

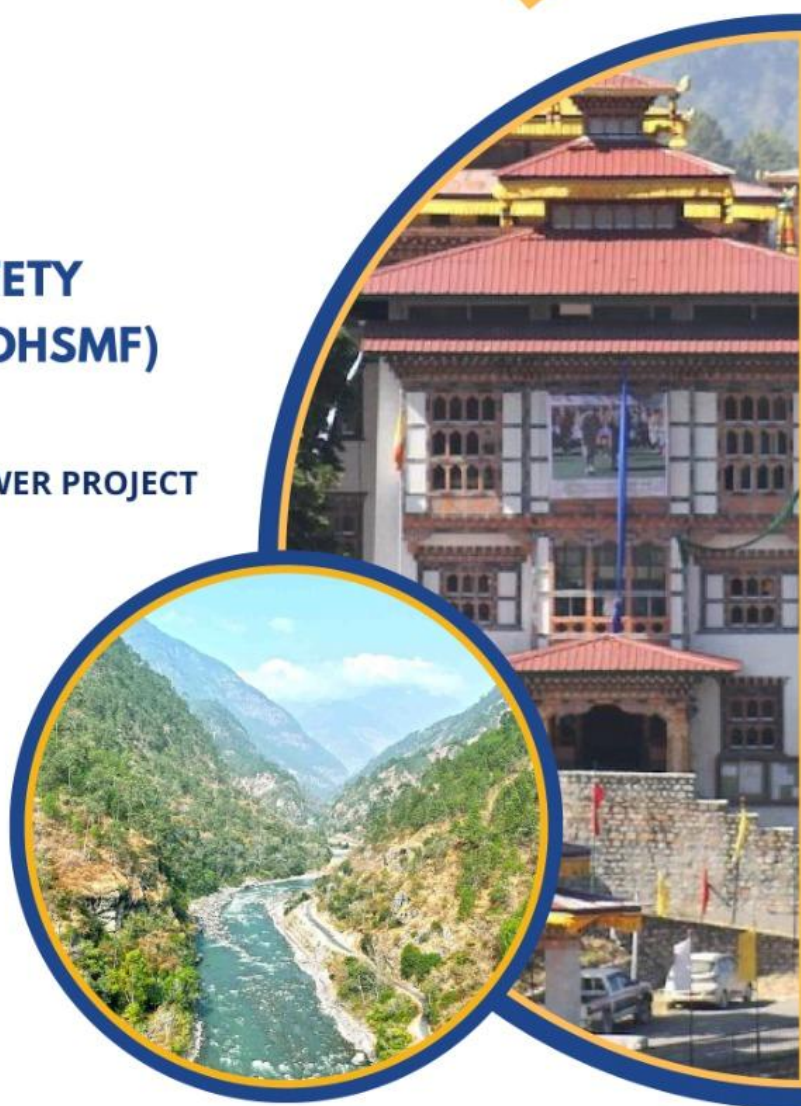


DORJILUNG HYDRO POWER LIMITED

OCCUPATIONAL HEALTH & SAFETY MANAGEMENT FRAMEWORK (OHSMF)

**1125 MW DORJILUNG HYDROELECTRIC POWER PROJECT
MONGAR AND LHUENTSE, BHUTAN**

JUNE 2026



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Abbreviations

COP	Code of Practices
CHS	Community Health and Safety
DHPP	Dorjilung Hydroelectric Power Project
DGPC	Druk Green Power Corporation
DPM	Deputy Project Manager
EHS	Environment, Health and Safety
ESF	Environment and Social Framework
ESS	Environment and Social Standard
HPP	Hydroelectric Power Project
OHSMF	Occupational Health and Safety Management Framework
OHSMF	Occupational Health and Safety Management Plan
ILO	International Labour Office
ITA	International Tunnelling Association
LTI	Lost-time injury
LTIFR	Lost Time Injury Frequency Rate
km	Kilometer
MW	Megawatts
OHS	Occupational Health and Safety
OHSO	Occupational Health and Safety Officer
PR	Processes
PPE	Personal Protective Equipment
RCC	Roller Compacted Concrete
SOPs	Standard Operating Procedures
TRIR	Total Recordable Injury Frequency Rate



1 Introduction

The Dorjilung Hydroelectric Power Project (DHPP) is a proposed 1,125 MW run-of-river hydroelectric facility on the Kurichhu River in eastern Bhutan, spanning the Lhuentse and Mongar districts. It will include a 139.5 m high roller-compacted concrete (RCC) dam (85 m above riverbed), creating a reservoir of approximately 44 million cubic meters. A 14.97 km headrace tunnel on the right bank will convey water to an underground powerhouse housing six Francis turbines. The powerhouse is located about 10 km upstream of the existing 60 MW Kurichhu Hydropower Project (KHP), with the dam situated roughly 36 km upstream of KHP.

The estimated project cost is \$1.7 billion, with construction expected to take 7 years, funded by the World Bank and other international partners. Around 6,350 workers will be engaged during construction, the majority being foreign labor. Druk Green Power Corporation (DGPC) will mobilize approximately 460 Bhutanese workers.

This Occupational Health and Safety Management Framework (OHSMF) outlines the Contractor's corporate-level policies, processes, and Standard Operating Procedures (SOPs). A list of key processes and SOPs for the Main Works Contract is included in this document. The Contractor is required to prepare a detailed Occupational Health and Safety Management Plan (OHSMP) based on this framework, **6 months prior to the mobilization**. Contractor's OHSMP will address site-specific procedures, equipment, and comprehensive measures to safeguard the health and safety of all personnel involved during the project construction.

2 Occupational Health and Safety Management Framework

2.1 Purpose

This OHSMF provides clear guidance to support the Contractor in preparing a comprehensive Occupational Health and Safety Management Plan. Its primary goal is to ensure that all project activities are carefully planned, executed, monitored, and managed in accordance with established health, safety, and environmental standards.

This OHSMF has been developed in place of a detailed OHSMP at this stage of the project. The reason for this approach is the current unavailability of critical information that would typically inform the preparation of a comprehensive OHSMP. Specifically, the contractor's standard operating procedures (SOPs), the exact types and capacities of construction equipment to be deployed, and detailed plans for workforce mobilization have not yet been finalized or disclosed.

Given these uncertainties, the OHSMF serves as a preliminary guiding document outlining the overarching health and safety principles, expectations, and regulatory obligations. Once the contractor finalizes the specifics of their construction work plan—including methodologies, equipment selection, and manpower deployment—they will be in a more informed position to prepare a detailed, site-specific OHSMP. The finalized OHSMP will then align with both the framework established in this document and the actual conditions of project execution and will be submitted to the Engineer for review and approval.

The OHSMF offers a structured, practical approach for managing Occupational Health and Safety (OHS) and Community Health and Safety (CHS) risks. It aligns with the World Bank's Environmental and Social Framework (ESF) and Standards, the World Bank Group's Environmental, Health and Safety Guidelines (EHSGs), as well as applicable Bhutanese laws, regulations, and OHS requirements. Further details are provided in Table 1 below.

Table 1: Relevant Laws, Regulations, and Frameworks

Requirements	Project related Schedule/rule/ and other
Occupational Health and Safety Management Plan (OHSMP)	Health and Safety requirement mentioned in the contract document.
Labour and Employment Act, 2007, Dept. of Labour, Ministry of Industry, Commerce and Employment	The Bhutan Labor Act of 2007, under chapter IX clause 34 to 41 emphasizes the importance of occupational health and safety in the workplace. These provisions oblige employers take necessary measures to create a safe and healthy environment for their employees.
Occupational Health and Safety Regulations 2022, Department of Labour, Ministry of Industry, Commerce and Employment.	This Regulation establishes standards on Occupational Health, Safety and Welfare that must be met by all workplaces within the coverage of the Labour and Employment Act of Bhutan 2007.



Requirements	Project related Schedule/rule/ and other
Safety Regulation 2008 of Electricity Regulatory Authority (ERA)	This Regulation makes provisions for the design, construction, operation and maintenance of electric power plant and equipment in a manner that is Electrically Safe.
Road Safety and Transport Regulations 2021.	This Regulations set out traffic rules and regulations, and minimum vehicle safety requirements to be followed by the employers, drivers and operators.
Explosive Rules, Ministry of Home Affairs, Royal Govt. of Bhutan	This Explosive Rules sets out the minimum requirements of import, transport, handling, storage and usage of explosives to ensure rightful use and prevent accidents.
World Bank Environmental and Social Management Framework 2018, ESS-2: Labor and Working Conditions	This standard obliges the Developer to develop and implement written labor management procedures applicable to the project. These procedures will set out the way in which project workers will be managed, in accordance with the requirements of national laws. The standard also emphasizes measures relating to occupational health and safety to be applied to the project activities which includes identification of potential hazards to project workers, particularly those that may be life threatening, provision of preventive and protective measures, training to project workers and maintenance of training records, documentation and reporting of occupational accidents, diseases and incidents, emergency prevention and preparedness and response arrangements to emergency situations and remedies for adverse impacts such as occupational injuries, deaths, disability and disease.
World Bank Environmental and Social Management Framework 2018, ESS-4: Community Health and Safety	This standard put emphasis on community exposure to risks and impacts of project and includes road safety risks; risks associated with security personnel as well as addressing water-related, communicable and non-communicable diseases that can result from projects activities and have impact on project labor as well as the community.
World Bank Group General Health and Safety Guidelines, 2007	This guideline provides technical guidance and examples of Good International Industry Practice (GIIP) to help employers achieve acceptable environmental, health, and safety performance, focusing on preventing or minimizing risks to human health and the environment.
EHS guidelines for Construction Material Extraction, 2007	This document includes information relevant to construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite, as well as to the extraction of dimension stone. Also includes management of environmental issues such as Air emissions, noise and vibrations, water, waste and land conversion. As well as highlights OHS hazards such as respiratory hazards, noise and physical hazards and community health and safety as well
ISO 45001 (Occupational Health and Safety Management System Standard).	
International Tunneling Association Guidelines for Good Occupational Health & Safety Practice.	
International Labour Organization Code of Practice in Health and Safety in Construction	
Safety and Health in Building and Civil Engineering Work, ILO Codes of Practices.	
American National Standard Institute (ANSI) for PPEs. As for example, Eye and Face Protection (ANSI Z87.1-1989), Head Protection (ANSI Z89.1-1986), Foot Protection (ANSI Z41.1-1991) or equivalent PPE providing the same or higher level of protection and acceptable to the Engineer.	
ISO, ASTM and others for materials and workmanship.	
Good International Industry Practices (e.g., OSHA).	

2.2 Scope

This framework document is applicable on all operational construction-related activities, including tunnelling and underground works, material transportation, batching and crushing plant operations, muck handling/cleaning, retention wall preparation, and LOTO (Lockout/Tagout) implementation related to the Project. Some of the key potential high-risk activities involved in DHPP include but not limited to the following:



- Drilling and Blasting operations and related activities such as storage and transfer of explosives from magazine to the blast site;
- Ground control and support structures for tunnelling work;
- Construction of up and down stream coffer dams and main hydraulic dam;
- Excavation work;
- Operation of heavy and mobile equipment on site and on community roads including passenger vehicles, dumper trucks, jumbo, excavators, graders, loaders etc.;
- Work at height (e.g., cleaning of slopes after blasting and scaling);
- Confined space entry;
- Lifting and crainage;
- Electrical work;
- Operation of crushing and batching plants;
- Maintenance and operation of the site camp and other facilities like workshop and first aid center; and
- Excavation Operation and associated risk to community members.

2.3 Objectives and Targets

This guidance is developed on the following objectives:

- Safe operation with Zero harm to community members and all site personnel including Contractor's Staff and visitors.
- Meet or exceed the contractual safety obligations.

The Contractor will establish project-specific, measurable targets to achieve the above objectives. These targets will be determined based on the Contractor's commitment to continual improvement, benchmarking against external peer groups, and input from relevant stakeholders. Targets will be set annually for each project site, aligned with the fiscal year. The following examples illustrate the types of targets expected under the DHPP framework, serving as guidance for the Contractor:

- Total Recordable Injury Rate¹ of 1.5 or less (or based on the Contractor previous yearly trend).
- Lost Time Injury Frequency Rate² of 0.5 or less (or based on the Contractor previous yearly trend).

The Contractor's senior leadership—including the General Manager, Project Manager, Construction Manager, and Technical Director—must demonstrate full commitment to achieving the above-mentioned targets. To drive performance and ensure accountability, the Contractor should establish both leading and lagging indicators aligned with these targets. Examples of leading indicators that reflect senior management commitment are provided below. Comprehensive details of all Key Performance Indicators (KPIs) should be outlined in the "PR13: Measurement" process within the Contractor's project-specific OHS guidance. (The OHS processes are discussed in detail later in this framework.)

- All General Manager and Project Managers to complete 1 Walk-through Inspection per month.
- All Construction Managers to complete 2 Walk-through Inspections per month with their assigned Health and Safety Officer.
- All OHS supervisors complete 1 site inspection weekly.

2.4 Working together for Success

Safety is a shared responsibility and cannot be delegated solely to OHS Officers. While OHS staff play a critical support role—assisting line management with jobsite training, serving as trained observers, providing administrative support, and monitoring the effectiveness of the safety program—their efforts alone are not sufficient. Achieving the

¹ A rate of injuries and illnesses computed from the following formula: (Number of injuries and illnesses X 200,000) / Employee hours worked.

² A rate of lost time computed by: ((Number of lost time injuries in the reporting period] x 1,000,000) / (Total hours worked in the reporting period).



level of safety excellence expected by the Contractor requires the active commitment and participation of all personnel, every day, on every task.

The Contractor should adopt a structured hierarchy of OHS documentation. At the top are the mandatory requirements defined by the OHS Policy, followed by the agreed OHS Management System standards. These are further supported by other system controls such as standards, codes of practice, safe job procedures, safe work practices, site-specific safety instructions, and any other documented safe systems of work that promote a safe working environment at the execution level (see Figure 1).

