Analysis of Hazard Potentials, Risk Levels and Control Measures Using the HIRARC Method in the Clean Water Pipeline Construction Project of *PT CATL KARAWANG*

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ABSTRACT

Occupational Safety and Health (OSH) is a crucial aspect of construction activities to prevent accidents and occupational diseases. This research is intended to systematically identify potential hazards, assess the degree of associated risks, and formulate effective control measures by employing the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) metod in the clean water pipeline construction project of PT CATL Karawang. The research employed field observations and interviews with project supervisors and workers, followed by data analysis based on the HIRARC approach through the evaluation of likelihood and severity.

The findings indicate that the highest risk levels were found in pipe lifting and welding activities, which were categorized as high risk due to the potential for burns, falling materials and fire hazards. Excavation and pipe installation activities were categorized as *medium risk*, while supporting activities such as site measurement and cleaning were considered *low risk*. Recommended control measures include consistent use of personal protective equipment (PPE), improved supervision, and periodic safety training for workers.

Overall, the implementation of the HIRARC method has shown significant effectiveness in the systematic identification of workplace hazards and prioritizing risk control measures. Proper application of these controls can help minimize work-related accidents and strengthen the safety culture within construction projects

Keywords: *HIRARC, Risk Assessment, Hazard Identification, Risk Control.*

1. INTRODUCTION

Occupational Safety and Health (OSH) plays a vital role in the construction industry, which is known for its high accident rate due to complex activities, diverse workforce, and the use of heavy equipment and materials. Implementing an effective OSH management system helps prevent accidents, occupational illnesses, and financial losses that may impact productivity and project completion. Therefore, identifying potential hazards and assessing their risks are essential steps in developing effective safety control measures.[1]

The clean water pipeline construction project at PT CATL Karawang involves various high-risk activities such as excavation, pipe lifting, welding, and pipe installation. Each activity presents different types of hazards originating from human factors, equipment, materials, and environmental conditions. Without proper identification and control, these hazards could lead to accidents and disrupt project performance.

The HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method is widely recognized for its structured approach in identifying, assessing, and controlling occupational risks. This method evaluates the probability (*likelihood*) and the severity (*consequence*) of each hazard to determine the overall risk level and prioritize control actions. [2]

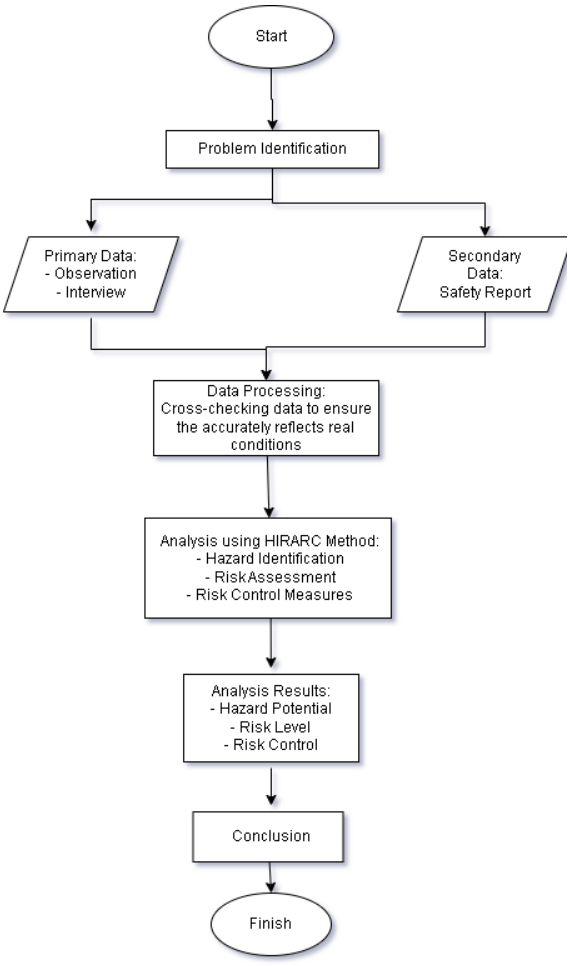
This research focuses on analyzing hazard potentials, assessing risk levels, and proposing control measures in the clean water pipeline construction project of PT CATL Karawang using the HIRARC method. The outcomes of this study are expected to provide practical recommendations for risk mitigation and contribute to improving OSH management practices in similar construction projects.

