# Development of Safety Plan to Improve OHS (Occupational Health and Safety) Performance for Construction of Dam Supporting Infrastructure based on WBS (Work Breakdown Structure)

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Abstract: Of all existing construction projects such as buildings, roads, dams, irrigation channels, bridges and tunnels, Dam is one of the construction projects that has the highest probability of a workplace accident in the world. By developing a safety plan based on the use of WBS (Work Breakdown Structure) that has been standardized as an object in this research to obtain risks that have an impact on workplace accidents, it is expected to reduce the level of workplace accidents that occur. This study aims to develop a safety plan to reduce the level of workplace accidents as one indicator of OHS (Occupational Health and Safety) performance using qualitative methods. The results of this study are sources of risk and risk that are classified as high which have potential hazards and have an influence on OHS performance on the components of the Road Access and Bridges as well as Tunnels and Dodge Channels. In addition, a safety plan document will be developed based on the RK3K PU 05 / PRT / M / 2014 format and refers to the high risks that have been identified based on the WBS to achieve improved OHS performance by reducing the rate of workplace accidents.



## 1 INTRODUCTION

Dams are buildings in the form of land, stones, concrete, or stone pairs that are built in addition to holding and storing water, can also be built to hold and accommodate mine waste (tailings) or to collect mud so that reservoirs are formed (PP No. 37 of 2010). In the 2014-2019 period, dam projects in Indonesia will be carried out on a large scale. Indonesian government is currently keen to realize this infrastructure (Kausarian et al., ). Given a large number of stakeholders / parties involved in the construction process, then in its planning, a standard that can be used by various parties that carry out its construction needs to be used. The standard was created in a systematic form in the form of WBS (Work Breakdown Structure) that has been studied by (Hidayah et al., 2018). The existence of this WBS standard will present uniform requirements in the estimation, monitoring and control (PMBOK, 2017).

According to (Hidayah et al., 2018) Standard Dam WBS consists of 8 supporting infrastructure / subproject jobs in naming the level at the WBS, namely: Preparation, Access Roads and Bridges, Cofferdam, Tunnels and Dodge Channel, Main Dam, Spillway, Intakes, and other public facilities work. The lowest level on the WBS will present a series of detailed activities on the project. Each predetermined WBS level brings the WBS to a more complex level of activity, in which case activities are strongly affected by risk and risk will have an impact on the safety planning (Elsye and Latief, 2018). This plan is an attempt to prevent the occurrence of undesirable things that can lead to workplace accidents (Maengga, 2015).

Based on the 2014 Data and Information Center of the Indonesian Ministry of Health, every job always contains potential hazard risks in the form of work accidents where the amount of potential depends on the type of production, technology used, materials used, spatial planning and building environment as well as the quality of management and implementing staff. Of all the existing construction projects, the dam is a construction project with the highest work accident rate in the world. ICOLD since 1965 conducted studies until 1973, there were at least 236 accidents of various types of dams caused by various things and 76 accidents caused by design and 41 caused by construction (Asiyanto, 2011).

Workplace accidents can be prevented if all parties involved in construction projects start from the highest level such as reaching the lowest level such as the workers paying attention to and prioritizing OHS (Oc-



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cupational Health and Safety) aspects in each stage of the construction work carried out by creating a hazard handling strategy. Strategies for handling occupational hazards in construction can remove potential hazards, further investigation of hazards that often occur and can produce a safety plan on construction projects (Albert, 2014). Therefore, it is necessary to develop a safety plan with a WBS (Work Breakdown Structure) as a tool that will be used to compile the category and urgency of project risk assessment as a systematic risk system based on its source (Mhetre et al., 2016).

## 2 RESEARCH OBJECTIVES

The objective of this study is:

- To Identify sources of high potential hazard risk that affect OHS performance indicators (workplace accidents) at Access Road and Bridge Works and Tunnel and Evacuation Channels from Dam WBS (RQ1)
- To develop a risk-based safety plan from WBS Dam for Access and Bridge Road Works and Tunnel and Dodge Channels (RQ2)

## 3 LITERATURE REVIEW

### 3.1 Work Breakdown Structure (WBS) in Dam Construction

The WBS (Work Breakdown Structure) is a hierarchical decomposition of the entire scope of work that must be done by the project team to achieve project objectives and create the necessary work results, where each level decrease shows a more detailed definition (Institute, 2017).

