BC EAO EAC Application – Tenas Project

Section 13.0 Management Plans
Chapter 6 Explosives Management Plan

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VERSION 1.0

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Submitted by:	Telkwa Coal Limited Suite 1410 – 409 Granville Street Vancouver, BC V6C 1T2

Tenas Project

Section 13.0 Management Plans
Chapter 6 Explosives Management Plan

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ABBREVIATIONS AND ACRONYMS

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
ANE	Ammonium Nitrate Emulsion
ANFO	Ammonium Nitrate Fuel Oil
ANP	Ammonium Nitrate Prill
AQMP	Air Quality Management Plan (S13.0-C2)
BC	British Columbia
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
BC MEMLI	British Columbia Ministry of Energy, Mines and Low Carbon Innovation
BC MEMPR	British Columbia Ministry of Energy, Mines and Petroleum Resources
BMPs	best management practices
C	Chapter
CEMP	Construction Environmental Management Plan (S13.0-C4)
CEPA	*Canadian Environmental Protection Act*, 1999, SC 1999, c 33
CMSTHP	Chemicals and Materials, Storage, Transfer, and Handling Plan (S13.0-C3)
Code	Health, Safety and Reclamation Code for Mines In British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021)
DMP	Discharge Management Plan (S13.0-C5)
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
EMBC	Emergency Management British Columbia
EMP	Explosives Management Plan (S13.0-C6)
EMS	Environmental Management System (S13.0-C1)
FMSCP	Fuel Management and Spill Control Plan (S13.0-C7)
GovCan	Government of Canada
GPS	Global Positioning System
ISO	International Standards Organization
JAIR	Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019).
LOM	life-of-mine
MA/EMA	*Mines Act*, RSBC 1996, c 293 and *Environmental Management Act*, SBC 2003, c 53
MERP	Mine Emergency Response Plan (S13.0-C9)
MMU	Mobile Mix Unit
MSDS	Material Safety Data Sheet
MOC	Management of Change
MTCP	Minesite Traffic Control Plan (S13.0-C10)

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
MWMP	Minesite Water Management Plan (S13.0-C11)
NPRI	National Pollutant Release Inventory
NRCAN	Natural Resource Canada
OHSP	Occupational Health and Safety Program
Orica	Orica Canada Incorporated
PAG	potentially acid generating
PAMP	Public Access Management Plan (S13.0-C14)
PEP	Provincial Emergency Program
PETN	pentaerythritol tetranitrate
Project	Tenas Project
S	Section
SEMP	Socio-economic Management Plan (S13.0-C16)
SEPSCP	Surface Erosion Prevention and Sediment Control Plan (S13.0-C17)
SPP	Standard Policies and Procedures
TAC	Tenas Access Corridor
TCL	Telkwa Coal Limited
TDG	Transportation of Dangerous Goods
TNT	trinitrotoluene
UTM	Universal Transverse Mercator
WHMIS	Workplace Hazardous Materials Information System
WMPRE	Waste Management Plan for Refuse and Emissions (S13.0-C20)

UNITS OF MEASURE

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
°C	degrees Celsius
>	greater than
"	inch
<	less than
%	percent
BCM	bank cubic metre
cm	centimeters
kg	kilogram
km	kilometre
kV	kilovolt

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
m	metre
mm	millimetre
V	volt

EXECUTIVE SUMMARY

The Explosives Management Plan (EMP) addresses the delivery, storage, use, and handling of explosives for the Tenas Project (Project), including blasting operations. Blasting agents are required for the Project as there is bedrock overlying the economic coal seams that cannot be broken up with dozers, and thus needs to be broken up using explosives to allow removal so that the coal seams can be recovered. The EMP will also address some potential safety issues related to mine traffic onsite. Orica Canada Incorporated (Orica) will be the prime contractor for handling and delivery of explosive materials for Telkwa Coal Limited (TCL) and will conduct these operations from the Explosive Facility. TCL will be responsible for all blast designs and explosive loading and the actual blasting of patterns for the Project.

This EMP is designed to fulfill the guidance provided by provincial and federal statutes and best management practices (BMPs), the Project's Environmental Assessment Certificate (EAC), and the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019) (JAIR) and the resulting *Mines Act*, RSBC 1996, c 293 and *Environmental Management Act*, SBC 2003, c 53 (*MA/EMA)* permits.

Through implementation of this EMP and relevant Standard Policies and Procedures (SPPs), TCL will ensure Project activities are done safely and with minimal impact to the surrounding environment at the Project.

1. INTRODUCTION

The Explosives Management Plan (EMP) addresses the delivery, storage, use, and handling of explosives for the Tenas Project (Project), including blasting operations. Blasting agents are required for the Project as there is bedrock overlying the economic coal seams that cannot be broken up with dozers, and thus needs to be broken up using explosives to allow removal so that the coal seams can be recovered. The EMP will also address some potential safety issues related to mine traffic onsite. Orica Canada Incorporated (Orica) will be the prime contractor for handling and delivery of explosive materials for Telkwa Coal Limited (TCL) and will conduct these operations from the Explosive Facility. TCL will be responsible for all blast designs and explosive loading and the actual blasting of patterns for the Project.

2. PURPOSE AND OBJECTIVES

The EMP will outline the framework and principles that will guide the Project in the selection, procurement, safe handling, and use of explosives; and to ensure methods and procedures are in place to mitigate the risks associated with explosives, and comply with all applicable codes, standards, and legislation in that regard.

The EMP has the following objectives:

- Provide a systematic approach for the use, storage, and transport of explosives;
- Identify and develop systems, standards, and procedures;
- Define the duties and responsibilities of people required to work with, dispense, and transport explosives;
- Manage explosives stocks within the manufacturer's recommended storage conditions and shelf life;
- Provide a secure system for storage and control; and
- Manage nitrogen releases to the receiving environment while maintaining mine production targets with the overall goal of minimizing nitrogen releases into the environment.

The purpose of the EMP is to minimize onsite risk by adopting industry best management practices (BMPs) and applying them to specific site conditions.

Furthermore, this EMP is designed to fulfill the guidance provided by provincial and federal statutes, including the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019) (JAIR).

This EMP is just one (1) component of the overarching **Environmental Management System (S13.0-C1) (EMS)** for the Project.

3. SCOPE AND SCALE

The scope of this EMP is defined within the permit boundary of the operation and/or any construction activities that are directly associated with the operations that may exist outside of the permit boundary. This EMP is in effect during the Construction, Operation, Decommissioning and Reclamation and Post-closure phases and ceases to be in force at the final closure of the Project as approved by regulatory authorities.

The term “explosives” may be used in a general sense to refer to the broader issues surrounding both explosives and detonators.

4. COMPLIANCE OBLIGATIONS

This subsection will summarize the relevant compliance approvals and requirements that the EMP needs to address.

4.1 Regulatory Requirements

The control and use of explosives within Canada and British Columbia (BC) is covered by federal and provincial laws and regulations. **Table 4.1-1** below lists federal and BC regulations, and guidelines applicable to the management of explosives at the Project.

Several legislative requirements are applicable to the EMP. A short list of these requirements and their major applicable components are provided in **Tables 4.1-1**.

Table 4.1-1: Applicable Federal and Provincial Legislation, and Guidelines for Explosive Use in British Columbia (BC)

Legislation, Regulations, and Guidelines	Applicable Information
Canadian Environmental Protection Act, 1999, SC 1999, c 33 Government of Canada [GovCan] 1999) (*CEPA*)	Regulates the protection of the environment including pollution protection and related fines for non-compliance with applicable regulations. Mandates annual reporting to the National Pollutant Release Inventory (NPRI) for applicable facilities.
Mines Act, RSBC 1996, c 293 (Government of British Columbia [GovBC] 1996)	The Act applies to all mines during exploration, development, construction, production, closure, reclamation, and abandonment.
Explosives Act, RSC 1985 c.E-17 (GovCan1985)	The Act regulates the use and storage of explosives, and includes the Explosives Regulations 2013, SOR/2013-211 (GovCan 2013).
Transportation of Dangerous Goods Act, 1992, SOR/2001-286 (GovCan1992)	The Act regulates the transportation of dangerous goods and includes the Transportation of Dangerous Goods Regulations, SOR/2016-95 (GovCan1995).
Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021) (Code)	The Code regulates occupational health and safety requirements, and Part 8 is about use, care and handling of explosives and blasting particulars.

The JAIR for *Mines Act*, RSBC 1996, c 293 and *Environmental Management Act*, SBC 2003, c 53 (*MA/EMA*) permits does not provide direction on an EMP; however, section 3.5.10 Explosives Storage Facilities of the JAIR provides requirements that need to be addressed by a permit application such as:

- a description of any onsite operational explosives storage and/or manufacturing facilities;
- a description of all plans to retain a licensed explosives contractor;
- a description of all plans for explosives use during the Project's Construction Phase;
- a description of all plans for explosive use during the Project's Operation Phase;

- an evaluation of explosives residuals in the discharge(s) from the site; and
- any other relevant information.

The explosives section (Part 8) of the Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021) (Code) has been reviewed and taken into consideration when designing this EMP. A summary of the permits and licenses required are listed below:

- Factory License: required under the federal *Explosives Act*, RSC 1985, c E-17 (Government of Canada [GovCan] 1985);
- Permit for Use of Explosives: required under the federal *Explosives Act*, RSC 1985, c E-17 (GovCan 1985);
- Explosive Dangerous Good Transportation Permits: required under Transport Canada and Natural Resource Canada (NRCAN); and
- Magazine Permit: required under the Code.