2. METHODOLOGY

2.1 Research Design

A descriptive qualitative methodology was adopted in this research to systematically identify potential hazards, analyze corresponding risk levels, and develop effective control measures within the clean water pipeline construction project at PT CATL Karawang. .The HIRARC method was applied to analyze risks systematically through observation, interviews, and documentation. Table 1 presents a research flowchart.

Figure 1. Research Flowchart



2.2 Research Location

The research was conducted at the PT CATL clean water pipeline construction site located in Karawang, West Java.

2.3 Data Collection Techniques

Data were collected using the following methods:

1. Field Observation to directly identify potential hazards during construction activities.
2. Interviews with workers, supervisors, and safety officers to gather information regarding work procedures, PPE usage, and safety practices.
3. Documentation Review including photographs, safety reports, and site records supporting the risk analysis.

2.4 Data Analysis Method (HIRARC)

The HIRARC analysis consists of three main stages:

1. Hazard Identification identifying potential hazards in each work activity.
2. Risk Assessment assessing risk levels based on *likelihood* and *severity* using the formula:

   $$\text{Risk Rating} = \text{Likelihood} \times \text{Severity}$$

   Risk levels are classified as:

   a) Low Risk

   b) Medium Risk

   c) High Risk
3. Risk control is carried out by identifying and selecting suitable control measures based on the hierarchy of controls, which includes elimination, substitution, engineering controls, administrative controls, and the application of PPE.[4]

2.5 Data Validation

Data were validated by cross-checking field observations with interview results and existing safety documentation to ensure that the analysis accurately reflects real conditions in the field.

3. RESULTS AND DISCUSSION

3.1 Hazard Identification

The research identified several potential hazards associated with main construction activities: excavation, pipe lifting, welding, pipe installation, and backfilling. Common hazards include trench collapse, being struck by heavy materials, burns from welding sparks, and ergonomic injuries due to improper posture.

3.2 Risk Assessment

Table 1 presents a summary of the risk assessment results.

Table 1. Risk Assessment

No	Work Activity	Potential Hazard	Likelihood	Severity	Risk Rating	Risk Category
1	Excavation	Trench collapse	3	4	12	High
2	Pipe Lifting	Struck by material	3	5	15	High
3	Welding	Burns and sparks	3	4	12	High
4	Pipe Installation	Hand injury from fittings	2	3	6	Medium
5	Backfilling	Back strain from poor posture	2	2	4	Low

3.3 Risk Control

Recommended control measures include:

- Strengthening trench walls with shoring to prevent collapses.
- Implementing safe work procedures for lifting and welding operations.
- Ensuring proper use of PPE such as helmets, gloves, safety shoes, and welding masks.
- Conducting regular safety training and supervision to reinforce safe behavior

3.4 Discussion

The findings confirm that the HIRARC method is effective for identifying hazards and determining risk priorities in construction activities. Activities with *high risk*, such as pipe lifting and welding, require continuous supervision and strict compliance with safety procedures. Consistent PPE use, administrative controls, and worker awareness play a significant role in reducing accident frequency.

4. CONCLUSION

1. The main potential hazards identified in the project include trench collapse, burns, and being struck by heavy materials.
2. The highest risk levels were found in pipe lifting and welding activities, categorized as *high risk*, while pipe installation was *medium risk*, and backfilling was *low risk*.
3. Effective control measures include consistent PPE use, regular safety supervision, implementation of safe work procedures, and safety training programs.

The utilization of the HIRARC approach proves effective in recognizing potential hazards and determining control priorities, which contributes to minimizing accident risks and improving the effectiveness of occupational safety and health management systems in construction activities.

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