Based on (Hidayah et al., 2018), the WBS Standard for dam construction projects for each subproject consists of 4 levels. Dam projects can be divided into 8 (eight) work subprojects, namely Preparation, Access Roads and Bridges, Cofferdam, Tunnels and Dodge Channel, Main Dam, Spillway, Intakes, and other public facilities work. The following is an example of Standard WBS Identification in tunnel and dodge channel construction:

- Level 1 is the name of the project (dam subproject: tunnel and dodge channel)
- Level 2 is the Work Section (dewatering, soil, support and protection, concrete, drilling, and grouting)
- Level 3 is the Sub Work Section (for a sub work section of support and protection there are support and protection for open excavation work and supporting work for tunnel excavation)
- Level 4 is the Work Package (for work package of support and protection for open excavation work consisting of a shortcrete wire mesh protection package, grouted anchor protection, masonry protection, and dolken wood protection)
- Alternative Methods / Design between Level 4 and Level 5
- Level 5 is an activity which is a derivative of a work package
- Level 6 is resources such as material, equipment, and labor resources

### 3.2 Risk Management

Risk is a variation in terms of what might happen (Fisk, 1997). Risk is considered a negative term, but in the engineering construction industry, managing risks that arise is very necessary and carried out in a structured manner, knowledge of risk management that can nullify and minimize the risk of occurring in construction projects (Mhetre et al., 2016). Risks are threats to life, property, or financial impacts due to the dangers that occur (Duffield and Trigunarsyah, 1999).

Risk management is all series of activities related to risk, namely planning, assessment, handling, and monitoring (Kerzner, 2001). According to risk assessment carried out with 2 methods namely qualitative analysis and quantitative analysis (Mhetre et al., 2016). The qualitative analysis focuses more on determining priority risks, identifying risks, seeing their impact on projects and relying on experts as a comparison, while quantitative analysis is more on statistical calculations (Institute, 2017). This study uses qualitative risk analysis with a probability / Impact Risk Rating Matrix that is referenced by PMBOK because the results of validated questionnaires to experts are based on priority risk assessments using probabilities, impacts and other influential factors.

Risk handling (RR) can be categorized into 4 categories, namely: Avoid / V, Mitigation / M, Transfer / T, and Accept / A (Labombang, 2011). According to (Mhetre et al., 2016) Avoid is done by reducing all causes of risk, Mitigation is done to reduce the possibility or impact of risk, Transfer by transferring risk to other parties to be responsible for the management and if it occurs, Accept is done when it is impossible to reduce or take advantage of risk.

## 3.3 Concept of OHS or Safety Performance

### 3.3.1 Definition of OHS or Safety Performance

Based on OHSAS 18001: 2007 Clause 3.15, OHS (Occupational Health and Safety) Performance is a measurable result of managing an organization's OHS risk, with a note:

- OHS performance measurement includes a measurement of control effectiveness implemented by the organization.
- In the context of the OHS management system, the results can be measured compared to the organization's OHS policy, the objectives of the OHS, and the OHS performance requirements

### 3.3.2 OHS or Safety Performance Indicators

According to (Wu et al., 2015) and (Lu et al., 2016) Indicators of safety performance consist of 6 things, namely:

- Safety awareness, the safety awareness of a construction project is the awareness of all stakeholders from the leadership to the workers
- Safety costs, Safety Costs must be part of the investment that is measured and carried out in SMK3 which includes training, incentives, and salaries of safety supervisors.
- Accident Level, Safety documentation of construction projects is an element of awareness and security of construction project performance and can be considered as a measure for performance evaluation
- Productivity, Safety, and productivity are the most important requirements in improving the performance of construction projects
- Management of self-discipline, to ensure construction safety, the company has good control of all aspects, such as security objectives, mechanism for construction assessment procedures and resource mobilization
- Performance Measurement, Companies can identify deficiencies in occupational health performance according to previous historical knowledge, and then make a quick and effective response.