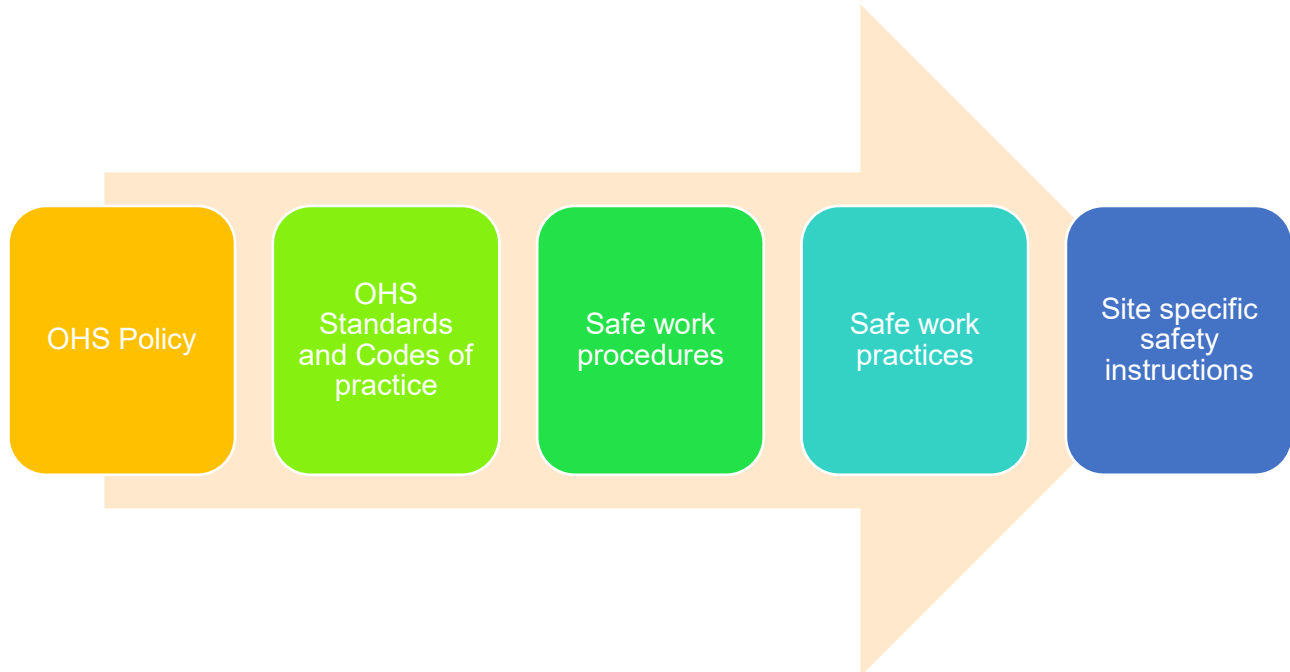


Figure 1 OHS management system

All requirements within this documentation hierarchy must align with and support the requirements at higher levels. This alignment ensures consistency, coherence, and integrity across the Contractor's Occupational Health and Safety Management Plan (OHSMP). The OHS Policy defines the Contractor's overall commitment and guiding principles for health and safety, while the OHS Management System Standard operationalizes this commitment into structured and enforceable practices.

All supporting documents—such as procedures, instructions, and site-specific protocols—must be developed to comply with and reinforce the OHS Policy and Management System Standard. These top-tier documents must apply universally to all activities and operations covered under the Contractor's OHSMP, ensuring that safety considerations are fully embedded in all phases of project execution, from planning and design through to construction, commissioning, and closeout.

2.5 OHSMP Review and Revision

This OHSMP provides guidance to support the Contractor in meeting the Employer's expectations, which form part of the Contractor's contractual obligations to ensure safe work practices. Given the complexity and scale of the project, the OHSMP must be treated as a live document, subject to periodic review and updates under the following circumstances:

- A change in the project scope
- Scheduled six-monthly reviews
- Modifications in construction methodology or techniques based on site conditions
- In response to a significant OHS hazard, major incident, or as directed by the Engineer
- At the conclusion of the project, to capture lessons learned and support improvements in future projects

The Contractor's OHS Officer will be responsible for coordinating and linking of the OHSMP with the other relevant ES management plans including Traffic Management Plan, Community Health and Safety Management Plan, Site Security Management Plan, [etc.to](#) ensure different management plans are implemented in a coordinated manner and overlapping risks and impacts are managed consistently across the project as well as review and update process, ensuring that all changes are properly documented, communicated, and implemented across relevant work areas.



In addition to the overarching OHSMP, the Contractor shall develop, submit, and implement OHS sub-plans and Standard Operating Procedures (SOPs) to address specific construction hazards. These may be submitted either as standalone documents or incorporated within relevant Method Statements. All such documents must align with the structure and intent of the overall OHSMP and reinforce the hierarchy of documentation described in this framework.

2.6 OHSMP Documents Structure

Figure 2 presents the document hierarchy of the OHSMP.

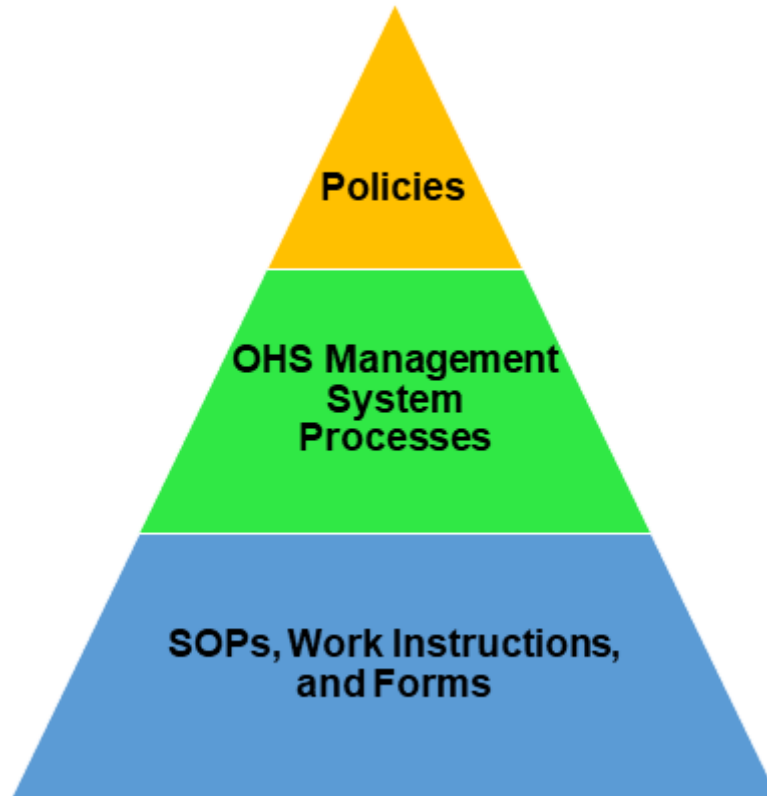


Figure 2: Document hierarchy of the OHSMP

2.7 Policies

The Contractor's operating policies represent the highest-level documents within its organizational governance framework. These policies provide strategic direction and ensure consistency in operations across various geographic locations where the Contractor operates. They reflect the commitments of senior management and serve as guiding principles for day-to-day decision-making and conduct.

Typical operating policies include the following:

- Human Rights Policy
- Health and Safety Policy
- Alcohol and Drug Policy
- Business Conduct and Ethics Code

These foundational policies form the basis for all subsequent management systems, procedures, and practices, ensuring that the Contractor operates with integrity, responsibility, and a strong commitment to safety and ethical standards worldwide.

2.8 Management System Processes

The Contractor shall develop, implement, and maintain a project-specific Occupational Health and Safety Management System (OHSMS) Manual as part of the Contractor's OHSMP. The OHSMS Manual shall serve as the overarching document for the main contract package, linking all relevant OHS policies, management plans, Management System Processes, procedures, SOPs, risk assessments, work instructions, forms, checklists, and monitoring and auditing [requirements](#) into a single structured system.

Management System Processes shall form an integral part of the OHSMS Manual and shall function as second-tier documents beneath the Contractor's overarching OHS policies. These processes shall translate policy commitments into structured and reasonable requirements to ensure consistent implementation across all project sites.



The Contractor's OHSMS Manual and associated Management System Processes shall be project-specific and tailored to the scope, risks, site conditions, and operational requirements of the project. They shall be developed in alignment with the Occupational Health and Safety Management Framework provided by the Employer and shall support effective implementation, monitoring, review, and continuous improvement of health and safety performance throughout the project lifecycle.

The following Management System Processes should be developed, at a minimum, to ensure effective planning, implementation, monitoring, and review of health and safety practices:

- PR 01: Induction
- PR 02: Job Hazards Analysis
- PR 03: Meetings
- PR 04: Personal Competency and Training
- PR 05: Short Service Worker Program
- PR 06: Reward and Recognition
- PR 07: Disciplinary Procedure
- PR 08: Permit to Work Process
- PR 09: Work Observation Process
- PR 10: Critical Risk Protocol
- PR11: Personal Protective Equipment
- PR 12: Incident Investigation
- PR 13: Measurement – Leading & Lagging
- PR 14: Pandemic Action Plan Covid-19
- PR 15: OHS Compliance Audit
- PR 16: Emergency Response Plan
- PR 17: Inspections
- PR 18: Personal Risk Assessment
- PR 19: Risk Management
- PR 20: Document Control
- PR 21: Communication
- PR 22: Non-Compliant procedures
- PR 23: Management of Change
- PR 24: Subcontractor Management
- PR 25: Occupational hygiene monitoring
- PR 26: Stop work authority
- PR 27: Visitor management and site access control
- PR 28: Workplace monitoring
- PR 29: Fitness for work
- PR 30: Journey Management
- PR 31: Simultaneous Operations Management (SIMOPS)

For reference, a sample process is included in Annex 1 to guide the Contractor to prepare the remaining Processes.

2.9 Standard Operating Procedures (SOP)

Standard Operating Procedures and Work Instructions are primarily technical in nature and represent the third tier in the Contractor's overall risk management documentation hierarchy of the OHSMP. These documents provide

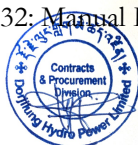


detailed, task-specific guidance to ensure safe and consistent execution of activities in accordance with the Contractor's policies and Management System Processes.

To support the effective implementation of SOPs, a suite of forms, checklists, and templates should be developed. These tools serve as practical aids to reinforce control measures, facilitate compliance, and support monitoring and verification efforts in the field.

Based on the preliminary risk assessment (refer to Annex 2), the Contractor is required to develop the following SOPs. This is a non-exhaustive list, and additional SOPs may be necessary depending on the evolving scope and site-specific risks of the project:

- SOP 01: Explosives – Storage, Transport and use
- SOP 02: Work at Height
- SOP 03: Excavation
- SOP 04: Mobile Equipment
- SOP 05: Barricading and signs
- SOP 06: Cell Phone Use
- SOP 07: Safe Driving
- SOP 08: Drilling and Blasting
- SOP 09: Material Haulage (Loading and Unloading)
- SOP 10: Traffic Interface Planning
- SOP11: Severe Weather
- SOP 12: Lifting and Hoisting
- SOP 13: Scaffold Erection
- SOP 14: Working Near or Over Water
- SOP 15: Illumination
- SOP 16: Ground Support
- SOP 17: Water Management - Tunneling
- SOP 18: Ventilation
- SOP 19: Fire
- SOP 20: Electrical Systems
- SOP 21: Hazardous Material Management
- SOP 22: Equipment Inspection & Maintenance
- SOP 23: First Aid
- SOP 24: Worker Welfare Facilities
- SOP 25: Camp Management
- SOP 26: Emergency Response Plan
- SOP 27: Tunneling Operation
- SOP 28: Operation of Crushing and Batching Plants
- SOP 29: Confined Space Entry
- SOP 30: Contractor Security Management
- SOP 31: Cofferdam Construction
- SOP 32: Manual Handling



- SOP 33: Welding and Cutting
- SOP 34: Use of Compressed Air
- SOP 35: Radiation
- SOP 36: Chemical Cleaning
- SOP 37: Working Near Energized Object
- SOP 38: Energy Isolation (LOTO)
- SOP 39: Identification and Removal of Loose Material and Fractured Rocks
- SOP 40 For hot works
- SOP 41: Fatigue management
- SOP 42: Heat and Cold stress
- SOP 43: Noise and vibration management
- SOP 44: Lone worker's safety
- SOP 45: Working in remote areas
- SOP 46: Working during monsoon/flood conditions
- SOP 47: Working around rotating equipment & machine guarding.

A sample SOP is presented in Annex 3 to guide the Contractor to develop all other procedures.

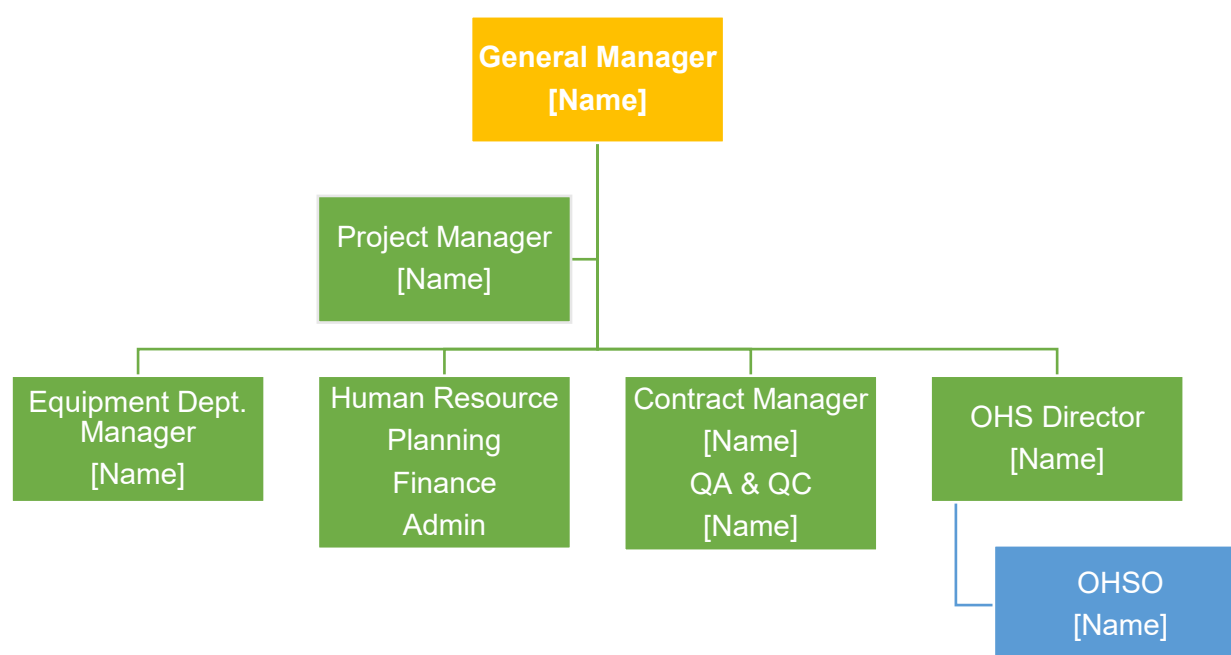
3 Project Organization

3.1 Contractor Organogram

A typical Contractor's organizational structure is illustrated in Figure 3. Every effort should be made to maintain a similar organogram throughout the duration of the project, particularly to ensure a clear and direct reporting line between Health and Safety functions and the General Manager or senior leadership.

