Attentiveness)						
9.	**Using Mobile Phone while Working** (No distraction, ignition source)						
10.	**Road Safety** (Over speeding, Overtaking, Wrong side driving etc.)						
Total							
Remarks:							

* * *