4.2 Standard Practices and Procedures (SPPs)

All TCL Standard Policies and Procedures (SPPs) will conform to the Code. In addition to regulatory requirements, the Project will implement SPPs that meet or exceed the required laws and regulations.

5. RELATIONSHIP TO OTHER MANAGEMENT PLANS

The Project is governed by an **EMS**, an overarching management plan strategy comprising a set of processes and practices which enable TCL to manage its environmental and safety performance in a holistic way, within an integrated framework. While the management plans are part of the **EMS**, the **EMS** is not just a collection of management plans.

In addition to the overall guidance of the **EMS,** this EMP has a relationship with other management plans that also present mitigation measures. Those management plans and their relationship to this EMP are listed in **Table 5-1**.

Table 5-1: Management Plans with Relationship to the Explosives Management Plan (EMP)

Management Plans	Nature of Relationship
Air Quality Management Plan (S13.0-C2) (AQMP)	Mitigations for air emissions including dust, is included in the AQMP. The Explosives Management Plan (EMP) covers specifics related to dust emissions from blasting only.
Chemicals and Materials, Storage, Transfer, and Handling Plan (S13.0-C3) (CMSTHP)	Mitigation and maintenance identified in the CMSTHP will ensure explosives materials are managed appropriately.
Construction Environmental Management Plan (S13.0-C4) (CEMP)	Should blasting be required in construction, the CEMP will mitigate effects on the environment.
Discharge Management Plan (S13.0-C5) (DMP)	The DMP covers all discharges for the Project including nitrogen releases due to blasting.
Environmental Management System (S13.0-C1) (EMS)	All management plans are part of the EMS.
Fuel Management and Spill Control Plan (S13.0-C7) (FMSCP)	One of the performance objectives for the FMSCP is to minimize spills from the use, storage and transfer of explosives.
Mine Emergency Response Plan (S13.0-C9) (MERP)	The MERP will mitigate effects of blasting incidents on employees and the public and provides requirements for reporting of Incidents and Dangerous Occurrences.
Minesite Traffic Control Plan (S13.0-C10) (MTCP)	A performance objective for the MTCP is to minimize wildlife interactions with blasting vehicles by following access rules.
Minesite Water Management Plan (S13.0-C11) (MWMP)	One of the performance objectives for the MWMP is to alleviate high nitrogen releases from explosives to the water system.
Occupational Health and Safety Program (S13.0-C13) (OHSP)	Manage the use, storage and transport of explosives and safety while blasting.
Public Access Management Plan (S13.0-C14) (PAMP)	Manage public access into the Project Area including when blasting.
Surface Erosion Prevention and Sediment Control Plan (S13.0-C17) (SEPSCP)	Mitigation methods and maintenance activities identified in the SEPSCP will help to control potential runoff and erosion from explosive storage and use areas.
Waste Management Plan for Refuse and Emissions (S13.0-C20) (WMPRE)	One of the performance objectives for the WMPRE is to manage the storage, transfer, use, and waste from blasting operations.
Wildlife Management Plan (S13.0-C21) (WMP)	One of the performance objectives for the WMP is to minimize wildlife interactions with blasting operations.

6. DETAILS OF EXPLOSIVES MANAGEMENT PLAN (EMP)

6.1 Health, Safety, and Environmental Considerations

The EMP is intended to provide protection against all identified aspects of explosive use and storage within the Project Area.

The risk of an incident resulting from the use of explosives and detonators for the Project will be assessed in accordance with the risk assessment methodology provided in the **EMS**, including SPPs and corrective actions, if any are necessary. The risk assessment will be updated whenever there are significant changes related to the use of explosives for the Project or after any Incident involving explosives.

The following are identified as site hazards for consideration when conducting a risk assessment associated with explosives:

- supply and transport of explosives and detonators to site;
- surface handling and storage of delivered explosives and detonators;
- blasting operations;
- unsupervised access;
- transport arrangements onsite;
- return and/or disposal of unused explosives and detonators;
- use of radio transmitters;
- security of explosives and detonators; and
- uncontrolled release of nitrogen from blasting operations.

Methods for reducing the identified hazards will be incorporated into the development of the procedures, guidelines, and forms as follows:

- undertake all transport of detonators and explosives in accordance with established procedures outlined in this EMP, relevant permits, licenses, approvals, and legislation;
- only use licensed suppliers for supply of explosives and detonators;
- only possess or use the category of explosives and detonators nominated on the site explosives permit;
- the handling and transport of explosives and detonators will only be conducted by designated personnel who are qualified to do so, in accordance with training, competence and regulatory certification;
- the use of explosives, detonators and accessories will only be conducted by designated Blasters and/or other personnel who are qualified to do so, in accordance with training, competence, and regulatory certification;
- all blasting activities are to be performed by at least two (2) persons, and at least one (1) of the two (2) must be a Blaster who is qualified in accordance with training, competence, and regulatory certification; while the other uncertified helper may help with blasting activities under the continuous supervision of a Blaster;

- all radios, including transmitters, mobile telephones, and mining equipment remote controls must be switched off when within 20 metres (m) of explosives or detonators;
- blasting will not be conducted on surface during active electrical storms;
- implementation of the site's security, hazardous materials, and emergency management plans; and
- risk assessment must occur following an incident, action item from an audit or change in operation, or if none of these occur a risk assessment must be conducted at least every three (3) years.

6.1.1 Risk Assessment

A formal risk assessment process was undertaken for the Project to identify the risks to personnel, environment, and equipment related to this Project, of which the use of explosives is a part of. The **Risk Assessment Tables** provided in **Appendix 13.6-A** were used to complete this assessment identified the following items and mitigations specific to blasting and explosive use. The risk assessment is summarized in **Table 6.1-1.**

Table 6.1-1: Risk Assessment for Explosives

Risk	Mitigations	Likelihood	Consequence	Risk Rating	Follow-up Action Plan
Unintended Explosion	▪ Trained personnel ▪ Electronic detonators ▪ Use of tried and tested explosives that have been used safely at numerous operations ▪ Use of an experienced contractor from Orica Canada Incorporated (Orica)	Rare	Severe	Medium	Perform third-party audits of blasting operations.
Direct damage to equipment, personnel, or the environment from blasting	▪ Trained personnel ▪ Electronic detonators ▪ Use of tried and tested explosives that have been used safely at numerous operations ▪ Use of an experienced contractor from Orica ▪ Use of industry standard clearing circles for personnel and equipment.	Rare	Major	Low	Monitor flyrock and alter clearing circles and blasting procedures.
Loss or theft of explosives	▪ Trained personnel ▪ Industry standard magazines ▪ Audits ▪ Bar code tracking	Rare	Major	Low	Install cameras for magazine areas.
Excessive nitrogen losses from blasting influencing water quality	▪ Trained personnel ▪ Electronic detonators ▪ Use of tried and tested explosives that have been used safely at numerous operations	May	Minor	Medium	Review use of alternate explosive formulations with Orica for leaching potential

Risk	Mitigations	Likelihood	Consequence	Risk Rating	Follow-up Action Plan
and fish habitat.	▪ Use of an experienced contractor from Orica ▪ Double primming of all holes ▪ Crushed rock for stemming of holes ▪ Hydrovac of misfires versus washing of misfires				

A review of all risk assessments is to be undertaken either at least every three (3) years (minimum), or as soon as possible when:

- there is any significant change in any process, system or procedure relating to the storage or handling of any explosives;
- there is evidence that the original risk assessment no longer adequately assesses or manages the risk associated with the hazards; or
- a high potential incident occurs onsite involving explosives.

Records of all risk assessments and associated documentation are to be kept by the Project and are to be made available to employees and contractors. Records must be retained for as long as explosives are either stored, managed or used by the Project.

The Project will maintain a series of mitigation measures regarding explosives onsite. Each mitigation measure may be supported by various other management plans, some of which have been identified above while others are outlined in in upcoming subsections of this EMP.

6.1.2 Planning

The use of explosives for the Project will involve a structured planning methodology. It will involve the following items:

- geology considerations;
- pit wall configuration;
- blasted material characteristics;
- blast design;
- drilling; and
- selection of explosives, detonators, and supplier.

6.1.2.1 Geology Considerations

The first item to review is the geology of the area in which blasting will be performed, to understand the location of beddings, cross joints, faults, coal seams, and groundwater flow levels. These factors will influence the design of the blast and its ultimate ability to generate appropriately sized material for efficient excavator productivity which is 90 percent (%) less than (<) 25 centimeters (cm). The presence of a coal seam and whether it needs to have through-seam drilling and blasting or can have only the highwall material drilled and blasted is an item that will need to be addressed for any blast pattern near a coal seam. The

presence of different geochemical zones within a blast pattern is another aspect of concern especially if the geochemical zones are classified as potentially acid generating (PAG) and non-PAG material.

Closer to the Operation Phase, further SPPs will be generated in support of the blast designs related to geology.

6.1.2.2 Pit Wall Configuration

The next item to review is the geometry of the pit wall and its interaction with the proposed blast design. Items such as angled blast holes, changes in blast diameter, spacing and burden would be changed if the proposed pattern is adjacent to a final highwall configuration and/or final footwall configuration. **Figures 6.1-1** and **6.1-2** provide the draft pattern designs for two (2) instances as described below.