Establishing this direct linkage reinforces the visibility and priority of health and safety within the organization. It empowers the safety function to operate with authority, ensures that critical safety issues receive prompt attention at the highest level, and supports effective decision-making. This structure reflects best practices in organizational governance, where OHS is integrated into strategic leadership rather than being confined to operational or support levels.

Maintaining such a reporting structure also aligns with the principles of accountability, transparency, and continuous improvement embedded in the Contractor's OHS Management System.



Figure



3.2 OHS Organogram

The Contractor's typical occupational health and safety organization should look like as presented in Figure 4.

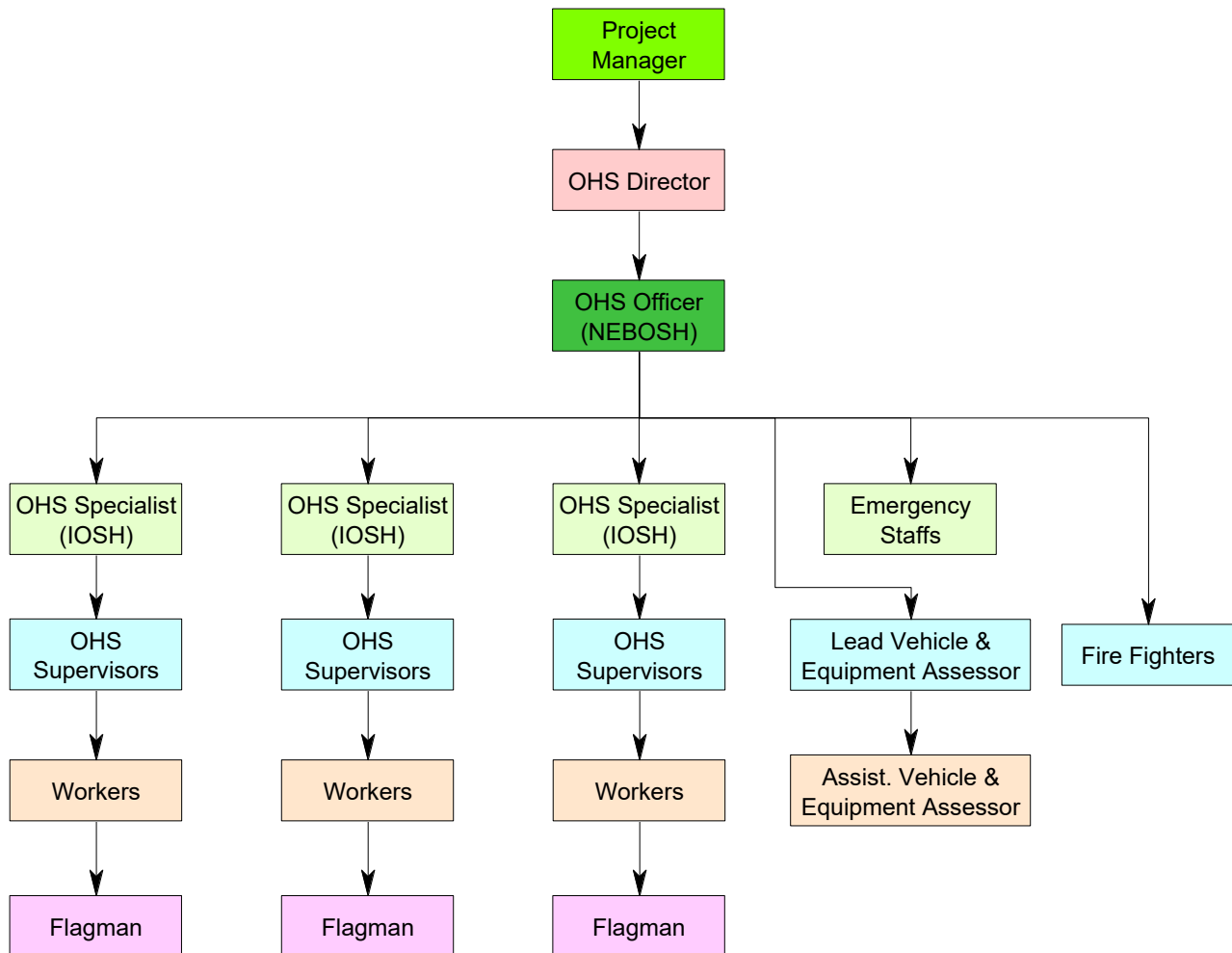


Figure 4: Proposed OHS Organogram of Contractors

3.3 Roles and responsibilities

These typical roles and responsibilities give a holistic understanding pertaining to implementation of the OHSMMP which comprises multiple processes and SOPs. However, each process and SOP may also have additional specific requirements pertaining to a specific role.

3.3.1 Project Manager

- Overall accountability for the development, implementation and maintenance of this OHSMMP.
- Accountable for allocation of sufficient resources for the execution of this plan.
- Ensure that empowered and competent personnel are available for the execution of this plan
- Make sure that Sr. leadership (all directors, Construction Managers and other line management personnel) are fully aware of their responsibilities as per the Processes and SOPs of this OHSMMP.
- Demonstrate visible leadership, walk to talk behavior to reinforce the implementation of this OHSMMP
- Attend monthly OHS Committee Meeting and monitor the performance through leading and lagging indicators.
- Discourage achievement of operational results at the cost of safety violations
- Develop a conducive culture where Personnel are authorized to *STOP unsafe work without fear of retribution



- Develop a culture where it is safe to speak up and provide the time, people and resources to respond to OHS concerns identified by their workers.
- Ensure that Work Observation program is utilized, and all incidents are fully investigated
- Review Executive Summary of incidents, ensure that Root Causes are being identified and resources are provided for the closure of Preventive and Corrective Actions
- Encourage reward and recognition where personnel demonstrate safe behavior or identify hazards and fairly apply disciplinary process when personnel cut short.

**ILO COP 2.2.12. Where there is an imminent danger to the safety of workers, the employer should take immediate steps to stop the operation.*

3.3.2 OHS Director

- Be a Subject Matter Expert of this OHSMP. Provide training and awareness regarding the implementation of this OHSMP that includes multiple Processes and SOPs
- Convene monthly OHS Committee meeting and share implementation progress, points of concern
- Be familiar with all local, national, and international laws that are applicable to the operations.
- Establish and maintain a professional relationship with Company /Contractor and subcontractor representatives.
- Establish an audit system that measures the effectiveness of this OHSMP

3.3.3 OHS Officer

- Be a Subject Matter Expert of the Contractor's OHSMP, a NEBOSH (or equivalent) certified, and 12 years of experience in construction. Provide training and awareness regarding the implementation of this OHSMP that includes multiple Processes and SOPs
- To be familiar with all local, national, and international laws that are applicable to Operations.
- Raise concern in the monthly OHS Progress Review meeting regarding implementation of controls stipulated in this OHSMP.
- Provide training to staffs on the OHSMP. Conduct regular sessions for all project team members to inculcate the requirements of this OHSMP.
- To report to the Contractor Management Team on implementation progress, monthly KPIs.
- To ensure that sufficient training and induction of all personnel is being provided and maintained.
- To ensure that visit induction is given to all visitors before they are allowed to visit the site.
- To develop the OHS awareness of all personnel employed on the project and ensures their participation in all aspects of the health and OHS program
- Provide guidance for the purchase of personal protective equipment
- Regular inspection of construction safety and security as per PR09: Work Observation Process
- Provide guidance to employees regarding their emergency response responsibilities.
- Decide whether a potential rescue service or team is adequately trained and equipped to perform permit space rescues of the kind needed at the facility and whether such rescuers can respond in a timely manner, and organize drills
- Review of OHS management plan every six months.

3.3.4 OHS Specialists

- Bachelor's Degree in Engineering/Science with 10 years of experience and IOSH certification (or equivalent).
- Perform the assigned inspections and discuss the findings with OHS Officer



- Ensure communication procedure and system to communicate emergency events to site supervisor and emergency authorities (e.g., Incident Response Center IRC and/or Police, health centers)
- Communicate with construction site personnel to help them understand the hazards of the site and understand the demands of the operating personnel about OHS matters

3.3.5 OHS Supervisors

- They allocate tasks and check that the workers are implementing OHS requirements to standard. They provide feedback and guidance on OHS implementation.
- Ensure that the controls stipulated in PTW (Permit to Work) are implemented and STOP the work when critical controls are missing or compromised
- Discuss JHA and conduct effective Tool Box Talk with all workers. Ask questions to ensure that they have a good understanding.
- Ensure that all new employees receive training as per PR01: Induction Process and PR05: Short Service Worker Process
- Conduct worksite observations, discuss safety concerns with workers
- Develop a culture where it is safe to speak up and provide the time, people and resources to respond to OHS concerns identified by their workers. They are also responsible for escalating issues that can't be resolved by the workers or at the supervision level.
- Responsible for making an incident scene safe and secure and for ensuring that hazards, near misses and incidents are entered into the reporting system.
- Ensure all workers use appropriate PPEs and train them how to use them.

3.3.6 Vehicle and Equipment Assessors

- Lead Assessor (7 years exp.) and Assistant Assessor (3 years exp.) with Degrees/Diplomas in Mechanical or Automotive Engineering
- Conduct routine and scheduled inspections of construction equipment (e.g., cranes, excavators, hoists, scaffolding).
- Verify that all equipment complies with manufacturer specifications, site-specific requirements, and relevant standards (e.g., OSHA, ISO, national codes).
- Inspect safety devices such as limit switches, emergency shutoffs, load indicators, alarms, etc.
- Maintain detailed inspection logs, checklists, and condition reports.
- Report non-compliance, defects, or malfunctions immediately to the site supervisor or safety officer.
- Issue recommendations for corrective actions or equipment withdrawal if unsafe.
- Coordinate or witness load tests, non-destructive testing (NDT), pressure tests, etc.
- Verify that all lifting equipment and pressure vessels have up-to-date certification and calibration.
- Ensure third-party inspections (where required) are conducted and documented.
- Review maintenance records and confirm scheduled servicing is completed.
- Recommend preventive maintenance actions to avoid equipment failure or breakdowns.
- Monitor wear and tear, especially in high-use machinery.
- Ensure equipment use complies with local regulations, construction codes, and safety standards.
- Support audits by regulatory bodies or client representatives.
- Work with operators, maintenance staff, and safety teams to coordinate inspection and shutdown schedules.
- Provide technical advice regarding equipment selection, load limits, and suitability.



- Participate in or provide training on proper equipment use and inspection techniques.
- Promote awareness about hazards related to faulty or misused equipment.
- Support investigations related to equipment-related accidents or near misses.
- Provide inspection data and technical insight into potential root causes.

3.3.7 First Responders (Certified in First Aid and CPR)

The Contractor shall provide First Responders certified by the Red Cross or an equivalent recognized national institution.

- Administer immediate Basic Life Support (BLS), CPR, and trauma care (hemorrhage control, stabilization) at each work front until secondary medical care is available. Avoiding mishandling and undue haste while working expeditiously to accomplish the task.

3.3.8 Flagman

The Contractor shall deploy trained Flagmen to regulate the movement of Contractor's Equipment and traffic at tunnel portals and haul routes.

- Manage one-way traffic, stop movements during Blasting Operations, and maintain clear access for emergency vehicles. They shall maintain continuous radio communication with the Technical Supervisors.

3.3.9 Workers

- Conduct Personal Risk Assessment Take 5 and do not proceed to work if unsafe to do
- Use authority to STOP work if observe an unsafe work by fellow worker or SSW
- Report hazards and at-risk behavior as and help the Contractor management to develop a conducive safety culture.
- Use PPE as provided and ins
- Conduct a visual inspection of equipment in the beginning of the operation and ensure that equipment is de-energized before working on a piece of equipment
- Ensuring that they wear appropriate PPE for the activity that they undertake
- Be aware and mindful of hazards related to any work activity; do not undertake a job or task if physically or mentally not fit
- Seek clarification for uncertainty relating to a task with the Supervisor.
- Do not undertake a job if not competent to do so
- Raise improvement opportunities
- Report near misses and actual incidents immediately to the supervisor.

3.3.10 Emergency Coordinator

Bachelor's Degree in Engineering, Occupational Health & Safety, Disaster Management, or related field and 10 years of experience (5 years in tunneling/underground works).

- Develop and maintain the Emergency Preparedness and Response Plan (EPRP); act as the Incident Commander during crises; and coordinate with external emergency services.

3.3.11 Field Emergency Professional (Underground Rescue Officer)

A specialist with a Certificate in Fire & Rescue and 5 years of experience in underground works.



- Lead search and rescue operations in tunnels; maintain breathing apparatus (SCBA) and rescue chambers; and execute regular emergency drills.

3.3.12 Emergency Medical Professional (Site Medic / Paramedic)

Registered Nurse or Paramedic with 5 years of experience in trauma care.

- Manage the on-site medical clinic, stabilize trauma patients, and coordinate Medical Evacuations (MedEvac).

3.3.13 Fire Fighters

Designated firefighters with Higher Secondary Certificate (Class XII) and specialized training in industrial and underground fire rescue.

- Prevent, combat, and extinguish fires; maintain firefighting equipment; and support rescue operations.

3.3.14 Entry Supervisors (Confined Space)

The Contractor shall designate Entry Supervisors accountable for safety in Confined Spaces.

Determine if acceptable entry conditions exist, authorize and cancel Entry Permits, and oversee all confined space operations.



Annex 1: Sample Process- PR 01: Induction
SAMPLE

OHS MANAGEMENT PROCESSES
(PR01: Induction Process)

June 2025
Revision. 00

Prepared By		Reviewed by	
	OHS Officer		Project Manager
Date:		Date:	

[NAME OF THE CONTRACTOR]



Detail of the Documents

DOC. No.	Title	Pages.
	PR01: Induction Process	7

Revision History

Version	Date	Comments	Prepared By	Approved By
00	20/06/2025	Drafted and submitted to the Engineer for review and approval		



● PR01: Induction Process

○ Purpose

It is one of the key processes to mitigate the risk and provide training to workers joining the Contractor's worksites.