According to (Garza et al., 1998) measurement of work safety performance can be viewed from 5 aspects, namely:

- Injury frequency rate
- Injury severity rate
- Average days change per disabling injury
- Project accident cost figures
- Number of incidents of work accidents

## 3.4 Safety Plan Concept in Construction Projects

### 3.4.1 Definition of Safety Plan

The safety plan is a plan document that contains practical safety that can help companies avoid potential hazards and can control them in the best way when in these hazard conditions (Elsye and Latief, 2018). In projects carried out by the Ministry of Public Works, the Safety Plan is known as RK3K or OHS Contract Plan.

RK3K is a complete document of the plan for the implementation of the Management System of OHS (SMK3) in the PU Sector and is a unit with the contract document of a construction work made by the service provider and approved by service users and subsequently used as a means of interaction between service providers and service users in implementing Management System of OHS (SMK3) of the PU (The Ministry of Public Works) field. In the standard safety plan, the document created is a document for the operational safety issues by covering hazard identification, risk assessment, and mitigation steps and conditions that must be met to maintain the level of safety.

### 3.4.2 Safety Plan Format

The ministry of manpower as a stakeholder develops a safety program indicates the variable (Machfudiyanto et al., 2018). Based on the format stated in government regulations PU 05 / PRT / M / 2014, this document consists of several parts, namely:

- OHS Policy
- OHS Organization
- OHS Planning
  - Hazard Identification, Risk Assessment, Priority Scale, Safety Risk Control, Responsible Person
  - Compliance with laws and regulations and other requirements
  - OHS Objectives and Programs
- OHS Operational Control
- Examination and Evaluation of OHS Performance
- OHS Performance Review

All the parts mentioned above already have their respective writing formats.

# 4 METHODOLOGY

This research was conducted with a qualitative approach to answer the research objectives. Surveys and discussions were carried out using structured research instruments in the form of questionnaires to experts from dam work with more than 10 years of experience. The flow of research can be seen from the following picture

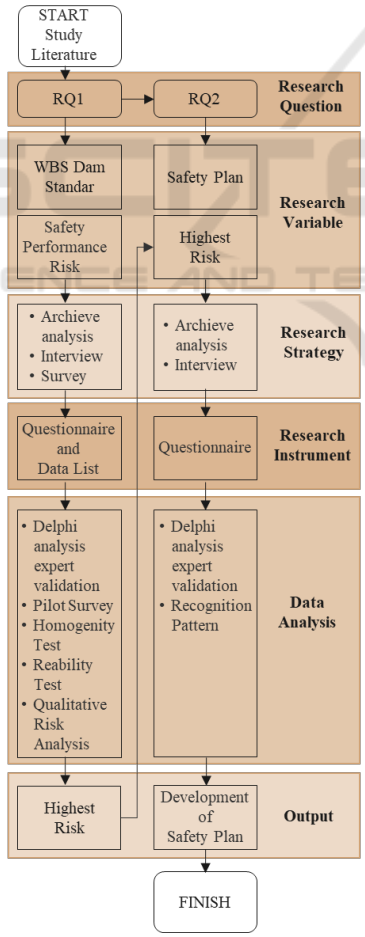


Figure 1: The research flow diagram

# 5 RESULT AND DISCUSSION

## 5.1 To Answer RQ1

### 5.1.1 Risks Affecting OHS Performance Indicators

Potentially hazardous risk identification is carried out for each activity of each work package derived from the results of a literature study taking into account the detailed methods and resources of the Standard Dam WBS (Work Breakdown Structure) for the work of access and bridge roads and tunnel and duct ducts. From the results of identification of these risks 507 risks that have the potential to be hazardous and affect the OHS (Occupational Health and Safety) performance indicators are the accident rates.

The results of risk identification are then verified, clarified, and validated for content and contract by experts. This strategy is carried out with a discussion with experts related to whether the risks include potentially dangerous risk factors, relevant or not with their activities and whether there are additional risks that have not been included.

The results of the discussion found 323 risks affecting the OHS performance indicators, namely the level of accidents in the access and bridge road subprojects and 312 risks for tunnel and evacuation subprojects from the dam WBS. Due to the number of repetitions of the same risk due to repetition of the same activity, the recalculation of the risk is carried out. To obtain 160 risks in the access road and bridge subprojects and 125 risks of tunnel and dodge subprojects.