The first is footwall stabilization drilling and the second is highwall stabilization drilling. The footwall method will require a modification of the production patterns to drill the wedge between the last full-length production hole that does not intersect the footwall coal seam or encroach upon the 2 m coal seam stand-off limit and the remaining holes up-dip.

These holes will have some or all the following modified to ensure that the footwall and coal seam are not damaged by blasting:

- drill length;
- burden;
- spacing; and
- use of smaller diameter drillholes.

The highwall stabilization drilling will include the use of pre-shear, stub, buffer, and production drilling. The pre-shear holes will be drilled one (1) pattern ahead of the trim blast.

To achieve the recommended bench face angles of 70 degrees and inter-ramp angles in mine rock up to approximately 50 degrees within the double bench sections, and to develop a stable face in weaker rock mass units, it will be essential that the pre-split holes are drilled and shot in sufficient time to be included in the mining schedule to implement these programs.

The trim blast pattern will include the stub, buffer and production holes and will be drilled by the 9-7/8 inch (”) drill. The trim blast will be shot to an open face to maximize movement and minimize energy reflected into the highwall.

Operating costs have been included to cover the additional cost of use of the small diameter (5-1/2”) drill. Drill utilization for both drills has been factored to capture the increased number of moves, increased difficulty of lining up on holes and the congestion encountered on the pattern.

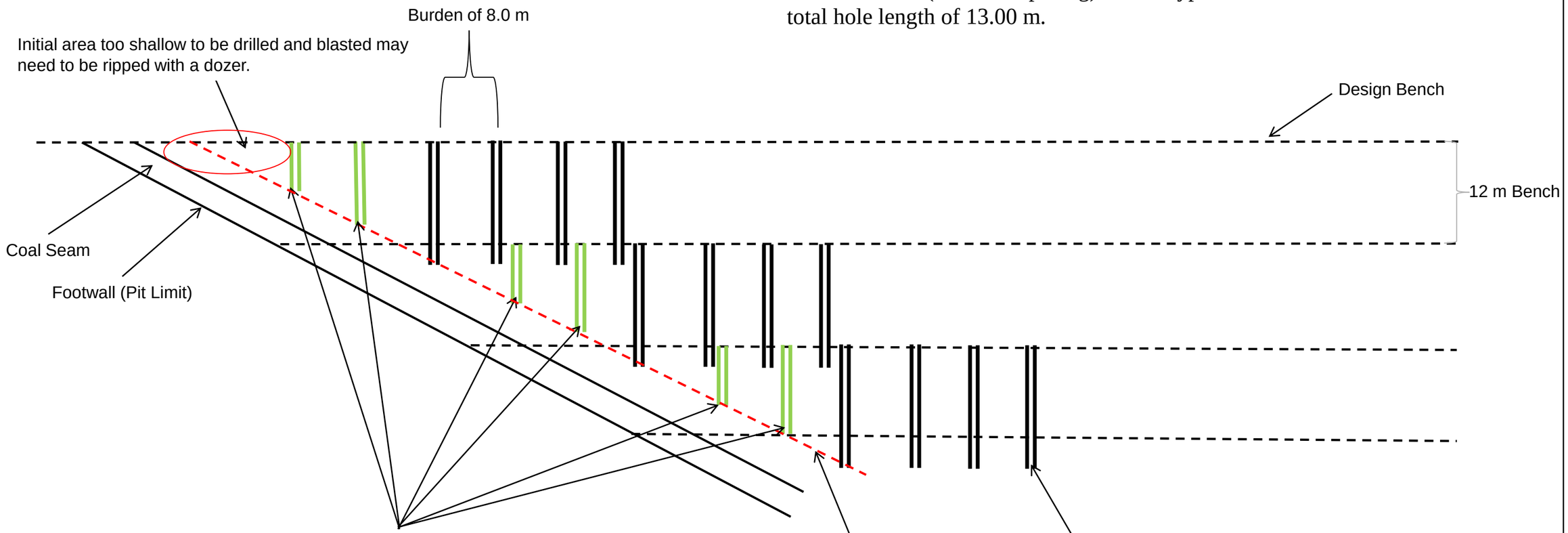
As part the pit wall configuration the bench height used for subsequent blast design is specified to currently be 12 m for the Project. This could change in the future. Another aspect of the pit wall configuration is an understanding where blast holes were completed on previous benches for potential bootlegs. At TCL, no planned hole will be within 1 m of a previously drilled and loaded blasthole unless authorized by the Mine Manager via a risk assessment.

Closer to the Operation Phase, further SPPs will be generated in support of the blast designs related to pit wall configurations.

Footwall Blast Pattern Design

SCHEMATIC SECTION VIEW

The use of the production drill (9.88 in dia.) will have a standard pattern of 8.0 x 9.3 m (burden x spacing), with a typical sub drill of 1.00 m for a total hole length of 13.00 m.



Modified production blast holes for length to coal stand off limit. These holes will need to be offset from the boot legs of the previous bench and have their explosive charges adjusted.

2 meter Stand Off from the top of a coal seam drill boundary.

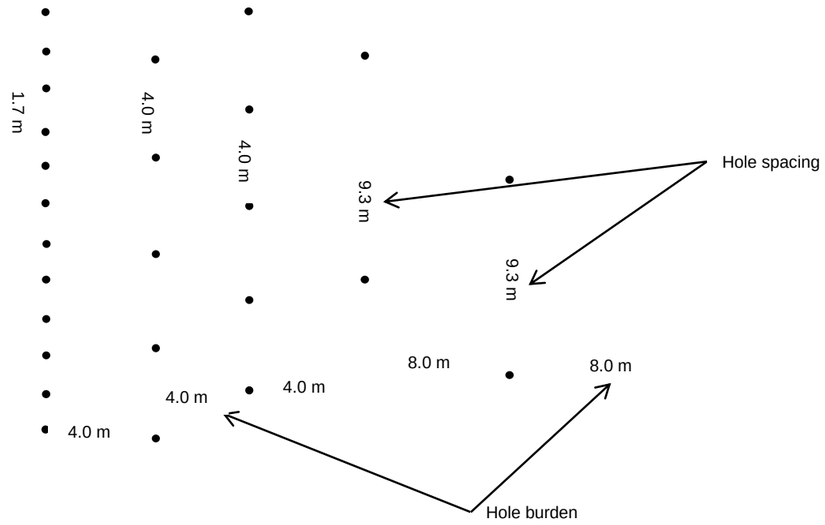
Production Blast Hole with 1.0 m Subgrade

Note: This figure is not to scale and is conceptual in nature

srk consulting		Telkwa Project – Tenas Pit FS
		Initial footwall blast design – 12m bench
		Date: July 2020 / Approved: XX / Figure: **6.1-1**