○ Scope

All staff members, temporary day workers and visitors

○ Procedure

- All new employees shall be provided an induction training according to their role and responsibilities.
- Training shall be conducted by OHS Officer or his designates.

Following table shows the trainers available at the Contractor.

Table PR01-1: Trainers from the Contractor

S. No	List of Training	Trainer
1.	Induction training	Site Engineer, OHS Staff (Name of the Staffs)
2.	Pre-start risk assessment	OHSO/Site Supervisor
3.	Visitors' training	Site Supervisor
4.	Awareness training	(Name of the Staffs)
5.	OHS staff development training	Company Head Office
6.	Job specific training	Electrical safety
7.		(Name of the Staffs)
8.		Blasting Safety
9.		Excavation Team + (Name of the Staffs)
10.		Defensive Driving
11.		(Name of the Staffs)
12.		Welding and hot work
13.		Rebar works in-charge, (Name of the Staffs)
14.		(Name of the Staffs)
15.		Lifting operations
		(Name of the Staffs)
		Concrete work
		(Name of the Staffs)
		Steel and rebar work
		(Name of the Staffs)
		Health and hygiene for
		(Name of the Staffs)
		Scaffolding
		(Name of the Staffs)
		Emergency plan training
		(Name of the Staffs)



16.	Emergency Training	First aid training	Department of Local Governance and Disaster Management, Red Cross Society
17.		Underground first aid	Government Emergency Agency, Red Cross
18.		Fire fighting	(Name of the Staffs)

■ Induction of New Workers:

- Training of new workers will be conducted in the presence of Supervision Engineers OHS staffs and clearance will be accorded to each staff for mobilizing on the worksite.
- OHS Staff delivering the Induction training shall maintain the records of all trainings and make it available to Supervision Engineers for inspection/audit.

Complete induction plan includes as a minimum the following components as applicable:

- Induction Training and introductions
- Filling of Personal Information Form (FORM PR01-01)
- OH&S procedures and Orientation (FORM PR01-01)
- Business overview workplace tour
- Who's who
- Nominated immediate boss or the mentor
- Assigned tasks
- Job position roles & responsibilities
- Safety procedures for work / Workplace hazards
- Client specific site/work & safety orientations
- Disciplinary Policy
- Defensive Driving (only for drivers)
- Work Permits (Purpose, Requirements, Use)
- WHMIS and SDS content and use
- PPE requirements, provision, use, and care
- Fatigue awareness & Fit for Duty
- Risk Assessment and Hazard reporting
- Incident and near miss reporting
- Emergency response

■ Orientation of Visitors:

- All visitors at project site (e.g., WB Team or short-term expatriate staff of the Engineer) shall be provided safety and security orientation before entering at work sites and visitor cards shall be issued.
- Visitors are required to bring their own following minimum PPE. In case unavailable the Contractor shall provide the same.
 - Safety shoes
 - High Visibility vest
 - Hard hat
- In field site safety staff will escort them at all the times. Orientation can be conducted in local language and English.
- Safety orientation shall cover the worksite hazards, risks associated and control measures.
- Security protocol.



FORM PR01-01: OHS INDUCTION

Name	
Nationality	
Position	
Date of Joining	

Sl.	Description	Remarks
1	Camp/office Facilities and Arrangements ● Camp/office plan (chart) ● Location of fire assembly point, fire extinguishers ● Location of working and restricted areas ● Location of clinic & first aid kits ● Location of messing, rest, smoking and accommodation areas ● Vehicle parking and one-way system., avoid reversing ● Camp offices ● Working hours & meal times ● No tampering with equipment or tools ● OHS organization structure	
2	Incident Prevention & Incident/Hazard/Near Miss Reporting ● Report ALL incidents to management	
3	Fire Prevention ● Types of fire and fire extinguishers type ● Fire prevention and fire extinguisher use	
4	Environmental Preservation ● Spill Control ● Litter collection and disposal ● Environmental Responsibilities	
5	Transport & Travel Rules ● Seat belt use ● Speed Limit	
6	Personal Protective Equipment (PPE) ● PPE required for the worker/supervisor ● PPE required in camp work areas, safety shoes for construction work in the operation and administration areas	
7	Health and Hygiene ● Reporting illnesses to doctor/Nurse/Paramedic	



Sr. No	Description	Remarks
8	Weather Management - Protective clothing - Water use - Symptoms of heat cramps, heat exhaustion and heat stroke	
9	Emergency Response Procedure - Fire - Earthquake etc.	
10	Safety is Everyone Responsibility Discussion	
11	Restricted Areas - Restricted Areas in the Project - Current Construction Activities - Protocols in the restricted area	
12	High Risk High Risk Areas & Ongoing Activities shall be Communicated to Workers & Staff	
13	Social Responsibility - Role and Responsibility of employee during community matters - Avoidance of interaction with communities	
Any Questions?		

Signature of Employee	Signature of OHS Representative	Date

Annex 2: Risk Assessment

Department: OHS		Risk Assessment	Written by:	Validated by:
Revision No.	Revision Date:	Revision Details	Commented By	Approved By
00	June 20, 2025	Preliminary draft framework prepared to guide the Contractor to prepare a full Occupational Health and Safety Management Plan		

Risk Ratings

Risk Matrix				Likelihood				
				Unlikely to occur but known in industry; probability .1%-1%	Likely to occur once or more in life of facility/organization; probability 1%-10%	Likely to occur once every two years or more; probability 10%-50%	Occurs more than once or twice per year, is continuous or certain to occur; probability 50%-80%	Multiple occurrences have happened frequently in the industry; probability >80% & above
				Remote (1)	Possible (2)	Occasional (3)	Likely (4)	Frequent (5)
				1	2	3	4	5
C o n s e q u e n c e	No impact or minor First Aid injury	Incidental	1	1	2	3	4	5
	First aid injury (e.g., minor cuts and bruises, eye irritation from dust) or very minor health effect	Minor	2	2	4	6	8	10
	Lost Time/ Non-Lost Time injury (e.g., sprains, fracture, cut, lacerations, burns or bruises) or health effect (i.e., deafness or dermatitis)	Moderate	3	3	6	9	12	15
	Major injuries: amputations, major fractures, multiple injuries, or health effects: severely life shortening disease, occupational illness	Serious	4	4	8	12	16	20
	Multiple fatalities or Multiple permanent disabilities	Catastrophic	5	5	10	15	20	25

Color coding		
Color	Risk	Score
Green	Low	1--6
Blue	Medium	8--10
Yellow	Warning	12--15
Red	High	16--25

RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
Tunneling and Underground work with Transportation of materials													
1	Drilling works	Struck by mobile equipment (jumbo)	- Inadequate clearance between jumbo and workers - Workers entering working face while jumbo operating (inadequate access controls) - Inadequate visibility - Distraction - Fatigue - Equipment failure (e.g. brakes, steering)	5	5	25	Multiple	- SOP05: Barricading and Signage. - SOP04: Mobile Equipment - SOP07: Safe Driving. - SOP08 Drilling and Blasting - SOP10: Traffic Interface Planning. - SOP22: Equipment Inspection & Maintenance..	1	5	5	Largely administration controls. Likelihood reduced due to lower potential of multiple fatalities.	Site Supervisor, Site Engineer, Construction Manager.
2		- Falling material and rocks - Vibrations from mobile/drilling equipment operation - Loose rocks	- Working with handheld drill machines. - Not following safe working procedures. - Poor clearance of working face. - Working at the same time above and below area. - Using improper working platform.	4	5	20	Multiple	- SOP15: Illumination. - SOP16: Ground Support. - SOP27: Tunnel Operation.	2	5	10	Likelihood decreased but no impact to severity	Site Supervisor, Site Engineer, Construction Manager.
3		Rotating, mechanical parts (e.g., spinning chuck, drill bit), loose clothing, hands.	Working with and or close to drilling equipment with loose clothing, hands in the line of fire.	4	3	12	Unlikely	- SOP22: Equipment Inspection and Maintenance - SOP05: Barricading and Signage.	2	3	6	Likelihood decreased but no impact to severity	Site Supervisor, Site Engineer, Construction Manager.
4		Compressed Air	Due to loose / improper connections, poor hose condition, improper and misuse of compressed air, carelessness for the fittings and accessories.	4	4	16	Single	SOP22: Equipment Inspection and Maintenance.	1	2	2	Likelihood decreased with the implementation of engineering controls but no impact to severity	Site Supervisor, Site Engineer, Construction Manager.
5		- Working at height - Open edges - Incomplete scaffolding or railings - Unguarded openings - Poorly stored or secured equipment	- Working without a proper working platform, not using the handrails and or full body harness or not tying the body harness above waist level. - Loose material or materials being kicked or bumped above the working platform, overreaching and or leaning from working platform.	4	4	16	Single (multiple could occur but unlikely)	- SOP02: Working at Height - SOP05: Barricading and Signage - SOP13: Scaffold Erection - SOP15: Illumination	2	4	8	Due to the complexity of controls for working at heights, lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
6		Hand arm vibration syndrome	Vibration due to poor maintenance and or poor operation of the machines.	3	3	9	No	• SOP22: Equipment Inspection & Maintenance	2	3	6	Likelihood decreased but no impact to severity due to controls being behavioral	Site Supervisor, Site Engineer, Construction Manager.
7		Inhalation of harmful substances	• Release of gases from blasting activity. • Release of gases from the natural stratigraphy. • Emissions from internal combustion engines.	5	3	15	Single	• SOP08: Drilling and Blasting • SOP18: Ventilation. • SOP21: Hazardous Materials.	1	3	3	Likelihood of release of harmful gases in hydropower construction is very unlikely.	Site Supervisor, Site Engineer, Construction Manager.
8		Unauthorized operations	Unauthorized workers / Unauthorized person enters working / drilling areas	5	5	25	Multiple	• PR01: Induction Process • SOP05 Barricading and Signage • PR04: Personnel Competency and Training • Check in Check out procedures	3	5	15	Administrative controls only	Site Supervisor, Site Engineer, Construction Manager.
9		High Noise Level	Noise from the operation of the equipment	5	3	15	No	• SOP08: Drilling and Blasting • SOP22: Equipment Inspection & Maintenance.	3	3	9	Unlikely to reduce the likelihood to “Possible” due to the typically poor implementation of noise controls	Site Supervisor, Site Engineer, Construction Manager.
10		Slip, trip and fall	Due to poor housekeeping (Ex. haphazard hoses and cables etc.)	5	3	15	Unlikely	• SOP05: Barricading and Signage. • SOP15: Illumination ○ Focus on walkways. • Housekeeping shall be done prior to commencement of work. Proper housekeeping of the site, cleaning of the working area. • Design work areas to have minimal trip and slip hazards. ○ Proper placement/ stacking of all materials away from the walkways, access ways. • Establish drainage to move water away from walkways and avoid pooling.	3	3	9	Unlikely to significantly reduce the likelihood. Slips, trips and falls are common in the construction industry.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								- Maintain clear walkways (ensure the walkways are free of equipment, tools, construction debris and other materials). - Where work areas are unsafe due to uneven ground, the work areas are to be graded. - Use footwear that provides good slip resistance.					
11		Lack of illumination screening hazards.	Poor lighting arrangement at the work front.	4	4	16	Single	SOP15: Illumination	2	4	8	Potential remains for inadequate lighting and poor illumination of hazards, particularly when dealing with a progressive work front.	Site Supervisor, Site Engineer, Construction Manager.
12		- Heavy tools & equipment, - Repetitive movements, - Sustained awkward posture, - High sudden force, - Working at incorrect heights, - Poor workspace design (e.g. inadequate space to safely lift tools and equipment).	- Awkward positioning in case of manual drilling machine - Poor lifting techniques - Ergonomic hazards resulting musculoskeletal injuries	5	3	15	No	- Design work to reduce the need for manual handling. - Use lifting aids. - Training and awareness of the workers involved in manual handling: - Controls to reduce the need for manual handling (e.g., lifting aids, ergonomically designed work areas, smaller equipment units). - Correct lifting technique. - Workers involved in drilling to be provided with training on controlling ergonomic risks relating to drilling. - Proper body posture while carrying out manual lifts. - Consider using a team lift. - Regular rotation of workers involved in lifting and manual handling.	4	3	12	Unlikely to significantly reduce the likelihood. Permanent musculoskeletal injuries are common in the construction industry.	Site Supervisor, Site Engineer, Construction Manager.

RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								Proactive injury management.					
13	Transportation of explosives	- Detonators and explosives transporting together. - Large numbers of explosives being transported together, - Inadequate explosive packaging, - Unsecured explosives, - Presence of an ignition source (e.g., smoking or naked flames), - Collision,	- Explosive comes into contact with an ignition source. - Sympathetic / un-intended detonation.	3	5	15	Multiple	- SOP01: Explosives – Storage, Transport and Use - Explosives Act 1989- Govt. of Bhutan.	2	5	10	No change to consequence. Likelihood slight decrease because controls are largely behavioral.	Contractors & Construction Managers
14		Explosive theft – explosives are attractive to some third parties and not easily obtained	Due to insecure vehicle or worksite	2	5	10	Multiple	- SOP30: Contractor Security Management - SOP01: Explosives – Storage, Transport and Use - SOP08: Drilling and Blasting. - SOP05: Barricading and Signage.	1	5	5	No significant change to consequence. Explosives could still kill multiple people.	Contractors & Construction Managers
15	Setting up explosives & blasting	- Unintended/unplanned detonation of explosives, - Lightening, - Ignition sources (e.g. smoking), - Extraneous electricity (e.g. stray current, static charge, radio frequency energy, mobile phones, capacitive or inductive coupling), - Friction, - Misfires, - Late firing (hang fires),	Each of these can initiate a chain reaction that can result in an explosion.	4	5	20	Multiple	- SOP01: Explosives – Storage, Transport and Use, - SOP05: Barricading and Signage, - SOP08: Drilling and Blasting, - SOP11: Severe Weather,	3	5	15	No significant change to consequence. Explosives could still kill multiple people. Incidents involving unintended/unplanned blasts have occurred in the construction industry.	Site Supervisor, Site Engineer, Construction Manager.
16		Fly rock	- Failure to anticipate fly rock within the line of fire. - Poor blast hole design or poor execution of the design increasing fly rock. - Failure to obey blasting warnings or signals and order of blaster. - Attempting to dig out or improperly handling a misfire.	3	5	15	Multiple	- SOP01: Explosives – Storage, Transport and Use - SOP08: Drilling and Blasting - SOP05: Barricading and Signage	2	5	10	No significant change to consequence. Explosives could still kill multiple people.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
17		Miss Fire	Dealing improperly with the miss fire, attempting to dig out or improperly treat misfire	4	5	20	Multiple	- SOP01: Explosives – Storage, Transport and Use - SOP08: Drilling and Blasting - SOP05: Barricading and Signage	3	5	15	No significant change to consequence. Explosives could still kill multiple people. Incidents involving the management of misfires have occurred in the construction industry	Site Supervisor, Site Engineer, Construction Manager.
18		Unauthorized entry	- Failure to follow Procedures, - Poor check-in and check-out system, - Miscommunication and improper clearance,	5	5	25		- PR01: Induction Process - PR04: Personnel Competency and Training. - SOP01: Explosives – Storage, Transport and Use. - SOP05: Barricading and Signage. - SOP08: Drilling and Blasting. - SOP29: Confined space.	3	5	15	No significant change to consequence. Explosives could still kill multiple people.	Site Supervisor, Site Engineer, Construction Manager.
19		Noise	- Due to explosion - Not following the design specifications.	3	3	9	No	- SOP01: Explosives – Storage, Transport and Use. - SOP05: Barricading and Signage. - SOP08: Drilling and Blasting.	2	3	6	Unlikely to drop the risk to Possible due to the generally poor implementation of noise controls.	Site Supervisor, Site Engineer, Construction Manager.
20		Vibration from the blast potentially impacting the structural integrity of structures within & surrounding the site.	Blasting vibrations can be increased due to inadequate design specifications or inadequate implementation of the blast design.	2	5	10	Multiple	- SOP01: Explosives – Storage, Transport and Use. - SOP05: Barricading and Signage. - SOP08: Drilling and Blasting. - Structural Integrity Assessment & Collection of base line data prior to commencement of blasting activities. - Periodic monitoring of impact by blasting activities through installation of ground vibration monitoring devices.	2	5	10		Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT														
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility	
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk			
21		Hazardous gases, dust and fumes.	Explosive reaction results in the formation of hazardous gases, fumes and dust.	3	4	12	Single	- SOP21: Hazardous Materials. - SOP08: Drilling and Blasting. - SOP18: Ventilation.	2	4	8	Correct application of wetting & ventilation should lower the likelihood of this.	Site Supervisor, Site Engineer, Construction Manager.	
22	Scaling	Loose or unstable rock	Disturbance of the working face can result in loose or unstable rock falling striking workers or equipment.	4	5	20	Multiple	- SOP03: Excavation - SOP05: Barricading and Signage - SOP15: Illumination - SOP16: Ground Support - SOP27: Tunneling Operation	2	5	10	Likelihood decreased but no impact to severity	Site Supervisor, Site Engineer, Construction Manager.	
23		High Noise Level	Noise from the operation of the equipment.	4	3	12	No	- SOP16: Ground Support - SOP22: Equipment Inspection & Maintenance. - SOP27: Tunneling Operation	3	3	9	Unlikely to reduce the likelihood to "Possible" due to the typically poor implementation of noise controls	Site Supervisor, Site Engineer, Construction Manager.	
24		Dust	Due to scaling	3	4	12	Single	- SOP05: Barricading and Signage - SOP08: Drilling and Blasting - SOP18: Ventilation - SOP21: Hazardous Materials	2	4	8	Correct application of wetting & ventilation should lower the likelihood of this.	Site Supervisor, Site Engineer, Construction Manager.	
25		Dark worksite	Poor lighting arrangement at the work front	4	5	20	Multiple	SOP15: Illumination	2	5	10	Potential remains for inadequate lighting and poor illumination of hazards.	Site Supervisor, Site Engineer, Construction Manager.	
26	Mucking	Driving without authorization	Operation of machines and dumpers by unauthorized operators and drivers.	4	5	20	Multiple	- PR01: Induction Process - PR04: Personnel Competency and Training - Check in Check out procedures - SOP01: Explosives – Storage, Transport and Use - SOP04: Mobile Equipment - SOP07: Safe Driving - SOP09: Material Haulage (Loading and Unloading). - SOP05: Barricading and Signage	2	5	10	Likelihood	Site Supervisor, Site Engineer, Construction Manager.	



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								SOP31: Office, Camp and Site Security					
27		Vehicle pedestrian interaction	- Inadequate visibility - Blind spot - Distraction - Fatigue - Equipment failure (e.g. brakes, steering)	5	5	25	Multiple	- SOP04: Mobile Equipment - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP09: Material Haulage (Loading and Unloading). - SOP10: Traffic Interface Planning. - SOP22: Equipment Inspection & Maintenance.	3	5	15	Likelihood decreased but no change to impact severity. While there are controls to alert the driver and the worker, if a vehicle collides into a worker it will be very difficult to prevent it from being an extreme energy exchange.	Site Supervisor, Site Engineer, Construction Manager.
28		Unsecured loads	Overloading buckets and material bouncing out of buckets by improper loading and operation of earthmoving equipment exposing workers located within the line of fire.	3	4	12	Single	- SOP04: Mobile Equipment - SOP05: Barricading and Signage - SOP09: Material Haulage (Loading and Unloading). - SOP10: Traffic Interface Planning - SOP15: Illumination	2	4	8	While these controls should reduce the likelihood, they rely on behavioral controls so material still could fall out of a bucket or dumber with workers in the line of fire.	Site Supervisor, Site Engineer, Construction Manager.
29		Hazardous gases	Due to explosion; formation of hazardous gases and Fumes	3	4	12		- SOP18: Ventilation - SOP21: Hazardous Materials Management	2	3	6	With these controls in place there may be a very low-level exposure to hazardous gases and fumes	Site Supervisor, Site Engineer, Construction Manager.
30		Dust	Movement of machinery, loading / unloading when the material is dry and made easily airborne	3	4	12	Single	- SOP09: Material Haulage and Unloading). - SOP18: Ventilation - SOP10: Traffic Interface Planning	2	4	8	With these controls in place there may be a very low-level exposure to dust	Site Supervisor, Site Engineer, Construction Manager.
31		Noise	Movement of machinery, loading / unloading	4	3	12	No	SOP09: Material Haulage and Unloading).	3	3	9	Unlikely to drop the likelihood to "Possible" due to the generally	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								SOP22: Equipment Inspection & Maintenance.				poor implementation of noise controls.	
32		Vehicle exhaust emissions	Running vehicles and equipment with internal combustion engines in tunnels	2	4	8	Single	- SOP09: Material Haulage (Loading and Unloading). - SOP18: Ventilation. - SOP22: Equipment Inspection and Maintenance.	1	4	4	Likely that workers will still be exposed to diesel particulates with controls in place.	Site Supervisor, Site Engineer, Construction Manager.
33	Transportation of material inside tunnels	Light vehicle/heavy vehicle/pedestrian interaction	- Speeding - Falling material - Inadequate visibility - Blind spot - Distraction - Fatigue - Equipment failure (e.g. brakes, steering)	4	5	20	Multiple	- SOP04: Mobile Equipment - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP09: Material Haulage (Loading and Unloading). - SOP10: Traffic Interface Planning. - SOP22: Equipment Inspection & Maintenance.	2	5	10		Dirver, Operator, Site Supervisor, Site Engineer, Construction Manager.
34		Unsecured loads	Due to over speeding and overloading	4	4	16	Single	- SOP04: Safe Driving - SOP09: Material Haulage (Loading and Unloading) - SOP10: Traffic Interface Planning. - Well maintained machines and vehicles - Designated path for pedestrians and machines, no overloading.	2	4	8		Diver, Operator, Site Supervisor, Site Engineer, Construction Manager.
35		Machine failure	Due to poor/no maintenance and repair	3	5	15	Multiple	- SOP07: Safe Driving. - SOP22: Equipment Inspection and Maintenance.	2	5	10	If the brakes fail or the steering fails on a dumper and strikes a Light vehicle or pedestrians it could still result in multiple fatalities.	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.
36		Vehicles overturn	Poorly maintained access roads, over speeding and improper edge protections of the excavations, equipment failure, wet roads, fatigue.	4	5	20	Multiple	- SOP04: Mobile Equipment - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP10: Traffic Interface Planning.	2	5	10	If an accident occurs it may still result in multiple fatalities. None of these controls	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								SOP22: Equipment & Maintenance.				restricts a truck to only killing one person	
37	Transport of material on access and public roads	Being struck or run over by moving machines, 3rd party accident from loose material	- Due to falling material from the dumpers during transportation when the dumpers are overloaded - Driving at unsafe speed and not to conditions - Fatigue - Equipment failure - Distraction	4	5	20	Multiple	- SOP04: Mobile Equipment. - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP09: Material Haulage (Loading and Unloading). - SOP10: Traffic Interface Planning. - SOP22: Equipment & Maintenance.	3	5	15	If an accident occurs it may still result in multiple fatalities. None of these controls restricts a truck to only killing one person	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.
38		Unsecured loads	During transportation of mucking material filled to the point where it falls out of the truck	2	5	10	Multiple	- SOP04: Mobile Equipment. - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP09: Material Haulage. - SOP10: Traffic Interface Planning. - SOP22: Equipment & Maintenance.	2	5	10	Assuming that the trucks are not overfilled, large material is unlikely to fall out of the truck.	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.
39		Machine failure	Due to poor maintenance and repair	3	5	15	Multiple	- SOP07: Safe Driving - SOP22: Equipment and Maintenance	2	5	10		Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.
40		Lack of edge protection	- Especially at river sides - Equipment failure - Wet roads - Fatigue	4	5	20	Multiple	- SOP04: Mobile Equipment - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP10: Traffic Interface Planning.	2	5	10	If an accident occurs it may still result in the death of the driver. None of these controls will prevent a driver from driving off the edge but it will reduce the likelihood.	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
41	Rock bolts, installation of ribs and girders	- Working at height - Open edges - Incomplete scaffolding or railings - Unguarded openings - Poorly stored or secured equipment	- No fall protection measures - Improper working platforms - Falling material - Materials being kicked or bumped	4	4	16	Single (multiple could occur but unlikely)	- SOP02: Working at Height - SOP05: Barricading and Signage - SOP13: Scaffold Erection - SOP15: Illumination - SOP16: Ground Support - SOP27: Tunneling Operation	3	4	12	Due to the complexity of controls for working at heights, lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.
42		Working platform not designed for working at heights	Convenience	4	4	16	Single (multiple could occur but unlikely)	SOP02: Working at Height	3	4	12	Due to the complexity of controls for working at heights lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.
43		Suspended loads	Moving girders for wall and roof support into place during installation	4	4	16	Single (multiple could occur but unlikely)	SOP12: Lifting and Hoisting	3	4	12	Due to the complexity of controls for lifting lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.
44		Dropped objects	Working groups operating within the drop zone of overhead working groups	4	4	16	Single (multiple could occur but unlikely)	SOP002: Working at Height	3	4	12	Due to the complexity of controls for working at heights lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
45	Shortcreting	Rebound and dust	Due to shotcrete spray, exposure to material	4	3.0	12	No	- SOP16: Ground Support - SOP21: Hazardous Materials Management - SOP27 Tunneling Operation	2	3	6	PPE should make exposure of skin and eyes unlikely. Improper use of the PPE may result in contamination but likely to be low level.	Site Supervisor, Site Engineer, Construction Manager.
46		Hazardous chemical additives used to make concrete	Exposure to hazardous material	4	3	12		- SOP18: Ventilation - SOP21: Hazardous Materials	1	1	1		Site Supervisor, Site Engineer, Construction Manager.
47		Unset/loose concrete	Due to falling of freshly sprayed concrete	4	3	12		- SOP16: Ground Support - SOP27 Tunneling Operation	1	3	3	Inspections to confirm that concrete is safe may not pick up all the hazards but the likelihood is reduced	Site Supervisor, Site Engineer, Construction Manager.
48		Hand, limbs injury	Crushed limbs as a result of the shortcreting machine being unintentionally switched on or maintenance and cleaning during movement.	3	3	9		- SOP16: Ground Support - SOP27 Tunneling Operation	2	3	6	Likelihood decreases but an event would still likely involve a lost time injury and potentially be permanent.	Site Supervisor, Site Engineer, Construction Manager.
49	Dewatering	Electric Shock/Electrocution	Due to leakage in power line, machine and improper connections, scattered cables, inadequate maintenance (including cable wearing)	3	4	12	Single (unlikely to be multiple)	- SOP20: Electrical Systems - SOP22: Equipment Inspection & Maintenance.	2	4	8	Electric shock could still result in a fatality unless the voltage can be reduced.	Site Supervisor, Site Engineer, Construction Manager.
50		Open water	Due to open edges into water ponds and sump pits	4	4	16		- SOP05: Barricading and Signage - SOP14: Work Near or Over Water	1	4	4	Drowning could still occur but likelihood reduced.	Site Supervisor, Site Engineer, Construction Manager.
51		Slip, trip and fall	- Due to scattered cables - Surface water - Tools and equipment left on the walkway	5	3	15	Unlikely	Cables must not be placed over walkways (for example use battery power tools, run the cables at a high level, tie loose cables together, or relocate them off the walking path). Where this is not possible, they must be fixed and appropriate protectors applied to	3	3	9	Unlikely to significantly reduce the likelihood. Slips, trips and falls are common in the construction industry.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								reduce the risk of tripping or damage to the cable. - Establish drainage to move water away from walkways and avoid pooling. - Regular cleaning of the walkways from slush & mud. - Maintenance of water pipes, joint, no leakage. - Regular and routine cleanup of the work area, removing trip hazards.					
52	Scaffolding	- Working at height - Open edges - Incomplete scaffolding or railings - Unguarded openings - Poorly stored or secured equipment	- During scaffold erection, dismantling and working on scaffold - Collapse of scaffold due to inadequate design, erection, overloading, adverse weather, vehicle collision, inadequate inspection	4	4	16	Single (multiple could occur but unlikely)	- SOP02: Working at Height - SOP05: Barricading and Signage - SOP13: Scaffold Erection - SOP15: Illumination - SOP22: Equipment Inspections and Maintenance	2	4	8	Due to the complexity of controls for working at heights Lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.
53		Falling material	- Improper working platform, - Gaps in working platform - Missing toe boards - Missing safety nets or barricading of below working area, and; - Throwing/dropping material during dismantling	3	4	12	Single (multiple could occur but unlikely)	- SOP02: Working at Height - SOP05: Barricading and Signage - SOP13: Scaffold Erection - SOP15: Illumination - SOP22: Equipment Inspections and Maintenance	2	4	8	Due to the complexity of controls for working at heights Lapses still possible with the implementation of working at height controls. Could still result in fatality.	Site Supervisor, Site Engineer, Construction Manager.
54	Electrical Installation	- Electric Shock, Electrocutation, - Fire	- Due to poor electric cables installations, Insecure cables at site, - webbing, - Overloading of circuits and improper connections, - Improper grounding, - Inadequate maintenance (including cable wearing)	3	4	12	Single (unlikely to be multiple)	- SOP20: Electrical Systems - SOP22: Equipment Inspection & Maintenance.	2	4	8	Electric shock could still result in a fatality unless the voltage can be reduced.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT														
i.	SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.					Likelihood	Consq	Risk			Likelihood	Consq;	Risk		
55		General working area	Slips, trips and falls,	- Improper placement of material, - poor housekeeping	5	3	15	Unlikely	- Proper placement/stacking of all material away from the walkways, access ways. - Housekeeping shall be done prior to commencement of work. Proper housekeeping of the site, cleaning of the working area. - Design work areas to have minimal trip and slip hazards. - Establish drainage to move water away from walkways and avoid pooling. - Illuminate walkways. - Maintain clear walkways (ensure the walkways are free of equipment, tools, construction debris and other materials). - SOP05: Barricading and Signage. - Where work areas are unsafe due to uneven ground the work areas are to be graded. - Use footwear that provides good slip resistance.	3	3	9	Unlikely to significantly reduce the likelihood. Slips, trips and falls are common in the construction industry.	Site Supervisor, Site Engineer, Construction Manager.
56			Open water (working near the river)	Due to going near river without any authorization.	4	4	16	Single	- SOP05: Barricading and Signage - SOP14: Work Near or Over Water	1	4	4	Controls should reduce the likelihood but not consequence.	Site Supervisor, Site Engineer, Construction Manager.
Batching Plant Operations														
1.		Aggregate batching system / Feeding	Pedestrian Loader interaction	- Hit by or struck by machine or bucket or material while feeding aggregate and sand with loader - Distraction - Fatigue - Poor visibility	3	4	12	Single	- SOP05: Barricading and Signage - SOP04: Mobile Equipment - SOP07: Safe Driving - SOP09: Material Haulage (Loading and Unloading) - SOP10: Traffic Interface Planning - SOP15: Illumination - SOP28: Plant and Construction Operation	2	4	8	Largely administration controls. Likelihood reduced due to lower potential of multiple fatalities.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT														
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility	
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk			
2.		Dust	Dust due to dry material and vehicle movements	3	4	12	Single	- SOP21: Hazardous Materials - SOP28: Plant and Construction Operation	2	4	8	Correct application of wetting & ventilation should lower the likelihood of this.	Site Supervisor, Site Engineer, Construction Manager.	
3.		Chemical hazards	Injury due to steel fibers and chemical contacts During feeding and physical contact	3	3	9	Unlikely	- SOP28: Plant and Construction Operation - SOP21: Hazardous Materials	2	3	6	Potential still exists for terminal lung disease from inhaling silica or fibrous materials. In addition, the controls are focused on PPE.	Site Supervisor, Site Engineer, Construction Manager.	
4.	Conveyor belts	Caught in between	working near conveyor belts with loose clothing and missing barricades	4	4	16	Single	- SOP28: Plant and Construction Operation - SOP05: Barricading and Signage - SOP22: Equipment Inspection and Maintenance - SOP20: Electrical Systems	2	4	8	These controls reduce the likelihood but won't reduce the consequence	Site Supervisor, Site Engineer, Construction Manager.	
5.	Mixer System	Struck by or Caught in between	Caught in between or struck by while working /maintenance during operations	4	4	16	Single	- SOP28: Plant and Construction Operation - SOP05: Barricading and Signage - SOP22: Equipment Inspection and Maintenance - SOP20: Electrical Systems	2	4	8	These controls reduce the likelihood but won't reduce the consequence	Site Supervisor, Site Engineer, Construction Manager.	
6.	Traffic movement	Knocked over or struck by or run over	Vehicle operations in the area and unauthorized entry	4	5	20	Multiple	- PR01: Induction Process - PR04: Personnel Competency and Training - Check in Check out procedures - SOP01: Explosives – Storage, Transport and Use - SOP04: Mobile Equipment - SOP07: Safe Driving. - SOP10: Traffic Interface Planning. - SOP05: Barricading and Signage. - SOP22: Equipment & Inspection & Maintenance.	2	5	10	Largely administration controls. Likelihood reduced due to lower potential of multiple fatalities	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.	