Then a pilot survey is conducted to the respondent to find out whether all the risks that have been identified previously can be understood by everyone in the project environment.

### 5.1.2 Risk Assessment

Risk evaluation of a project depends on the probability of occurrence (frequency) and its impact (Duffield and Trigunarsyah, 1999).

$$FR = FxD \quad (1)$$

Risk evaluation which is then called risk level analysis (FR) is a multiplication between frequency (F) and impact (D) which in this study was obtained from the distribution of questionnaires with a likelihood scale of 1-5. The following are indicators of the scale:

Table 1: Frequency Scale Indicator (F).

| Scale | Criteria | Indicators |
|---|---|---|
| 1 | Very Low | Very unlikely to occur |
| 2 | Low | It is less likely to occur |
| 3 | Moderate | Pretty likely to occur |
| 4 | High | May occur |
| 5 | Very High | Very possible to occur |

Table 2: Impact Scale Limit (D).

| Scale | Severity/Loss/Impact Indicator | |
|---|---|---|
| | Person | Property |
| 1 | Does not cause labor to be injured | Do not cause interference to vehicles or heavy equipment or surrounding facilities or cause physical care for at least 15 minutes |
| 2 | The workers are lightly injured (enough first aid treatment or clinic) and can continue to work | Causes minimal disruption to vehicles or heavy equipment but does not cause work to be hampered |
| 4 | Workers are severely injured to disability of functions or organs and need treatment outside the project location (clinic or hospital) 2x24 Hours | Facilities and equipment were severely damaged, requiring 1-7 days of recovery |
| 5 | Workers experience permanent disability or die | Facilities and equipment were severely damaged, requiring more than 7 days of recovery |

From the likelihood scale, the weighting will be carried out on the PMBOK scale. The following is the weighting:

Table 3: Weighting Frequency and Impact.

| Value | Criteria F | Weight F | Criteria D | Weight D |
|---|---|---|---|---|
| 1 | Very Low | 0,1 | No effect | 0,05 |
| 2 | Low | 0,3 | Less influ-ential | 0,1 |
| 3 | Moderate | 0,5 | Pretty In-fluential | 0,2 |
| 4 | High | 0,7 | Influential | 0,4 |
| 5 | Very High | 0,9 | Very influ-ential | 0,8 |

The weighting when multiplied to obtain FR values will result in the FR (risk level analysis) category range as follows:

Table 4: Risk Category.

| Risk Score | Risk Level Analysis (FR) | Steps for Handling |
|---|---|---|
| 0.18 - 0.72 | High Risk | Reduced risk is carried out to a lower place |
| 0,06 – 0,17 | Moderate Risk | Correction steps are needed in a certain period |
| 0.01 - 0.05 | Low Risk | Repair steps whenever possible |

After the calculation is done, 17 of the highest risks are obtained as shown in table 5.

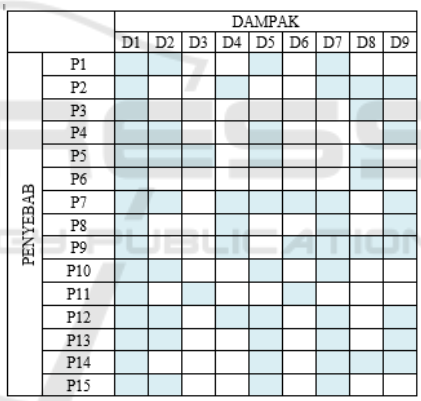


Figure 2: Risk Causes and Impact Matrix.

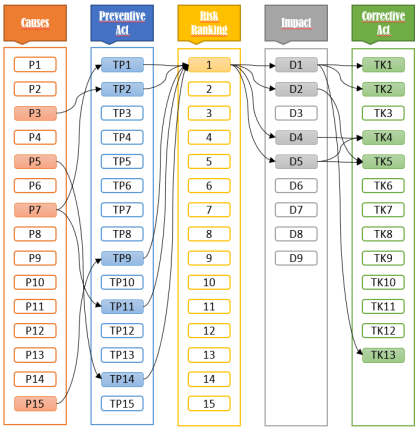


Figure 3: Recognition Pattern for Highest Risk.