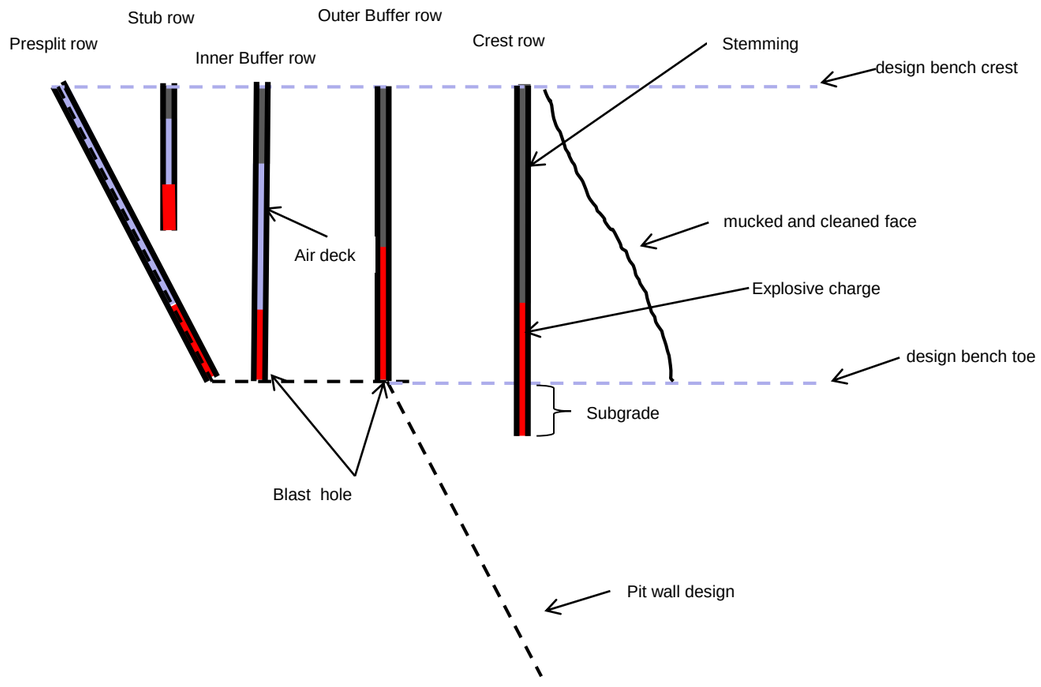
Blast Pattern Design

SCHEMATIC PLAN VIEW



Blast Pattern Design

SCHEMATIC SECTION VIEW



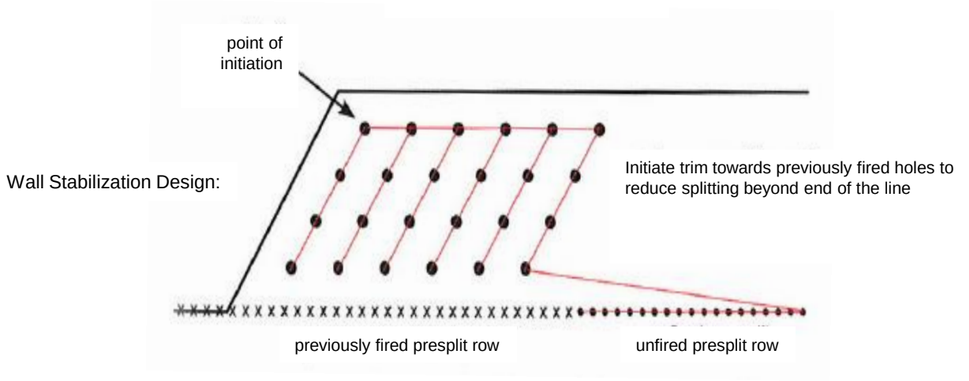
Blast Pattern Design Criteria

	Unit	Presplit Row	Stub Row	Inner Buffer Row	Outer Buffer Row	Crest Row
Hole diameter	inches	5.5	9.88	9.88	9.88	9.88
Hole length	m	12.77	6	12	12	13
Hole Angle	°	70	0	0	0	0
Decoupled		Y	Y	Y	N	N
Burden	m	4.0	4.0	4.0	8.0	8.0
Spacing	m	1.7	4.0	4.0	9.3	9.3
Air Deck	m	Y	Y	Y	N	N
Subgrade	m	0	0	0	0	1.00
Stemming column	m	0.00	1.00	1.80	4.30	4.30
Charge weight	kg	11	29	58	446	446
Powder factor	kg/bcm	0.12	0.30	0.30	0.50	0.50
Energy factor	kcal/tonne	37	92	92	153	153

Note: Typical modified production blast shot to a free face and loaded with Heavy ANFO - Emulsion.

Blast Initiation Design

SCHEMATIC PLAN VIEW



Note: This figure is not to scale and is conceptual in nature

srk consulting		Telkwa Project –Tenas Pit FS
		Initial highwall stabilization design – 12m bench
		Date: July 2020 / Approved: XX / Figure: **6.1-2**

6.1.2.3 Blasted Material Characteristics

TCL has specified the following material % passing configuration to allow for efficient excavator production, which is illustrated by **Figure 6.1-3** below.

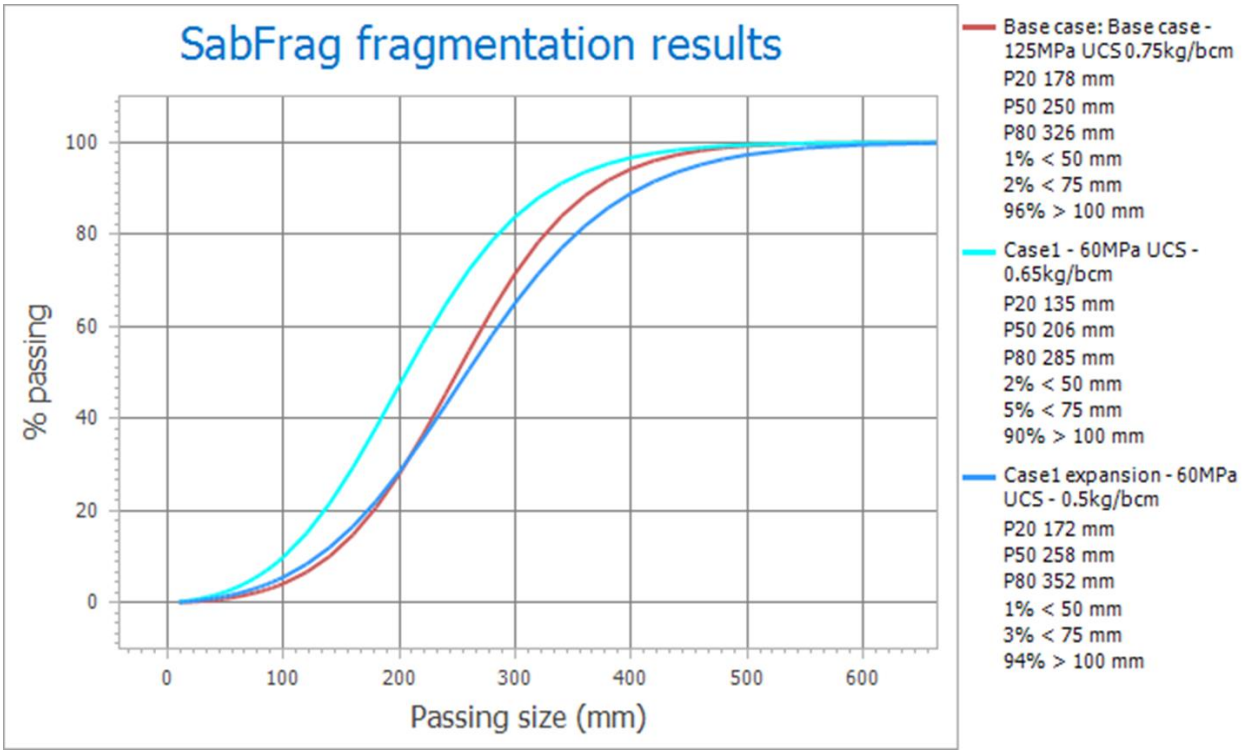


Figure 6.1-3: Material percent (%) passing configuration

6.1.2.4 Blast Design

With an understanding of geology, pit wall configuration, and blasted material characteristics, the blast design can then be completed. The goal is to produce the blasted material characteristics for as low a cost as practical. The final blast design requires the following elements:

- signed by the Senior Mine Engineer, Blaster, and Mine Superintendent;
- map that illustrates the blast design, date, with scale bar, north arrow, bench name, blast name (phase, bench, blast number, date), Universal Transverse Mercator (UTM) grid lines, spacing, burden, previous bench blast holes;
- loading instructions specified, including type and quantities of explosives required;
- timing instructions provided;
- powder factor of blast;
- energy factor; and
- subdrill and stemming specification.

Closer to the Operation Phase, further SPPs will be generated in support of the blast design aspect.

6.1.2.5 Drilling

Once the draft blast design is completed this can be used for drilling instructions for the Project. A base of bench and location is to be provided to the survey group and/or to the on-board Global Positioning System (GPS) systems on the drills to allow for drill patterns to be accurately executed in the field. In summary, holes drilled should have the following information:

- drill hole diameter;
- elevation to be drilled to for every hole;
- anticipated location of geochemical layers encountered in the drillholes;
- anticipated location of coal seams to be encountered in the drillholes;
- pit design lines to be achieved; and
- dip of drillholes.

Closer to the Operation Phase, further SPPs will be generated in support of the drilling aspect.

6.1.2.6 Selection of Explosives, Detonators, and Supply Requirements

This subsection addresses selection of explosives, detonators, and suppliers.

6.1.2.6.1 Types of Explosives Used Onsite

Only explosives that are permitted by relevant legislation licenses, permits, and approvals will be used by the Project. Explosives will only be used for the permitted applications. Explosives used by the Project must be licensed in accordance with the *Explosives Act*, SC 1985, c E-17 (GovCan 1985). All technical data and material safety data sheets (MSDS) for all explosive materials used by the Project will be readily available to employees and contractors onsite. In addition to regulatory approvals, the type of explosives used by the Project must be risk assessed in accordance with the overall site risk assessment methodology under the **EMS** and as approved by the Mine Manager.

TCL currently contracts Orica to supply explosives to the Project. As part of these services Orica is responsible for the production of an emulsion matrix offsite and to provide blasting agents, explosive raw materials, and services for blasting activities. Orica is a leading supplier of industrial explosives to the mining industry in both BC and Internationally. Orica employs a health, safety and environment management system known as Zero Harm which captures all aspects of occupational health and environmental releases.

Raw materials, including Ammonium Nitrate Prill (ANP) are sourced from Orica and shipped to site while fuel oil for blending on the drill pattern is provided by the Minesite and/or Orica. The contractor produces the emulsion matrix offsite and it will be shipped to site for storage and blending with the ANP, and fuel oil to produce various blasting agents.

Blasting tasks will be completed by TCL using Blasters who hold a BC Blasting Ticket in good standing with support from Orica on technical aspects of explosives use and blasting operations.

6.1.2.6.2 Ammonium Nitrate and Fuel Oil (ANFO)

Ammonium Nitrate and Fuel Oil (ANFO) (94% ammonium nitrate, 6% fuel oil), is a product widely used in the mining industry and contains over 30% nitrogen by weight. Ammonium nitrate takes the form of porous prills, which combine with fuel oil (absorption and adhesion) to form an explosive. ANFO has no water resistivity, and as such the nitrogen present is soluble. Currently the Project is not planning on using pure ANFO for blasting due to its poor water resistivity. Onsite ANFO will be stored separately, and they will only be blended when they are ready to be placed into a borehole.