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
7.		Unprotected edges	- Vehicles operations close to the unprotected edges - Equipment failure - Wet roads - Speeding - Falling material - Inadequate visibility - Blind spot - Distraction - Fatigue - Equipment failure (e.g. brakes, steering)	3	5	15	Multiple	- SOP04: Mobile Equipment - SOP05: Barricading and Signage. - SOP07: Safe Driving. - SOP10: Traffic Interface Planning. - SOP22: Equipment Inspection & Maintenance.	2	5	10	If an accident occurs it may still result in multiple fatalities. None of these controls restricts a truck to only killing one person	Driver, Operator, Site Supervisor, Site Engineer, Construction Manager.
8.	Maintenance operations	Caught in between Struck by Electrocutd	Maintenance work without any lock out and tag out process	3	4	12	Single (unlikely to be multiple)	- SOP20: Electrical Systems - SOP22: Equipment Inspection & Maintenance	2	4	8	Controls rely on behavior. Potential controls are not effectively put in place.	Site Supervisor, Site Engineer, Construction Manager.
9.	Electrical Installations	Electric shock and electrocution	- Due to current leakage if the RCCB/ELCB not/properly installed. - Poor electrical installations and fittings	3	4	12	Single (unlikely to be multiple)	SOP20: Electrical Systems	2	4	8	Controls rely on behavior. Potential controls are not effectively put in place.	Site Supervisor, Site Engineer, Construction Manager.
10.	General	Slip, trip and fall	- Improper placement of material - Poor housekeeping - Convenience	5	3	15	Unlikely	- Proper placement of all material away from the walkways, access ways, Proper housekeeping, cleaning of the site - Design work areas to have minimal trip and slip hazards. - Illuminate walkways. - Housekeeping shall be done prior to commencement of work. - Maintain clear walkways (ensure the walkways are free of equipment, tools, construction debris and other materials). - Establish drainage to move water away from walkways and avoid pooling. - SOP05: Barricading and Signage. - Where work areas are unsafe due to uneven ground the work areas are to be graded. - Use footwear that provides good slip resistance.	3	3	9	Controls rely on behavior. Potential controls are not effectively put in place.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
11.		Open water	- Slips and trips - Overbalance - Bank collapse	4	4	16	Single	SOP14: Working Near or Over Water	1	4	4	No change to severity but lower likelihood.	Site Supervisor, Site Engineer, Construction Manager.
12.		Pets in working area like dogs, goats	- Due to improper site fencing, - Lesser awareness in locals.	3	5	15	Multiple	- SOP01: Explosives – Storage, Transport and Use - SOP05: Barricading and Signage - SOP07: Safe Driving	2	5	10	No change to severity but lower likelihood.	Site Supervisor, Site Engineer, Construction Manager.
13.		Entry of unauthorized personnel in working area	Locals entering at site without authorization etc.	5	5	25	Multiple	- PR01: Induction Process - PR04: Personnel Competency and Training - Check in Check out procedures - SOP05: Barricading and Signage	3	5	15	No change to severity but lower likelihood.	Site Supervisor, Site Engineer, Construction Manager.
Crushing Plant Operations													
1.	Hopper Feeding	Being knocked over Hit by or struck by Caught in between	- Feeding during excavator or loader, hit by or struck by machine or bucket or material. - Distraction - Fatigue - Poor visibility	3	4	12	Single	- SOP28: Plant and Construction Operation - SOP05: Barricading and Signage - SOP04: Mobile Equipment - SOP07: Safe Driving - SOP09: Material Haulage (Loading and Unloading) - SOP10: Traffic Interface Planning - SOP15: Illumination	1	5	5	Largely administration controls. Likelihood reduced due to lower potential of multiple fatalities	Site Supervisor, Site Engineer, Construction Manager.
2.		Dust	Dry material	3	4	12	Single	- SOP18: Ventilation - SOP28: Plant and Construction Operation - SOP21: Hazardous Materials	2	4	8	Correct application of wetting & ventilation should lower the likelihood of this	Site Supervisor, Site Engineer, Construction Manager.
3.		Noise	Noise due to machine operations if not using ear plugs	4	3	12	No	- SOP22: Equipment & Inspection Maintenance. - SOP28: Plant and Construction Operation	3	3	9	Unlikely to drop the likelihood to “Possible” due to the typically poor implementation of noise controls	Site Supervisor, Site Engineer, Construction Manager.

RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
4.	Jaw crushing and vibration feeder	Struck by Caught in between	Caught in between or struck by wheel rotation while working during operations	3	4	12	Single	- SOP20: Electrical Systems - SOP28: Plant and Construction and Operation - SOP05: Barricading and Signage - SOP22: Equipment and Inspection and Maintenance	3	3	9	These controls reduce the likelihood but won't reduce the consequence	Site Supervisor, Site Engineer, Construction Manager.
5.	Conveyor belts	Caught in between	Working near conveyor belts with loose clothing and missing barricades	4	4	16	Single	- SOP28: Plant and Construction and Operation - SOP05: Barricading and Signage	2	4	8	These controls reduce the likelihood but won't reduce the consequence	Site Supervisor, Site Engineer, Construction Manager.
6.	Vibration screens	Struck by	Rebounding stone or stone particles from screens	3	3	9	Unlikely	SOP28: Plant and Construction and Operation	1	3	3	These controls reduce the likelihood but won't reduce the consequence	Site Supervisor, Site Engineer, Construction Manager.
7.		Dust	Dry material	3	4	12	Single	- SOP18: Ventilation - SOP28: Plant and Construction and Operation - SOP21: Hazardous Materials	2	4	8	Correct application of wetting & ventilation should lower the likelihood of this	Site Supervisor, Site Engineer, Construction Manager.
8.		Noise	Noise due to machine operations if not using ear plugs	4	3	12	No	- SOP22: Equipment & Inspection and Maintenance. - SOP28: Plant and Construction and Operation	3	3	9	Unlikely to drop the likelihood to "Possible" due to the typically poor implementation of noise controls	Site Supervisor, Site Engineer, Construction Manager.
9.	Traffic movement	Knocked over or struck by	Vehicle operations in the area	4	5	20	Multiple	- SOP05: Barricading and Signage - SOP04: Mobile Equipment - SOP07: Safe Driving - SOP09: Material Haulage (Loading and Unloading) - SOP10: Traffic Interface Planning - SOP15: Illumination - SOP28: Plant and Construction and Operation	2	5	10	Largely administration controls. Likelihood reduced due to lower potential of multiple fatalities	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
10.		Unprotected road edges	Vehicle operations in the area	2	5	10	Multiple	- SOP05: Barricading and Signage - SOP04: Mobile Equipment - SOP07: Safe Driving - SOP09: Material Haulage (Loading and Unloading) - SOP10: Traffic Interface Planning - SOP15: Illumination	1	5	5	Largely administration controls. Likelihood reduced due to lower potential of multiple fatalities.	Site Supervisor, Site Engineer, Construction Manager.
11.	Maintenance operations	Caught in between Struck by	Maintenance work without any lock out and tag out process	4	4	16	Single	- SOP28: Plant and Construction Operation - SOP05: Barricading and Signage - SOP22: Equipment Inspection and Maintenance - SOP20: Electrical Systems	2	4	8	These controls reduce the likelihood but won't reduce the consequence	Site Supervisor, Site Engineer, Construction Manager.
12.		Electrocuted	- Poor electrical installations and Maintenance - Work without any lock out and tag out process	3	4	12	Single (unlikely to be multiple)	- SOP20: Electrical Systems - SOP22: Equipment Inspection & Maintenance	2	4	8	Controls rely on behavior. Potential controls are not effectively put in place.	Site Supervisor, Site Engineer, Construction Manager.
13.	Electrical Installations	Electric shock and electrocution	- Due to current leakage if the RCCB/ELCB not/properly installed. - Poor electrical installations and fittings	3	4	12	Single	- SOP20: Electrical Systems - SOP22: Equipment Inspection & Maintenance	2	4	8	Controls rely on behavior. Potential controls are not effectively put in place.	Site Supervisor, Site Engineer, Construction Manager.
14.	General	Personal injury	- Improper placement of material, - Poor housekeeping	5	3	15	Unlikely	- Proper placement of all material away from the walkways, access ways, Proper housekeeping, cleaning of the site. - Design work areas to have minimal trip and slip hazards. - Illuminate walkways. - Housekeeping shall be done prior to commencement of work. - Maintain clear walkways (ensure the walkways are free of equipment, tools, construction debris and other materials). - SOP17: Water Management - SOP05: Barricading and Signage. - SOP27: Tunneling Operation.	3	3	9	Controls rely on behavior. Potential controls are not effectively put in place.	Site Supervisor, Site Engineer, Construction Manager.



RISK ASSESSMENT													
i. SN#	Activity	Hazards	Reasons	Risk Ranking			Fatality Risk?	Control Measures	Evaluation after choice of measures			Residual justification	Responsibility
ii.				Likelihood	Consq	Risk			Likelihood	Consq	Risk		
								• PR11: Personal Protective Equipment.					
15.		Open water	Open edges Slips and trips Bank collapse Distractions	4	4	16	Single	• SOP14: Working Near or Over Water	2	4	8	No change to severity but lower likelihood.	Site Supervisor, Site Engineer, Construction Manager.
16.		Pets in working area like dogs, goats	Due to improper site fencing, lesser awareness in locals.	3	5	15	Multiple	• SOP05: Barricading and Signage • SOP07: Safe Driving	2	5	10		Site Supervisor, Site Engineer, Construction Manager.
17.		Entry of unauthorized personnel in working area	Locals entering at site without authorization etc.	4	5	20	Multiple	• Induction Process • PR04: Personnel Competency and Training • Check in Check out procedures • SOP05: Barricading and Signage	2	5	10	No change to severity but lower likelihood	Site Supervisor, Site Engineer, Construction Manager.