Table 5: The Highest Risk That Affects OHS Performance; Subprojects: Tunnel and Dodge Channels.

| Risk | Rank | Risk Score | Activities | Work Package |
|---|---|---|---|---|
| An explosion occurred due to missfire during drilling | 1 | 0,2611 | Installation of Explosives (Drilling) | Stone Drilling |
| | | | | Closed Excavation / Tunnel |
| | 2 | 0,2580 | Drilling | Rockbolt Protection |
| Lack of oxygen | 5 | 0, 2176 | Making an Air Ventilation System (Suction and Blowing) | Closed Excavation / Tunnel |
| excavation work | | | | Excavation |
| | | | | Stone Drilling |
| | | | | Stone Retaining Wall Protection |
| | | | | Dolken Wood Retaining Wall Protection |
| Being crushed or exposed to blasting debris | 15 | 0,1814 | Stone Blasting | Stone Drilling |
| | | | | Closed Excavaton / Tunnel |

## 5.2 To Answer RQ2

Before developing the RK3K/safety plan document, it is necessary to know the causes and impacts of the risks that occur so that a risk response can be found that will be used in the development of RK3K.

### 5.2.1 Causes and Effects of Risk

According to experts during the discussion, in the construction of the Dam, in general, can be separated into 2 work, namely preparation and main work. Work that is generally included in the main work in dam construction is work that requires special methods in its implementation such as excavation, embankment, concrete placing, blasting, formwork installation. While other works just use simple methods.

Of all the causes it has been concluded that there are 15 causes of risk that produce 9 different impacts which can be seen from the table below.

In activities classified as preparation work, the causes of risk in the project are usually caused by P1, P3, P4, P5, P6, while the activities classified as main work are caused by causes caused by preparatory work and added by P2, P7, P8, P9, P10. It proves that an error occurred in the design or inappropriate construction (Kausarian et al., 2018).

Then an analysis of causes and impacts is illustrated through a matrix to find the root of the problem and the impact of each risk on OHS (Occupational Health and Safety) performance. The analysis can be seen in figure 2. From the matrix below it can be seen that the same impact can be caused by more than one cause. For example, impact 1 (D1), which is injury, wound, or death can be caused by all causes.

### 5.2.2 Risk Response

Risk response is a handling action taken against the risks that may occur (Labombang, 2011). Based on the analysis of the causes and effects of high risk as stated in Table 5, it was concluded that there were 15 preventive measures and 13 corrective actions that could be taken.

Of all the causes, the impact of preventive and corrective actions was analyzed using the recognition pattern at the highest risk shown in table 5. The recognition pattern can be seen from figure below.

### 5.2.3 Development of the Safety Plan

From the results of discussions with experts, the RK3K/safety plan document whose the general format had been submitted previously was carried out in section C.1 which has been arranged in a table format

Table 6: The Highest Risk That Affects OHS Performance; Subprojects: Acces and Bridge Road.

| Risk | Rank | Risk Score | Activities | Work Package |
|---|---|---|---|---|
| Workers are hit by piles during lifting / erecting | 3 | 0,2290 | Steel Pole Designing | Structural Steel Piles |
| | 7 | 0,2100 | Drafting of Wood Piles | Wood Piles |
| | 14 | 0,1893 | | |
| | 11 | 0,1987 | Design of Prefabricated Concrete Piles | Pre- fabricated Concrete Piles |
| | 4 | 0,2195 | Placing the girder on the bearing pad | Erection using the double crane method |
| Falling from a height | 6 | 0,2113 | Reinforcement | Abutment / Column / Pier Head (Concrete Cast Insitu) |
| | | | Expansion Joint | |
| | | | Bearing Pad | Elastomer Bearing Pad |
| Tower crane collapsed due to overload | 8 | 0,2022 | Installation of Concrete Drainage Precast Box Culvert | Concrete Drainage Precast Box Culvert |
| Precast concrete befalls workers | 9 | 0,2020 | U-Ditch Precast Concrete Drainage Installation | U-Ditch Precast Concrete Drainage |
| | 10 | 0,1990 | Installation of Concrete Drainage Precast Box Culvert | Concrete Drainage Podcast Box Culvert |
| Workers are buried in land during excavation work | 12 | 0,1925 | Mechanic Excavation | Ordinary Land |
| | | | | Excavation |
| | | | | Soft Stone Excavation |
| | | | | Stone Drilling |
| | | | | Paved Pavement Excavation |
| | | | | Excavation of Concrete Pavement |
| | | | | Structure Excavation |
| Broken Sling Crane | 13 | 0,1906 | Installation of Concrete Drainage Precast Box Culvert | Concrete Drainage Precast Box Culvert |