6.1.2.6.3 Emulsion Bulk and Packaged Products

Emulsion-blended products are created when emulsion and ANFO are combined in a variety of proportions to make these products. These combinations are denser than ANFO and have water resistivity that is directly related to the percentage of emulsion in the final mixed product.

The emulsion component is a thick gel-like mixture in which reactants are intimately blended, at the molecular level, together with emulsifiers that stabilize it and render it water resistant. Water resistant products will be used when groundwater conditions in the boreholes would result in any degradation of the other blasting agents. In dry boreholes, a blended agent with lower amounts of emulsion will be employed.

The Project is proposing to use the following blasting agents:

- Heavy ANFO (Fortan Extra 35% through 50% emulsion);
- Bulk Emulsion 70 (Fortis 70% through 99% emulsion);
- Bulk Emulsion 100 (Fortis 100% emulsion);
- Packaged Emulsion (Fortel); and
- Sentel Powersplit.

The following **Table 6.1-2** summarizes the blasting agents onsite according to the *Transportation of Dangerous Goods Act*, SC 1992, c 34 (GovCan 1992).

Table 6.1-2: Blasting Agents Used by the Tenas Project

Type	Trade Name	Shipping Name	UN Number	Class	Division	Compatibility Group	Storage
Ammonium Nitrate	Bulk ANFO	Ammonium Nitrate	1942	5	1	D	Bulk
Bulk Emulsion Explosives	Fortan 35	Blasting Type E	0332	1	5	D	Bulk
Bulk Emulsion	Fortis 70	Blasting Type E	0332	1	5	D	Bulk
Bulk Emulsion	Fortis 100	Blasting Type E	0332	1	5	D	Bulk
Packaged Booster Sensitive Emulsion	Fortel Plus	Blasting Type E	0332	1	1	D	Explosive Magazine

Type	Trade Name	Shipping Name	UN Number	Class	Division	Compatibility Group	Storage
Packaged Booster Sensitive Emulsion	Sentatel Powersplit	Blasting Type E	0241	1	1	D	Explosive Magazine
Cast Boosters	Pentex AP	Boosters without Detonators	0042	1	1	D	Explosive Magazine
Detonators Electronic	IKON RX III		0030	1	1	B	Cap Magazine

The following provides a summary of these five (5) blasting agents in terms of the percentage of emulsion and ANFO contained within in them:

- Heavy ANFO will consist 35% of offsite delivered emulsion and 65% ANFO. Heavy ANFO will be used in the majority of applications where moderate water resistivity is required. Furthermore, this material's proportions can be changed up to 50% ANFO and 50% offsite delivered emulsion while still using the same loading methodology;
- Bulk Emulsion 70 (Fortis 70) will consist of 70% of offsite delivered emulsion and 30% ANFO. This emulsion blend will be used in applications where heavier water conditions are encountered. Furthermore, this materials proportions can also be changed up anywhere between 70% emulsion and 99% emulsion;
- Bulk Emulsion 100 (Fortis 100) will consist of 100% of offsite delivered emulsion and 0% ANFO. Pure emulsion will only be used where extreme water conditions are encountered in the blast holes.
- Packaged Emulsion (Fortel) is a smaller diameter, water resistant, packaged water gel explosive. It will be used in locations not accessible by the Mobile Mix Unit (MMU); and
- Sentel Powersplit is a packaged product, and it is used in pre-shear blasting applications and makes up less than 1% of TCL's explosive usage by weight.

Annually on a typical production pattern, approximately 65% of the holes will be loaded with Heavy ANFO, 30% with bulk emulsion 70 and 5% with bulk emulsion 100, depending on the water conditions in the individual holes. Blasting agents are stored on site at a controlled area managed by Orica in accordance with a permit and related guidance provided by NRCAN Explosives Safety and Security Branch. The blasting agents are transported to the drill pattern by Orica employees. Orica is responsible for product sourcing, storage, quality control, and delivery of blasting agents to the blasthole. The TCL Blaster directs the loading of the product and is responsible for loading and firing each blast.

6.1.2.6.4 Cast Boosters

Cast booster consist of Pentolite (a mixture of pentaerythritol tetranitrate [PETN] and trinitrotoluene [TNT]) and is used to boost the initial energy released from the firing of a detonator to optimize the reliability of initiation, reducing the chance of misfired holes and therefore, improves the safety and performance of bulk explosives products. The detonator is completely encapsulated in Pentolite which is a high-power explosive product specially designed to be used as raw material, preventing inadvertent impact on the detonator. A protective saddle is also included in the base of these boosters to prevent damage to the detonator's shock tubing, signal line, wire, and/or fuse.

Pentolite boosters are stable explosives which are only cap sensitive and have a long shelf-life when stored under recommended conditions. Pentolite boosters are water resistant, and the ingredients do not dissolve in water. Hydrostatic heads commonly found in a mining environment also have no effect on pentolite boosters.

6.1.2.6.5 Detonators

Only detonators that are permitted by relevant legislation licenses, permits, and approvals will be used on the Project. Detonators will only be used for the permitted applications. Delay detonators must have a means of identifying their delay period. All technical data sheets and MSDS will be readily available onsite. In addition to regulatory approvals, the type of detonators used on the Project must be risk assessed in accordance with the overall site risk assessment under the **EMS** and approved by the Mine Manager. The Project will be using electronic detonators for most of its holes as means to get a superior blasting outcome and to reduce the likelihood of misfires. In some cases, conventional non-electric denotators required in specialty applications.

6.1.2.6.6 Detonating Cord

A detonating cord is not required for electronic systems selected by this Project. However, if it is required for speciality applications it will be provided by Orica.

6.1.2.6.7 Connecting Cord and Delay

A connecting cord and delay are not required for electronic systems selected by this Project. However, if required for speciality applications it would be provided by Orica.

6.1.2.6.8 Selection of Supplier

The supplier of explosives and detonators must be a licensed seller of blasting agents. For the purposes of this EMP, Orica is the current supplier of record. Orica was selected based on their ability to provide premixed emulsion to site which eliminated the requirement of constructing an emulsion factory within the Project Area.

6.1.2.6.9 Blasting Machines

All blasting machines must be permitted by relevant licenses, permits and approvals. The blasting machine used by the Project is the IKON SURB System.

Closer to the Operation Phase, further SPPs will be generated in support of the explosive, detonators and blasting machine selection.

6.2 Purchasing of Explosives and Detonators

6.2.1 Types and Quantities of Explosives Used

The Mine Superintendent will order explosives, accessories, and detonators of the type and quantity required. The Mine Superintendent will ensure that the quantity of explosives and detonators to be ordered does not exceed that specified in the magazine permit. **Tables 6.2-1** and **6.2-2** below provide the anticipated explosive and detonator quantities required over the mine's life. The quantities are based on the latest mine plan as provided in **Appendix 13.6-B** and will be revised monthly for the current year of operations and yearly for life-of-mine (LOM) forecasts.

Table 6.2-1: Projected Explosive, Booster, and Detonator Use for Tenas Project: Years -0.5 to 10

Year	Units	Year - 0.5	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Prime BCM Mined	BCM	489,938	1,489,938	2,659,752	2,659,752	5,547,256	6,166,006	5,753,506	5,341,006	4,103,506	3,282,631	4,099,381	5,134,756
BCM Blasted	BCM	0	327,142	1,550,797	2,190,258	3,449,591	2,509,746	3,218,502	3,557,059	3,383,197	2,948,714	3,382,260	4,307,764
% Blasted	%	0	22.0%	58.3%	82.3%	62.2%	40.7%	55.9%	66.6%	82.4%	89.8%	82.5%	83.9%
Powder Factor	kg/ BCM	0	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
FORTAN EXTRA 35 (HEAVY ANFO)	kg	0	122,678	581,549	821,347	1,293,597	941,155	1,206,938	1,333,897	1,268,699	1,105,768	1,268,348	1,615,412
FORTIS EXTRA 70 (EMULSION)	kg	0	40,893	193,850	273,782	431,199	313,718	402,313	444,632	422,900	368,589	422,783	538,471
PACKAGED EMULSION	#	0	0	0	0	0	0	0	0	0	0	0	0
Yearly FORTAN EXTRA 35 Trucks	#	0	10	47	66	103	75	97	107	101	88	101	129
Yearly FORTIS EXTRA 70 Trucks	#	0	3	16	22	34	25	32	36	34	29	34	43
Daily # of FORTAN EXTRA 35 Trucks	#	0	0.05	0.22	0.32	0.50	0.36	0.46	0.51	0.49	0.43	0.49	0.62
Daily # of FORTIS EXTRA 70 Trucks	#	0	0.02	0.07	0.11	0.17	0.12	0.15	0.17	0.16	0.14	0.16	0.21
Yearly AN Delivery Trucks	#	0	3.1	14.5	20.5	32.3	23.5	30.2	33.3	31.7	27.6	31.7	40.4
Yearly FORTIS EXTRA 70 Delivery Trucks	#	0	2.0	9.7	13.7	21.6	15.7	20.1	22.2	21.1	18.4	21.1	26.9

***Notes**: #=number of; %=percent; BCM=bank cubic metres; kg=kilograms*

Table 6.2-2: Projected Explosive, Booster, and Detonator Use for Tenas Project: Years 11-21