Note: OHS team of the Contractor shall prepare the risk assessment using this template based on their work procedures and equipment to be used. Update as required when there are changes in the procedure and equipment and monitor all activities for compliance and implementation.

Project Manager:

OHS Officer:

Signature

Signature

Annex 3: Sample SOP01: Explosives- Storage, Transport and Use



SAMPLE**Standard Operating Procedures
(SOP01: Explosives- Storage, Transport and Use)****JUNE 2025****Revision. 00**

Prepared By		Reviewed by	
	OHS Officer		Project Manager
Date:		Date:	

[NAME OF THE CONTRACTOR]

Detail of the Documents

DOC. No.	Title	Pages.
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Revision History

Version	Date	Comments	Prepared By	Approved By
00	20/06/2025	First Draft for review by the Engineer		

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1 SOP01: Explosives - Storage, Transport and Use

1.1 Purpose

This standard provides minimum safety requirements that are mandatory to safely execute explosive operations at the Project.

Bhutanese legal requirements and international best practices (e.g., OSHA, ILO COP) as agreed in the contract are covered in this standard.

1.2 Reference

- SOP03 - Barricading and Signage
- SOP04 – Safe Driving
- PR 09 - Work Observation Process
- PR 12 - Incident Investigation Process
- International Tunneling and Underground Space Association (ITA), November 2008. ITA Guidelines for Good Occupational Health and Safety Practice in Tunnel Construction. ITA Report No 001.
- Labour and Employment Act, 2007, Dept. of Labour, Ministry of Industry, Commerce and Employment
- Occupational Health and Safety Regulations 2022, Department of Labour, Ministry of Industry, Commerce and Employment.
- International Labour Office (ILO), 1992. Safety and Health in Construction.

1.3 Scope

This operating standard is applicable to all activities involving explosives including but not limited to acquisition, transportation, storage, transfer, blasting and recycling activities.

1.4 Definitions

Magazine: means a building specially constructed in accordance with a design approved by the authority having jurisdiction (in Bhutan Chief Inspector of Explosives) and intended for storage of more than 5 kg of explosives.

Detonator: means a capsule or case which is of such strength and construction and contains fulminate in such quantity that the explosion of one capsule or case would communicate the explosion to like capsules or cases when in the proximity.

Safety fuse means a fuse for blasting which burns and does not explode, and which does not contain its own means of ignition, and which is of such strength and construction, and contains an explosive in such quantity that the burning of such fuse would not communicate laterally with other like fuses.

1.5 Responsibilities

1.5.1 All Workers

- All persons who have a requirement to work with explosives (storage, transport, handling and use) must do so in compliance with this standard (as a minimum).
- Undertake a personal pre-task risk assessment before commencing any work, review the risk assessment if a change is experienced.
- Stop the work if uncontrolled unmitigated hazards are present.
- Raising hazards, near misses and incidents relating to this standard as per Incident Investigation Procedure

1.5.2 OHS Officer or his designate

- HSE Director or his designate shall ensure that:
- Only competent personnel can handle the explosives



- Regular inspection / audit is being done specific to this standard compliance and gaps are being tracked for closure. Stop the work if unmitigated hazards are present
- Any near miss or non-compliance of this standard is reported and investigated as per Incident Investigation Procedure
- Shall arrange to conduct a quarterly audit / inspection to ensure compliance to this standard

1.5.3 Site Supervisor

- Are solely responsible for implementing this standard at the worksite
- Ensure that Work Authorization (PTW) has been obtained from the Engineer before doing any physical activity at worksite
- Ensuring that only competent (trained, skilled and experienced) personnel are allowed to handle explosives
- Utilize minimum number of personnel while doing explosives related activities to reduce unwanted exposure

1.5.4 Blaster / Shot Firer

- Maintain required licenses for working with explosives
- Only undertake assignment when fit for the duty
- Make sure that PTW has been obtained from the Engineer and follow the agreed blast plan
- Establish the blast area and remove all persons from the area before the blast is fired.
- Ensure that all access routes to the blast area are guard or barricaded to prevent people and vehicles from entering.
- Before firing a blast, give ample warning to allow all persons to be evacuated from the blast area.
- Conduct a post-blast inspection to be certain the blast area is safe before anyone re-enters.

1.5.5 Other Staff

- Magazine Manager, is in charge of the full management of magazine on fortnightly basis. Magazine storekeeper, in charge of the daily management on the out-put and in-put of blasting materials of magazines.
- Supervision Engineer can audit the explosive magazine as and when required basis.
- Security guards, in charge of the security of the magazine on 24h/day.

1.6 Personnel Competency

- Following are the minimum competency criteria for the personnel handling explosives.
- Where personnel are falling short of that they should work as an SSW on the same job until they have been assessed and declared as graduated and competent.

TITLE / ROLE	MINIMUM COMPETENCY REQUIRMENT
Blaster / Shot firer	Relevant training certification, license and five years of relevant experience. The blaster shall be knowledgeable and competent in the use of each type of blasting method used. Blaster shall be in good physical condition and not take any narcotics, intoxicants, or similar types of drugs.
Magazine Supervisor	Relevant training certification and min 2 years of relevant experience
Loading staff	Relevant training certification and min 2 years of relevant experience
Security Staff	Trained in security job and aware of hazards of explosives and protocol for the magazine operation. Shall be trained on basic fire fighting



Van driver	License to operate the vehicle, licence to handle the explosives, training certificate, and min three years of relevant experience
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1.7 Audit / Inspection

OHS Officer or his designate shall arrange to conduct a quarterly audit / inspection to ensure compliance to this standard. Gaps identified in this audit shall be rectified on priority basis.

1.8 Explosive Handling and Management Procedure

1.8.1 Construction and Operation of the Magazine

Royal Government of Bhutan has issued Explosive Rules 2008 and ILO Code of Practice and provides requirements that must be adhered at all time for the magazine construction and operation.

1.8.2 Construction of the Magazine

- Magazine shall be constructed in accordance with Explosive Rules 2008 and Explosives Magazine Construction Permit must be obtained from the Royal Bhutan Police.
- The magazine must be located in an isolated area, far from public settlements, schools, hospitals, and roads.
- Minimum distance requirements (commonly 500m to several kilometers depending on the amount of explosive stored).
- The area must be geologically stable and not prone to landslides or floods.
- Must be built using non-flammable materials like RCC (Reinforced Cement Concrete).
- Adequate ventilation, temperature control, and lightning protection must be provided.
- Layout must include blast-proof walls, fencing, and access control points.
- Separate chambers for detonators and explosives, with safe distance between them.
- 24/7 security personnel or surveillance systems.
- Clear warning signage around the perimeter.
- Emergency response plan, including firefighting systems, must be in place.
- Entry to the magazine is restricted to authorized personnel only.
- Appropriate safety signs in local language shall be installed out of the magazine, showing no mobile phone, no match or lighter to be taken inside and a "No Smoking" sign

iii.



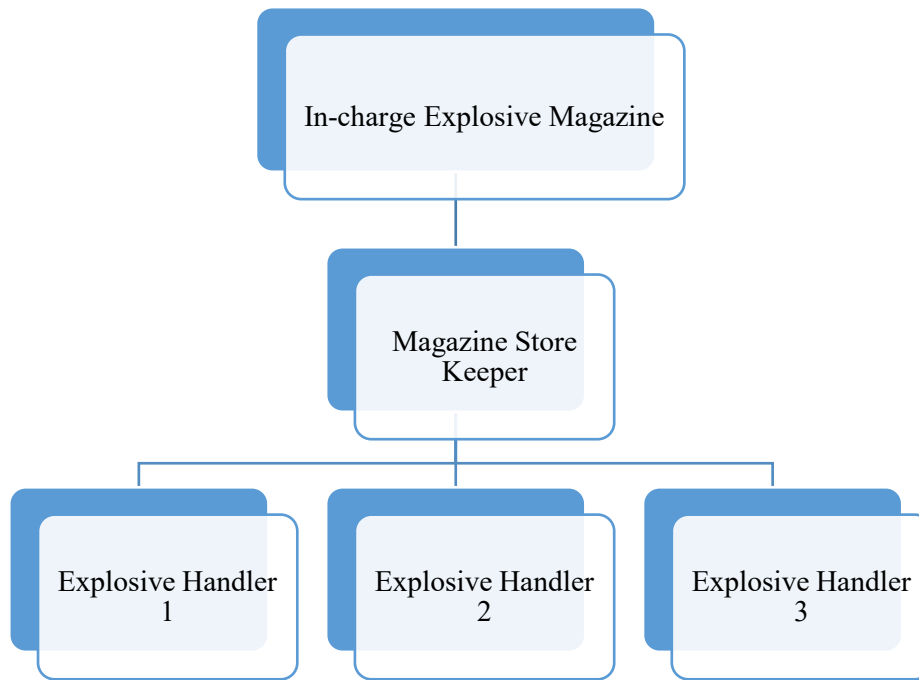


Figure SOP01-01: Explosive Magazine Management

1.8.3 Operation of the Magazine

General

- As per the contract requirement; no magazine store keeper shall be allowed to work more than ten hours in any 24 hours period and shall not be required or allowed to perform any other duty that will interfere with his duties as a magazine keeper.
- The name and address of the In-charge Explosive Magazine shall be intimated to the licensing authority having jurisdiction (provincial office of explosives)
- Operating license shall be obtained before magazine operation.
- No metallic, or hard staff causing impact or mobile phone, cigarettes, lighter or match box shall be taken inside the magazine
- Only flameproof electric lighting equipment shall be allowed in explosives magazines.
- Smoking shall not be allowed near the magazine
- Building to be kept clean, no grit, and constructed to cover the metallic structure
- Any combustible thing such as oiled rags, cotton rags something that can catch spontaneous fire not to be taken inside the magazine
- Minimum 5-meter area around the magazine store shall be clear from any kind of vegetative cover to avoid the risk of fire.

Security of the Magazine

- Magazine shall be guarded by security staff with enough strength who will be trained and maintain a log of personnel
- Magazine shall be kept locked all times and shall only be opened by authorized Magazine Store Keeper for the purpose of bringing in explosives or taken out
- Prohibit any fire totally around magazine and it must be extinguished as soon as possible when fires are observed.
- If a fire accident occurs in/around the magazine, the security will initiate firefighting immediately to extinguish fire.

Protection Against Lightening

- i. Lightning conductors installed at the magazine
- ii. Resistance of the conductor system tested by the engineer or a person having resistance testing competency training. Results displayed and one copy sent to the competent authority (explosive department)
- iii. When a thunderstorm is imminent, personnel nearby shall be moved away from the magazine

Record keeping

- Up to date records of explosives shall be maintained on the prescribed forms and retained for a minimum of 3 years and shall submit a report showing purchase, possession, sale, use, theft and destruction of explosives at the end of each fortnight on the following forms (actual templates given at the end of this SOP).
- i. Accounts of Receipts of Explosives FORM SOP01-EM-09D
- ii. Accounts of Explosives Used as per Form SOP01-EM-10E
- iii. Accounts of Explosives Transported by Road Van FORM SOP01-EM-10B
- iv. Accounts of Return of Explosives (if applicable) FORM SOP01-EM-10B

1.8.4 Storage and handling of explosives

- i. Overshoes should be kept at each store and worn by people who have to enter them.
- ii. Containers of explosives should not be opened with sparking tools, provided that metal slitters may be used to open cartons or similar containers.
- iii. Inventory as much authorized in the license of the magazine shall be stored.
- iv. Detonators and explosives shall be kept in separate premises

1.9 Explosives of different classes to be kept separate and transport in separate vehicles

- i. Follow manufacturers' guidelines for the storage, handling, transportation and use of explosive materials.
- ii. Set up the inventory of explosive materials to ensure that, the oldest stock is used first.
- iii. No package shall be opened inside the magazine, it will only be opened at a certain distance (as directed by authority) from the magazine on a smooth surface. The unpacked blasting material must be repacked before storing it again.
- iv. Explosives shall always be kept in its original package. If the original package brakes, the explosives must be kept in an approved package
- v. Only keep the inventory as authorized in the license.
- vi. The Contractor shall not handover or sell leftover explosives. Leftover explosives shall be returned to the explosive supplier as per the Explosive Rules 2010.
- vii. Personnel receiving the explosives will be escorted by the Magazine Manager when they go into the magazine.
- viii. All the blasting material will be handled with care during transportation and carrying in accordance with the manufacturers' specifications.
- ix. Different types of explosives shall be segregated in their original casing at appropriate distance / casing
- x. There shall be access between the explosive stockpiles for checking, counting and loading/unloading.
- xi. The height limit of explosive and igniter fuse stockpile will be 1.8 m and the limit of detonator stockpile will be 1.6 m.
- xii. Explosives recovered from blasting misfires shall be placed in a separate magazine. Disposal of misfired explosives will be registered in the appropriate record.

Receipt of explosives in magazine

- The blasting materials shall be received only by the Magazine Store Keeper.
- Van shall not be taken inside the store house. It must be parked 2.5m from the gate for loading / unloading.
- The Magazine Store Keeper shall enter the magazine area only after passing the security checks by the security guards.
- Relevant records shall be updated



1.9.1 Transportation of explosives

Government of Bhutan has issued Explosive Act 1989 and ILO Code of Practice which provides detailed requirements. Following includes those detailed requirements.

1.9.2 General

Explosive Act 1989 require a licensed vehicle for the transportation of explosives. Hence the Contractor has acquired the services of van from the explosive dealer in Pakistan Wah Nobel. Their vehicle is pre-approved and the driver is also experienced.