Table 7: Effect of Risk Affecting OHS Performance Indicators (Work Accidents)

| Code | Effect | Affected Subjects |
|---|---|---|
| D1 | Injury, Wound, Death | Labor and Community |
| D2 | Raises doubts for other workers | |
| D3 | Feel uncomfortable living around the project area | Society |
| D4 | The project stopped temporarily | Projects |
| D5 | Labor and equipment are idle or unproductive | Projects |
| D6 | The results of construction are too late to use | Company |
| D7 | Nearby equipment and facilities are damaged | Company |
| D8 | Got a bad company image | Company |
| D9 | Construction failure | Company |

Table 8: Causes of Risk Affecting OHS Performance Indicators (Work Accidents)

| Code | Cause |
|---|---|
| P1 | Human Error (Workers are tired, unhealthy, or negligent) |
| P2 | Do not carry out the correct work safety procedures for each job |
| P3 | Using Personal Protective Equipment (PPE) that is incomplete or not used at all |
| P4 | Do not carry out the Toolbox meeting / Safety Briefing / Safety Morning Talk (SMT) before starting work every day |
| P5 | Lack or absence of OHS signs or safety lines |
| P6 | Do not do House Keeping or 5R (Compact, Neat, Clean, Care, Diligent) |
| P7 | Missing or not following Work Instruction (WI) |
| P8 | There is no safety plan document or safety plan that does not refer to field conditions |
| P9 | Errors in planning and doing work methods (incorrect or not on target) |
| P10 | Work supervision or safety patrol is not carried out routinely or according to procedures |
| P11 | Do not anticipate conditions (weather or hydrology) in the project location that affect the work |
| P12 | The equipment used does not meet the standard specifications |
| P13 | There is no quality control or checking the specifications of the material or tool used |
| P14 | Material and tool checking is not carried out under applicable procedures |
| P15 | The appointment of workers is not selected or not through the right process so that workers are less competent in their field |

Table 9: Preventive Action

| Code | Preventive Action | RR |
|---|---|---|
| TP1 | Carry out the Toolbox meeting / Safety Briefing / Safety Morning Talk (SMT) before starting work every day | M |
| TP2 | Using a complete Personal Protective Equipment (PPE) | M |
| TP3 | Give and take training or coaching work methods | M |
| TP4 | Socialization to the public regarding the control of hazards that can be caused by the project | M |
| TP5 | Conduct maximum control of hazards by conducting routine and comprehensive supervision regarding work safety programs | M |
| TP6 | Arrange Job safety analysis before doing work | M |
| TP7 | Make comprehensive construction safety regulations | M |
| TP8 | Ensure that the worker is healthy before working | M |
| TP9 | Use worker that has a certificate or a specialist at his job and has experience | M |
| TP10 | Carry out Quality Assurance to ensure material specifications or tools according to standards | M |
| TP11 | Make Work Instruction (WI) for work methods that are easily understood by workers | M |
| TP12 | Plan a work safety program before the project starts | M |
| TP13 | Reviewing real conditions in the field in determining the safety plan before the project starts | M |
| TP14 | Use OHS warning signs or safety lines and barricades | M |
| TP15 | Perform workplace or housekeeping cleaning or 5R (Compact, Neat, Clean, Care, Diligent) | M |

from goverment regulations PU 05 / PRT / M / 2014 shown in figure 4.

The results of the development shown in figure 5, carried out are by detailing the job descriptions divided into 2, namely work packages (level 4 WBS/ Work Breakdown Structure) and activities (level 5 WBS) and in the risk control column detailed with preventive actions and corrective actions for construction work. So it can be seen an example of the development of section C.1 in the image below for the highest risk.