Year	Units	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21
Prime BCM Mined	BCM	5,134,756	4,516,006	3,484,756	3,484,756	3,484,756	3,484,756	3,484,756	3,484,756	2,659,756	2,451,978	922,124
BCM Blasted	BCM	3,804,171	3,238,772	2,444,278	2,575,845	3,124,538	2,967,519	3,147,090	3,036,062	2,307,888	2,141,121	922,124
% Blasted	%	74.1%	71.7%	70.1%	73.9%	89.7%	85.2%	90.3%	87.1%	86.8%	87.3%	100.0%
Powder Factor	kg/BCM	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
FORTAN EXTRA 35 USE	kg	1,426,564	1,214,540	916,604	965,942	1,171,702	1,112,820	1,180,159	1,138,523	865,458	802,920	345,797
FORTIS EXTRA 70 USE	kg	475,521	404,847	305,535	321,981	390,567	370,940	393,386	379,508	288,486	267,640	115,266
PACKAGED EMULSION	#	0	0	0	0	0	0	0	0	0	0	0
Yearly FORTAN EXTRA 35 Trucks	#	114	97	73	77	94	89	94	91	69	64	28
Yearly FORTIS EXTRA 70 Trucks	#	38	32	24	26	31	30	31	30	23	21	9
Daily # of FORTAN EXTRA 35 Trucks	#	0.55	0.47	0.35	0.37	0.45	0.43	0.45	0.44	0.33	0.31	0.13
Daily # of FORTIS EXTRA 70 Trucks	#	0.18	0.16	0.12	0.12	0.15	0.14	0.15	0.15	0.11	0.10	0.04
Yearly AN Delivery Trucks	#	35.7	30.4	22.9	24.1	29.3	27.8	29.5	28.5	21.6	20.1	8.6
Yearly FORTIS EXTRA 70 Delivery Trucks	#	23.8	20.2	15.3	16.1	19.5	18.5	19.7	19.0	14.4	13.4	5.8

***Notes**: #=number of; %=percent; BCM=bank cubic metres; kg=kilograms*

6.2.2 Material Safety Data Sheets (MSDS)

In addition to the technical data sheets, a MSDS inventory will be maintained for all explosives present, in accordance with Workplace Hazardous Materials Information System (WHMIS) (BC MEMLI 2021) and the **Chemicals and Materials Storage, Transfer and Handling Plan (CMSTHP) (S13.0-C3)**. The current MSDS for the explosive and non-explosive feed products used onsite are provided in **Appendix 13.6-C**.

6.2.3 Labels

All containers of explosives supplied to, used by, or managed by the Project must be labelled in accordance with all relevant legislation, licenses, permits, and approvals. The Code has specific requirements regarding the labelling of explosives and detonators (WHMIS).

6.3 Storage of Explosives, Boosters, and Detonators

Table 6.3-1 below provides a summary of the explosive related products and quantities stored at the Minesite.

Table 6.3-1: Explosive Quantities and Storage Locations

Material	Storage Type	Location	Quantity
Ammonium Nitrate Prill	Bulk-Ground Bin	Explosive Facility	50 tonnes
Ammonium Nitrate Emulsion	Bulk-Ground Bin-International Standards Organization (ISO)	Explosive Facility	30 tonnes
Sodium Nitrate	Bags	Explosive Facility	20-foot sea container
Cast Boosters	Boxes	Explosive Magazine	500
Detonators	Boxes	Explosive Magazine	500
Fortel	Bags	Explosive Magazine	4,500 kilograms (kg)
Sentel Powersplit	Boxes	Explosive Magazine	2,500 kg

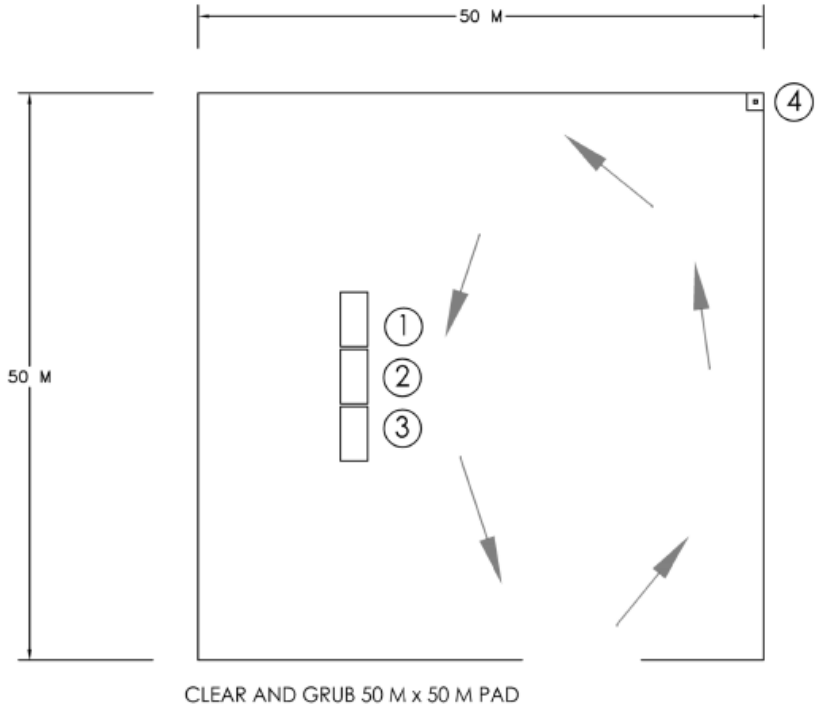
6.3.1 Storage of Explosives and Non-explosive Components at Explosive Facility

Explosives storage at the Project site will consist of three (3) main components:

1. bulk ANP storage;
2. bulk Ammonium Nitrate Emulsion (ANE) storage; and
3. packaged explosives and blasting accessories (such as detonators and connecting wires).

The storage facilities will be designed to meet all government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division of NRCAN.

All explosives and accessories will be stored in the planned Explosive Facility and Explosive Magazine site. The Explosive Facility and Explosive Magazine are greater than 300 m apart and 1,800 m from any other infrastructure as per the distance requirements under the *Federal Explosives Act*, RSC 1985, c E-17 (GovCan 1985) and regulations. A plan of the proposed Explosive Magazine location is shown in **Figure 6.3-1** below.



LEGEND:

1. M1 - 7,000 KG (8' x 16')
2. M2 - 7,000 KG (8' x 16')
3. D1 - 100,000 DETONATORS (8' x 16')
4. 5 M x 5 M SUMP

* ALL STORAGE INFRASTRUCTURE TO BE GROUNDED PER NRCAN GUIDELINES

Figure 6.3-1: Plan of the proposed Explosive Magazine storage location

6.3.1.1 Bulk Ammonium Nitrate Prill (ANP) Storage

Due to its hygroscopic nature, it is important that the ANFO be stored in dry silos or storage sheds, and not in humid or wet conditions. The internal crystalline structure of the product transitions at 32 degrees Celsius (°C) and -18° C. In conjunction with these changes there are corresponding volume changes of 3.6% and 2.8% respectively. Repeated cycling through these temperatures can break down the structure of the product. This is most important during summer and winter months, where day/night temperature variations may pass through either of these transition temperatures. If such exposure is unavoidable fast consumption will be undertaken.

Ammonium nitrate will be stored in silos at an Explosive Facility like that shown in **Figure 6.3-2** below. It is estimated that up to 41 tonnes of explosive will be used per week during peak operations of that approximately 25 tonnes will be ANFO. Due to the location of the Minesite being over 1,000 kilometres (km) from a source of prill in Alberta, 50 tonnes of ammonium nitrate will be stored onsite to allow for efficient operations.

6.3.1.2 Bulk Ammonium Nitrate Emulsion (ANE)

Bulk emulsion will be stored in one (1) 30-tonne International Standards Organization (ISO) style silo at the Explosive Facility as shown in **Figure 6.3-2** below. It is estimated that up to 20 tonnes of emulsion will be used per week during peak operations.

6.3.1.3 Explosive Infrastructure Location and Design

The current plan is to operate a conventional drill and blasting unit to allow for the mining of the rock material within the Project by excavators and loaders. Annual explosives consumption was determined by TCL based on the Project mine plan, explosive properties, and proposed powder factor. Based on the consumption rate, Orica developed a site plan and support infrastructure requirements. In summary, the following main items are required to support blasting onsite:

- 1 x 50 tonne ground-based silo for ANFO (see **Figure 6.3-2** below);
- 1 x 30 tonne ground-based silos for emulsion (see **Figure 6.3-2** below);
- wash bay and garage for explosive truck service and washdowns (see **Figure 6.3-3** below);
- office space which will be provided in TCL's Administration Building or via a portable trailer office onsite; and
- water management structures (as required).

An aerial photo of a typical Explosive Facility recently constructed by Orica in western Canada is provided by **Figure 6.3-4** below and is expected to be like the site used for the Project.