1.9.3 Specifications of the vehicle

- Air space between body and cab shall be at least 15 cm
- Driver's cab shall be fitted and covered externally with 0.914 mm aluminum sheeting. If the Driver's cab is fitted with wood it shall be treated to make it unflammable
- Cab doors shall be fitted having windows of non-splint (shatter proof) type glass
- Wind screen shall be fitted with the portion in front of the driver's seat pivoted on strong bras quadrants for opening
- Fuel tank shall be in front of fire screen. It should be located as to minimize the possibility of it being damaged if the vehicle has an accident. Stone guards should be provided.
- Fuel cut-off shall be fitted on the feed pipe in an easily accessible position and shall be capable of being operated without lifting the bonnet.
- Fire Extinguisher- Two chemical fire extinguisher of minimum 2kg shall be provided. Should be capable of Petroleum fire.
- Lighting- All electric wirings and battery cables shall be fully enclosed and maintained in good operating condition.
- Fire Screen - shall consist of only ply asbestos and 18-gauge steel sheet fitted to the whole driver's cab and extending to within 300 mm of the ground. The part extending from bottom of the cab to within 390 mm of the ground shall be carried on iron angle frame of light construction
- Painting and marking- Body and cab shall be painted and marked and lined with a color approved by the licensing authority. The van should be painted with aluminum or white paint. The letter "E" should be written prominently on the sides and rear of the van. The name and address of the licensee and license number should be written in small letters on one side. Vehicles holding inter-state or national permits shall be painted as per directions of road transport authority. However, another circle of 60cm diameter in red color should be painted on one of the flaps of the rear door of the van with the letter "E" inscribed in a circle.
- Total max load - shall not be more than as per license or vehicle own carrying capacity
- Tracking System – Van shall have tracking system for monitoring
- Vehicles used for the transport of explosives or detonators should be regularly inspected and maintained to check that they do not present any risk to the materials carried.

1.9.4 Loading offloading the vehicle

- Vehicle driver and Magazine Store Keeper shall ensure that:
- Detonators and the explosives shall be transported in separate vehicle in their original containers
- Carriage carrying the explosives, its inside that may meet the explosive package be covered with leather, lead, cloth or wood to avoid heat generation causing fire
- Explosives of different classes to be kept separate and transport in separate vehicles
- Containers should be marked to show the type of explosive kept in them.
- Put the explosives or detonators boxes gently on the ground or in to the container.



- The explosives shall be transported in wooden lined, lockable boxes (non-metallic locks) and the containers will be properly secured with straps (ropes or steel wire cables are not acceptable), to allow the boxes to be quickly moved to another vehicle in case of vehicle breakdown. No metallic object, such as handles, should be used for box handling which increases risk of sparks.
- No person shall smoke, or carry matches on any other flame producing device
- Loading shall be done in and stowed in a manner that:
 - explosives will not move and will be protected against friction and bumping,
 - after unloading still, the remaining loads can be stowed
 - During loading and offloading engine must be OFF, hand breaks applied, and wheels chock inserted

1.9.5 Driving the vehicle

- Driver shall not be less than 25 years of age, should have a driving license and be physically fit
- Transportation of explosives shall not be done in a towed vehicle or a vehicle towing another
- No other goods shall be carried with explosives
- No EXTRA passengers are allowed in the vehicle, only the driver and the Security guards.
- No radios or mobile phones to be turned on during transportation of detonators.
- If the van is parked at night on a public road the driver shall keep parking lights on, also install reflectors on vehicle for prominent warning of stationary vehicle
- In case of fire the driver shall warn and keep other vehicles and personnel minimum 300 m away
- No explosives should be transferred from the vehicles during the course of travel, near congested areas, public roads or inhabited buildings except in case of emergencies such as breakdown of the transportation vehicle.
- Vehicles transporting explosives shall avoid congested areas and heavy traffic unless it is a designated route. Routes for hazardous materials that have been designated by local authorities shall be followed. Do not stop or park the vehicle in villages or towns.
- The vehicle shall make no unnecessary stops.
- In case of a breakdown of the van, the driver or the person in charge of the vehicle shall-
 - Permit to make minor repairs (such as inflating a tire or mirror adjustment) if the repairs can be made posing an ignition
 - If major repairs are required, they are not carried out prevent such repairs until the explosives have been transferred to another van or removed from the vehicle and stored under proper security and care at a safe distance from the highway at least 300m away from personnel, inhabited premises and vehicles.
 - Report any breakdowns\ to the Contractor management. The Contractor management will who shall in turn report all details to the Chief Inspector and the inspector of explosives of the Jurisdiction
 - Security guard(s) shall accompany the explosives be provided from the place of loading to the place of unloading. Vehicles transporting explosives shall never be left unattended.

1.9.6 Explosive Release from the Magazine

This section gives guidance to the loaders and the magazine store keepers for safely collecting and releasing the explosives.

1.9.7 Instructions

- Explosive Magazine Pass will be issued by the HSE department and will require approval and consent from the Contractor Project Manager.



- Personnel entering the storage area shall carry an “Explosives Magazine Pass” at all times. Personnel without this Pass on will not be allowed to enter.
- On receipt of the day’s program, the Explosive Handler will collect explosives for the day’s job.
- The Explosive Handler hands over a request for the quantity of explosives required for the day’s work.
- The authorized person/store keeper will issue the quantity required to the explosive handler. This must be physically checked by the Store Keeper separately. The quantity must be reflected in the stock book / prescribed forms and signed off by both persons.
- The collection of explosives must be suspended if a thunderstorm and/or lightening occur.
- At the end of the day’s job, all unused explosive must be returned to the magazine for storage and the stock book/prescribed forms updated to reflect the return for safekeeping.
- Explosives must be kept in their boxes and guarded until they are put in the magazine.
- The in-charge of the magazine must reconcile the quantity of explosives returned in the log book.
- Any discrepancies must be reported immediately to the Project Manager, EHS Manager, the Engineer and to the Employer’s Representative. The discrepancies are to be fully investigated and corrective actions developed to prevent a recurrence
- The Store Keeper will then record in the stock book the following day:
 - Opening stock
 - Quantity consumed
 - Quantity returned
 - Final stock.
- The Store Keeper is in charge of pre-loading and the “Magazine In-charge” is in charge of the magazine. Both of them must sign off these figures.
- The stock book and all explosive record books must be left locked in the magazine for inspection and properly secured.
- Explosives shall be used in the order in which they are delivered so that old stocks are not allowed to accumulate.
- Visual checks shall be maintained to safeguard against deterioration of explosive stocks

1.9.8 Blasting Operation

1.9.9 Approval Requirements Prior Blasting Operation

- The Contractor team shall obtain a PTW to carry out the blasting. At a minimum the PTW shall include blasting plan, Job Hazard Analysis (JHA) and TBT form.
- Prior blasting inspection and approval shall be granted by the Engineer.
- The design of the blasting point shall take full consideration of the rock’s occurrence; type, degree of joint development and the trend of the rock mass by geology section. Blasting engineer will design the blasting pattern. AFI for blasting shall be submitted to the Engineer for review and approval.
- The blasting area will be selected in the line of resistance at the minimum and provisional surface areas to create more temporary surface.
- The direction of blasting hole and the rock shall roughly be parallel. According to the conditions of rock shape and the joint cracks then the right hole will be selected, oblique hole and flat hole etc.





1.9.10 Preparation before blasting:

- Detonators or explosives not immediately required for immediate use in tunnel should not be stored in the tunnel.
- If a change of shift is involved, a detailed handover (including handover documentation) shall be exercised.
- Preferably blasting should be done off shift or during breaks in the work.
- Preferably blasting above ground should be done in daylight.
- If blasting can endanger workers working on other contracts/operation:
 - a. blasting times shall be agreed between the two Contractors,
 - b. shots will not be fired until a warning has been given to the other Contractor and appropriate controls have been established.
 - c. the blasts are not to go ahead unless the blast zone is clear of all personnel
- If blasting above ground has to be done during darkness, roadways and pathways should be adequately lit.
- Only required explosives to be shifted to the work front. No surplus explosives are to be taken to the work front.
- Only water-resistant explosives should be used in tunneling.
- Under freezing conditions only explosives not susceptible to the cold should be used. In order to ensure adequate transmission of the detonation, cartridge diameter must be more than 30 mm and the space between explosives and surrounding material should be as small as possible.
- Initiator should be adequately maintained and initiator should match the detonator being used.
- Electrical fire lines should be installed on opposite sides of the tunnel away from power and water lines and no other electrical circuit should be installed on the same side of the tunnel as the blasting circuit.
- At an appropriate time before the final blasting warning signal, workers in the area and all unauthorized local people will be removed to a designated safe place outside of the blast exclusion zone the area being charged up will be demarcated with red flags prior to the commencement of charging up. This area was under the blasting supervisor and no access shall be permitted to unauthorized personnel. Safety staff will be used to secure the area prior to blasting, if necessary, Security and police shall also be used.
- All electronic devices shall be kept off while entering 100mtr radius of the charging area. Strict supervision shall be done to ensure the compliance

1.9.11 Emergency Preparedness Prior to Blasting

- The shot firer will conduct a safety sweep or clearance of the blast exclusion zone once the blast guards have confirmed (using positive communication) that they are in the correct locations (including but not necessarily limited to all access routes into the blast exclusion zone) and the area is clear of unauthorised personnel and equipment. All areas within the blast exclusion zone will be inspected for unauthorised personnel and equipment. Ensure that any buildings have been checked for presence of personnel.



- The blaster/shotfirer and the blast guards must remain in direct radio contact by use of hand held 2-way radios at all times.
- Guards must remain at their posts until they have received definite instructions to leave.
- Where equipment cannot be removed it must be as a minimum shutdown, isolated and secured from the possible effects of the blast.
- Weekly blasting schedule will be shared with the Engineer, police station and any other stakeholders (if needed). If there is a change, the modified schedule will be delivered to the same not later than twenty-four (24) hours before the first ignition of the day.
- Stand by ambulance shall be ready at the blast site at a safe distance (outside the blast exclusion zone) with qualified medic.
- All electronic devices shall be kept off while entering 100 metre radius of the charging area. Strict supervision shall be done to ensure the compliance.

Blasting and Alarms

- Before any shot is fired, all electrical circuits other than the blasting circuit should be de-energised within an adequate distance from the firing point.
- If a change of shift is involved detailed handover (including notes) shall be exercised.
- Ensure that mobile radio transmitter which is less than 30 meters away from the electric blasting caps, in other than original containers, shall be de-energized and effectively locked.
- Only suitable (Ex rated) battery lamps should be used during loading shot holes.
- Visual and audible warning signals, flags and barricades shall be used to create segregation.
- A siren of sufficient volume will be installed to be easily heard above the general site noise from all points within a radius of 1km of surface blasts. Road shall be closed with a prior intimation to all the stakeholders through the Engineers Real Time Communication social media group. Warning will be given by ringing Blasting siren, as follow:

Warning Signal 1st

The first warning is anticipating signal (once) which will be launched when the blaster arrives at site and is to charge the explosive and will last for 10~15s. Meanwhile, security guard/s will be arranged to stop unauthorized entry.

Warning Signal 2nd

The second warning is preparation signal which will be raised 30~60 minutes after anticipating signal when charging has been completed and safety guard/s have been arranged to clear off all people at the blasting area. This warning will be 10~15s and in two times with an interval of 2~3s.

Blast Signal 3rd

The third is initiation signal which will be sounded 15~20 minutes after preparation signal when all people have been cleared and before firing and initiation. It will be at a time and last for 10~15s.

All Clear Green Signal

The final warning is a green signal. It will be given out 10~15 minutes after blasting and after everything is cleared by the blaster. This warning will last for 10~15s and at only one time.



Blasting Notification display boards located at the main entrances to the site, as well as other locations, will be updated by the start of shift daily with the blasting schedule for that day.

1.9.12 Post Blasting Operations

- After blasting, the siren shall be operated to inform nearby people.
- Before continuing work, the blaster will inspect and verify that there is no explosive left.
- After every blast, the sides, workface and ceiling shall be inspected and cleared of loose rock.
- Guards must remain at their posts until they have received definite instructions to leave.
- After safe blasting, the excavated materials are removed then traffic will be resumed.

1.9.13 Misfire

- If a misfire is found, the blaster will provide proper safeguards for excluding all employees from the danger zone.
- No other work will be done except that necessary to remove the hazard of the misfire and only those employees necessary to do the work will remain in the danger zone.
- No attempt will be made to extract explosives from any charged or misfired hole; a new primer will be put in and the hole re-blasted.
- If re-firing of the misfired hole presents a hazard, the explosives may be removed by washing out with water or, where the misfire is under water, blown out with air. Misfire shall be recorded and reported to the Engineer as near-miss.
- If there are any misfires while using cap and fuse, all employees will remain away from the charge for at least 1 hour. Misfires will be handled by blast the shot firer. All wires will be carefully traced and a search made for unexploded charges.
- No drilling, digging, or picking will be permitted until all missed holes have been detonated or the Blasters has approved that work can proceed.

1.9.14 Leftover Explosive Materials

- If any blasting material remains after blasting construction, all the blasting material remaining must be handed back to the magazine by Handler in the same duty shift.
- When blasting material is handed back to the magazine, the Handler shall keep a material detailed sheet with information including receiver, receiving group, type, specification, quantity, reason of handing back and time relating to the material returned. The sheet shall be signed and confirmed by the authorized explosives handlers.
- Explosives shall be kept in their original packs. The Store Keeper shall maintain the records and put all materials back into the magazine after checking. After storing the blasting material, it should be checked again, and the Store Keeper shall make sure that the surrounding environment is safe in terms of security point of view.

1.9.15 Disposal of Explosives

- The Store Keeper checks varieties and quantities of the expired or unattended blasting materials, report to the material department and the leader who is in charge and apply for destruction.
- The expired and invalid blasting materials are destroyed according to the requirement of Explosives Rules of Pakistan, 2010 after the report is confirmed by material department and the leader who is in charge.
- Based on ILO COP and other requirements, (a) Explosives should not be destroyed except in conformity with the manufacturers' instructions, (b) Empty boxes and paper and fiber packing



materials, which have previously contained high explosives, will not be used again for any purpose, but shall be destroyed by burning at an approved location. (c) No material used in the wrapping or packing of explosives will be burned in a stove, fireplace or other confined space, (d) No person will remain within 30 m of a fire in which wrapping or packing material is burned.

- The relevant documents including procedures, permits and records will be kept



Address:

EXPLOSIVE USE REPORT

[illegible]

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Official Use Only

RETURN OF EXPLOSIVES

DESTRUCTION AND THEFT, IF ANY

		From:				To				From Factory Explosive Magazine [Contractor Name] Dorjilung Hydropower Project	
Date	Explosives issued from Magazine					A/U	Reasons for Destruction	Where theft reported to Police station and Dept. of Explosives. Give ref:	Remarks		
	Name	Class	Div.	Qty							
1	2	3	4	5	6	7	8	9			