Table 10: Corrective action

| Code | Corrective action | RR |
|---|---|---|
| TK1 | Evacuation and further handling of victims | A |
| TK2 | Providing health insurance to workers | T |
| TK3 | Socialization to the public regarding the control of hazards that can be caused by the project | A |
| TK4 | Recovery activity | A |
| TK5 | Conduct OHS socialization to workers both in the form of safety talk, safety induction, and toolbox meeting | A |
| TK6 | Use experts when making a safety plan | A |
| TK7 | Increase learning lessons for specifications of types and methods of work | A |
| TK8 | Make and carry out a safety plan / safety procedure for the method of work to be carried out | A |
| TK9 | Reviewing real conditions in the field in determining the safety plan before the project starts | A |
| TK10 | Replace tools according to specifications needed and according to standards | A |
| TK11 | Change workers with more competent and experienced people | V |
| TK12 | Carry out the Toolbox meeting / Safety Briefing / Safety Morning Talk (SMT) before starting work every day | A |
| TK13 | Conduct training to be responsive to risk that is going to be a disaster | A |

**Table: HAZARDS IDENTIFICATION, RISK ASSESSMENT, PRIORITY SCALE, SAFETY RISK CONTROL AND REPONSIBILITY**

Company Name :
Activity :
Location :
Date :

| No. | JOB DESCRIPTIONS | HAZARD IDENTIFICATION | RISK ASSESMENT | | | PRIORITY SCALE | SAFETY RISK CONTROL | PERSON IN CHARGE (Officer) |
|---|---|---|---|---|---|---|---|---|
| | | | Frequency | Severity | Risk level | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | | | | | | | | |

Figure 4: Table C.1 Hazard Identification, Risk Assessment, Priority Scale, Safety Risk Control, Responsible Person format from goverment regulations PU 05 / PRT / M / 2014.

**Table : HAZARDS IDENTIFICATION, RISK ASSESSMENT, PRIORITY SCALE, SAFETY RISK CONTROL AND REPONSIBILITY**

Company Name : PT. X
Activity : Subproject Tunnels and Dodging Channel
Location :
Date :

| No. | WBS LEVEL 4 | WBS LEVEL 5 | HAZARD IDENTIFICATION | RISK ASSESMENT | | | PRIORITY SCALE | SAFETY RISK CONTROL | PERSON IN CHARGE (Officer) |
|---|---|---|---|---|---|---|---|---|---|
| | Work Package | Activity | | Frequency | Severity | Risk Level | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 1 | Work Package:<br>• Stone Drilling<br>• Closed Excavation / Tunnel | Installation of Explosives (Drilling)) | An explosion occurred due to missfire during drilling | 0,4185 | 0,6241 | High 0,2612 | 1 | **PREVENTIVE ACTION**<br>1. Carry out the Toolbox meeting / Safety Briefing / Safety Morning Talk (SMT) before starting work every day<br>2. Ensure the work area is empty from all workers before blasting<br>3. Use OHS warning signs or safety lines and barricades<br>4. Using a complete Personal Protective Equipment (PPE)<br>5. Use worker that has a certificate or a specialist at blasting job and has experience<br>6. Make Work Instruction (WI) for work methods that are easily understood by workers<br><br>**CORRECTIVE ACTION**<br>1. Evacuation and further handling of victims<br>2. Providing health insurance to workers<br>3. Recovery activity<br>4. Socialization to the workers and public regarding the | Project Manager |

Figure 5: The results of the development table C.1 Hazard Identification, Risk Assessment, Priority Scale, Safety Risk Control, Responsible for the Highest Risk of Tunnel Subprojects and Dodge Channels.

# 6 CONCLUSION

Based on the process carried out to develop a safety plan, it can be concluded that 10 high risks in the access and bridge road subprojects and 5 high risks in the tunnel and dodge subprojects on the dam project can be seen from table 5.

By using the highest risk, the development of a safety plan was developed from the RK3K PU 05 / PRT / M / 2014 document. The results of the development carried out are by detailing the job descriptions WBS (Work Breakdown Structure) divided into 2, namely work packages (level 4 WBS) and activities (level 5 WBS) and in the risk control column detailed with preventive actions and corrective actions for construction work.

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