Figure 6.3-2: Photo of 1 x 30 tonne Emulsion Silos for storage and 1 x 50 tonne ammonium nitrate fuel oil (ANFO) silo

Figure 6.3-3: Example of proposed shop complex for the Explosive Facility

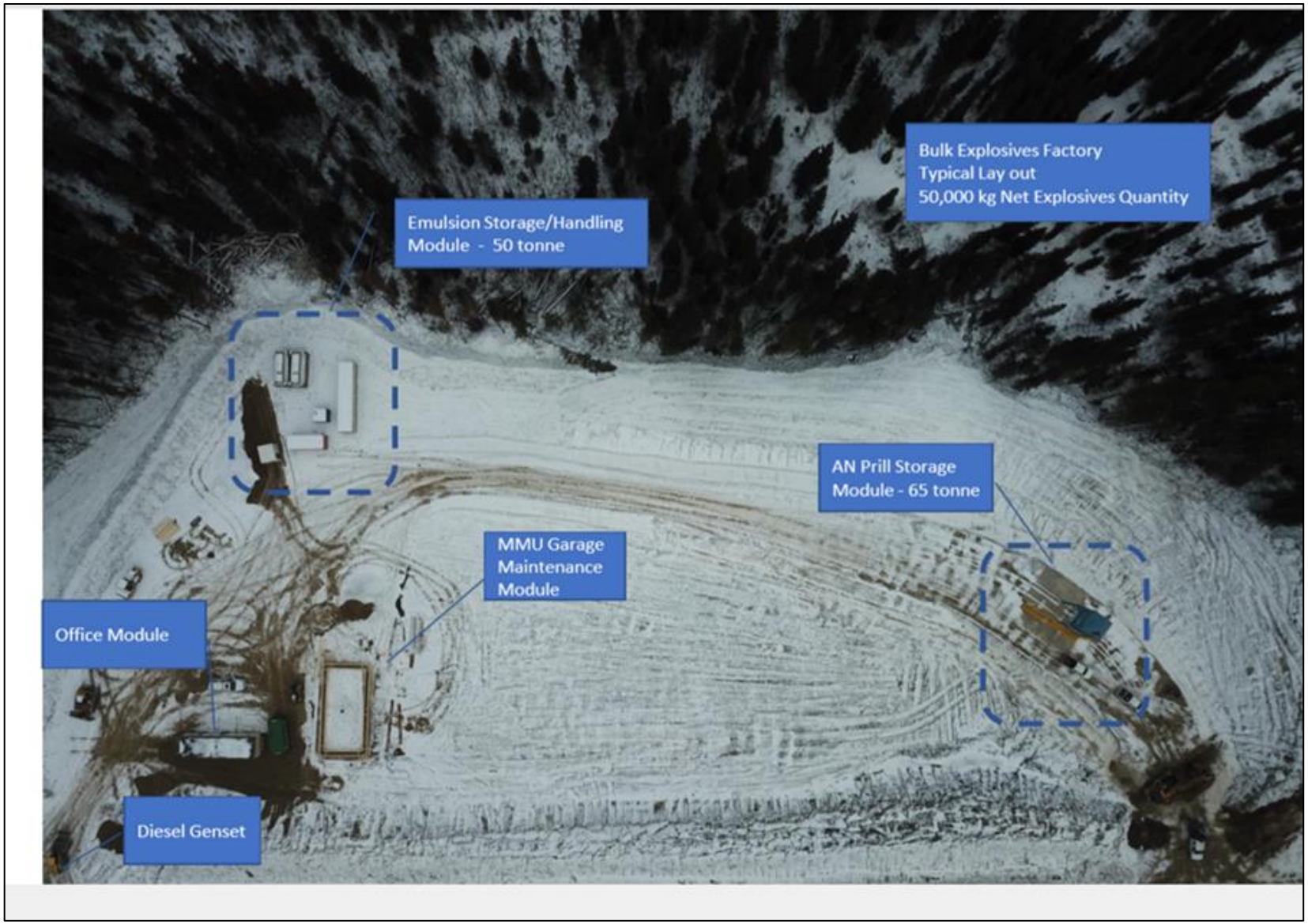


Figure 6.3-4: Example of proposed Explosive Facility overhead view for Tenas Project

The explosive infrastructure will be located approximately 800 m off the Tenas Access Corridor (TAC) accessing the Project and approximately 600 m north of the southern extent of the Tenas Control Pond.

6.3.1.4 Explosive Facility Operations

The Explosive Facility is located on the Project site approximately seven (7) km southwest of the Village of Telkwa, BC. The facility is used to supply the Project with blasting agents such as ANFO and services for use in all mining applications. The Explosive Facility is also where trucks transporting explosives are serviced and washed. An example of a site plan that is like what is going to be used for this Project is shown previously in **Figure 6.3-4.**

The scope of the operation for this factory is the storage and transfer of ANP and ANE. The Project will receive bulk ANE via 20 tonne bulk road tankers from McLeese Lake, BC, The product is stored in a 1 x 30 tonne ISO ground-based storage tank. The Project will also receive ANP via 40 tonne bulk road tankers from Prince George, BC and/or Carsland, Alberta. The product will be stored in a 50-tonne ground-based storage silo.

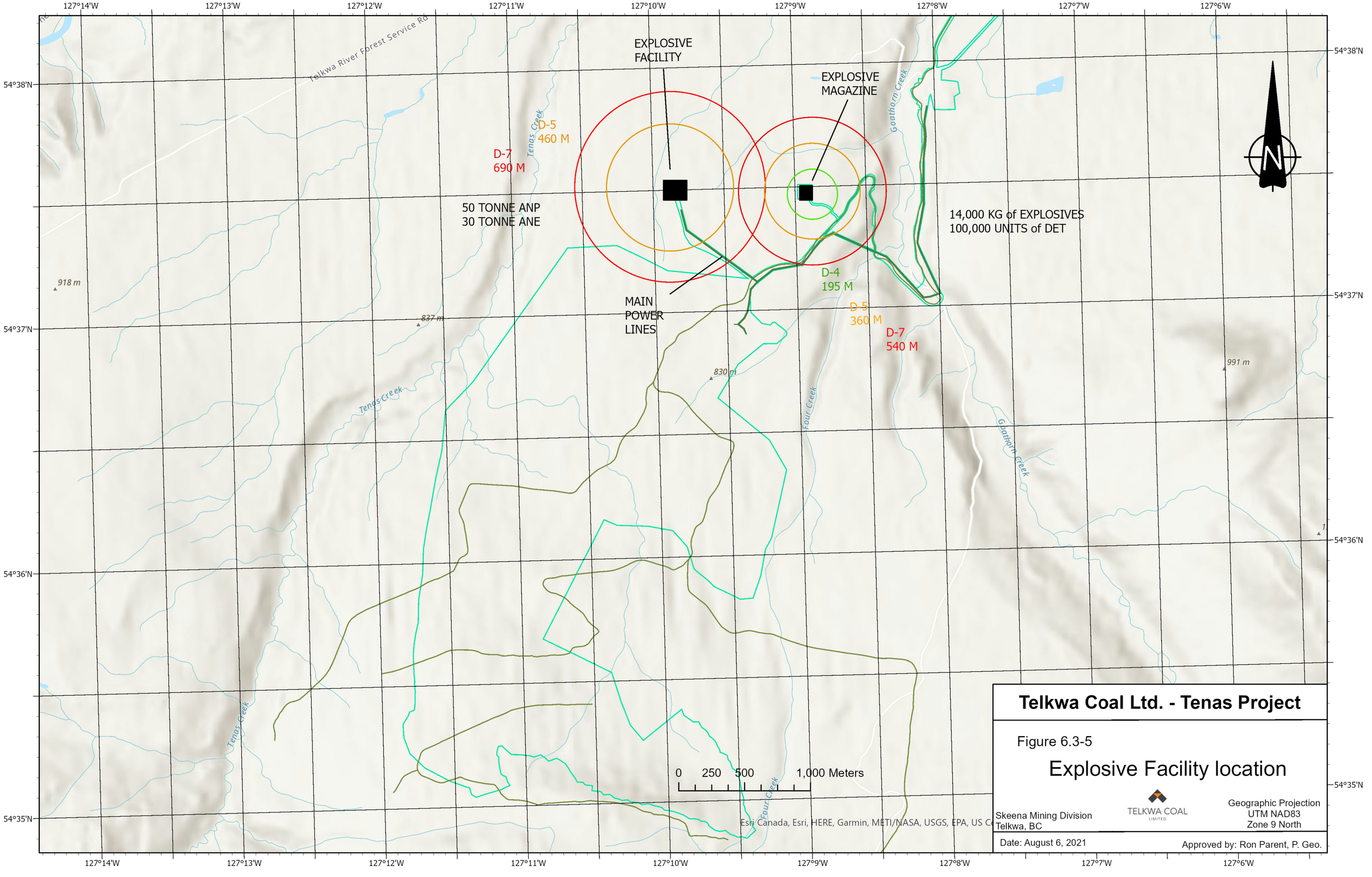
The Explosive Facility includes a maintenance shop with integrated wash bay. This building is used for a maintenance area for MMU and other support equipment. The site also has sea containers onsite that serve as pump storage, water storage, glycol, and nitrite mixing stations and additional workshop spaces. Electrical power for the Explosive Facility will be supplied by an overhead 25 kilovolt (kV) powerline adjacent to the Explosive Facility and then to a 25 kV to 600 volt (V) pole mounted transformer before being placed underground for distribution across the Explosive Facility's pad.

6.3.1.5 Explosive Facility Location

The Explosive Facility is located at the following longitude and latitude coordinates:

- 127.1564 West and 54.615 North.

Figure 6.3-5 below illustrates the location of the Explosive Facility with longitude and latitude coordinates.



Telkwa Coal Ltd. - Tenas Project

Figure 6.3-5

Explosive Facility location

Skeena Mining Division
Telkwa, BC

TELKWA COAL LIMITED

Geographic Projection
UTM NAD83
Zone 9 North

Date: August 6, 2021

Approved by: Ron Parent, P. Geo.

6.3.1.6 Access to Explosive Infrastructure

The only access to the Explosive Magazine and Explosive Facility is through the TAC that accesses the Project. The entrance to both the Explosive Facility and Explosive Magazine is equipped with a gate to control access. The site perimeter is delineated with berms, possible fencing, and warning signs are posted at the entrance to the Explosive Facility and Explosive Magazine. The Explosive Facility and Explosive Magazine access gates remain locked when Orica personnel are not present at the site unless an emergency arises.

6.3.1.7 Explosive Infrastructure Inspections and Explosives Reconciliation

The Explosive Facility will be licensed by Orica as a bulk explosives manufacturing site with NRCAN and will operate in full compliance. Orica's red book compliance management system will be used to audit and manage compliance with NRCAN and all applicable regulations pertaining to the site. Audits and inspections are conducted on scheduled and random intervals by qualified Orica personnel to ensure full regulatory compliance. Raw material inventories are managed and reconciled daily by Orica.

Bulk explosives will be manufactured and blended on board the MMU as authorized by NRCAN and at the direction of TCL as to location and volume. The blending of explosives will take place at the borehole collar. A TCL Blaster with a valid Blasting Certificate will supervise loading operations.

6.3.1.8 Explosive Infrastructure Emergency Response Plan

A revised Explosive Facility emergency response plan will be developed by Orica after a detailed risk review has been completed and as part of the Explosive Facility construction and commissioning activities for the Project. A draft **Emergency Response Plan** developed by Orica is provided in **Appendix 13.6-D** which will be updated once the Construction Phase is completed.

6.3.2 Storage of Explosives and Detonators in Magazines

Packaged explosives, and detonators will be stored by the Project in accordance with all relevant legislation, licenses, permits, and approvals. Rules for Explosive Magazine operation will be prepared in accordance with the Code, with relevant conditions of the magazine permit and with any relevant requirements stemming from onsite risk assessment processes. These rules will be developed once the magazines are purchased and placed onsite and explosives and detonators are ordered for these magazines.

6.3.2.1 Magazine Location, Design and Sizing

The Explosive Magazine is a storage building that is located 0.35 km off the Bypass Road accessing the Minesite, and approximately one (1) km north of the mining area. The Explosive Magazine location is compliant the NRCAN Quantity Distance Principles. An approved manufacturer or supplier will supply the magazines. Two (2) Type 4 magazines will be placed at the Explosive Magazine site. One (1) of the magazines will be used to store the detonators, shock tubes, detonating cord. The other magazine will hold packaged explosives products and cast boosters. The layout and placement of the magazine will consider the explosive regulations Quantity Distance Principles. They will be equipped with tamper proof locks. A berm will be established around the perimeter of the Explosive Magazine storage site and will be constructed to be 50% the height of the magazines put in place. **Figure 6.3-6** below illustrates a typical magazine facility that will be purchased for the Project.

Figure 6.3-6: 2 x typical Type 4 Explosive Magazine

6.3.2.2 Cleanliness and Maintenance of Magazines

The interior and exterior of the magazines will be maintained in a clean and orderly state in accordance with the Code. The magazines will be maintained in a weather-proof condition.

The magazines will be inspected in accordance with all relevant legislation, licenses, permits, and approvals. Routine inspections will be conducted by the Health, Safety, and Human Resources Superintendent, and the Environmental Coordinator.

Before any repairs are to be conducted on a surface explosives magazine or detonator house, any explosives or detonators contained within them will be removed or protected. If hot work is to be undertaken, or mechanical or electrically powered hand tools are to be used (including any prohibited equipment or materials), all explosives and detonators will be removed from the magazine (decommissioned) and placed in a safe location. No modifications or repairs that impact on any relevant legislation, licenses, permits, and approvals of the magazine are permitted without prior regulatory approval.

6.3.2.3 Access to Magazines

Only personnel designated as a Blaster by the Mine Manager will be issued a key, which allows access to the explosive and detonator magazines. Any personnel requiring entry into the magazines will be continuously supervised by a designated Blaster unless the specific magazine has been decommissioned.

Access keys to the magazines will be secured and controlled in accordance with all relevant legislation, licenses, permits, and approvals. Magazine keys will be kept in a magazine key safe and will be listed on a register. Magazine keys will be issued from the safe each time the magazines need to be accessed, and the keys are to be returned immediately after access is completed. The keys are to be signed out and back in again by the Blaster. The Mine Superintendent will be designated as the custodian of the magazine key safe and will ensure that control and security of the keys is maintained. If a key becomes unaccounted for at the end of a shift, the Mine Superintendent will take immediate action to secure the affected magazine, arrange for an inventory of the magazine as soon as it is practicable to do so, and report the matter for Incident Investigation. Magazine key access control will comply with all requirements of the Code.

6.3.2.4 Magazine Security

Daily security patrols of the Minesite's surface area will include an examination of the magazines to check that they are intact, locked, and that there have been no signs of forced entry. These patrols will be conducted at times of the day when there is reduced activity around magazine areas and will include an inspection of the boundary fence. Any breach of security at the magazines or theft of explosives or detonators will be reported immediately to the Mine Superintendent, who will in turn report to the Mine Manager. The Mine Manager will report any security breaches to the appropriate authorities and initiate an Incident Investigation. The magazines are located behind lock or secured gates with controlled entry. The Project will follow all provincial regulations pertaining to magazine security, maintenance, and inventory control.

6.3.2.5 Magazine Inspection and Explosives Reconciliation

The following provides a summary of the magazine inspection and reconciliation procedures.

6.3.2.5.1 Explosives Reconciliation Procedure

Orica personnel will initiate explosives inventory reconciliation which will occur at least weekly and provided to the Mine Superintendent. The reconciliation procedure and the frequency of the reconciliation will be conducted in accordance with all relevant legislation, licenses, permits, and approvals. An Explosives Reconciliation Procedure will be prepared and maintained by Orica which will detail personnel involved with this task.

The Code outlines specific requirements with respect to up-to-date reconciliation that will be conducted by the Blaster on each visit to the magazine.

The Mine Superintendent will report discrepancies to the Mine Manager. The Mine Manager will report any Incidents to relevant regulatory authorities, where required by legislation, licenses, permits, and approvals.

6.3.2.5.2 Magazine Inspection Procedure

TCL Blasters will initiate magazine inspection inventory reconciliation which will normally occur daily. During all magazine reconciliation inspections, a product inspection will also be conducted, including packaged explosives, delays, and detonators. Any product that is damaged, deteriorated, or appears abnormal in any

way will be treated as disposal product. The disposal products will be immediately identified and isolated from the acceptable products (while still contained within the magazine) and reported to the Mine Superintendent. The Mine Superintendent will arrange for safe disposal through Orica as per **Blast Site Safety Manual - Explosives and Packaging Disposal** in **Appendix 13.6-E**.

6.4 Deliveries of Offsite Explosives, Boosters, and Detonators

Explosives and detonators will only be purchased from Orica, or another approved explosive provider, an authorized explosive manufacturer and vendor in Canada. New stock deliveries will be initiated by raising a purchase order. Before raising a purchase order, it must be ensured that the total quantity in the magazine after the purchase does not exceed the licensed level. Explosives will be received into the magazines from an outside licensed contractor under the supervision of the Blaster. A Blaster will accompany the delivery from the turn off from the TAC onto the Explosive Magazine service road. The licensed supplier will be contacted the day of delivery to confirm their arrival time by the Blaster. **Table 6.4-1** below summarizes the expected quantity of explosives being delivered to site and their respective quantities.

Table 6.4-1: Delivered Quantities of Explosives, Detonators, and Boosters

Product	Maximum Transport Quantity	Means of Transport	Shipping Location	Frequency
Bulk Ammonium Nitrate	40 tonnes	Road Tanker	Prince George	Weekly
Bulk Emulsion	20 tonnes	Road Tanker	McLeese Lake	Weekly
Packaged Explosives	1 to 5 tonnes	Enclosed Van Truck	Terrace	Monthly
Detonators and Boosters	500 units of each	Enclosed Van Truck	Prince George	Weekly
Other accessories	250 units	Enclosed Van Truck	Prince George	Weekly

Prior to accepting a delivery of explosive or detonators the Blaster will:

- physically confirm that the explosives are of the correct type, have the correct labelling and their date of manufacture is current, and they have not been damaged;
- confirm that the detonator manufacture date on the packing carton does not exceed the appropriate expiry, and they are of the correct type, and they have not been damaged;
- confirm that quantities received are correct against the delivery waybill; and
- record all necessary information into the magazine log record book and ensure the inventory is reconciled regarding the quantities of delivered products.

The delivery of explosives and detonators to the magazines will be conducted in accordance with all relevant legislation, licenses, permits, and approvals. The delivery process will be in accordance with the Code.

6.5 Designations and Records

All designations related to the EMP will be made in writing by the Mine Manager, and only those personnel who have the relevant certifications or qualifications may be designated to manage explosives. All records

required in relation to the EMP will be kept for such periods in accordance with all relevant legislation, licenses, permits, and approvals. The Code has specific requirements regarding qualifications of Blasters and other personnel, and all designations will be made in accordance with the Code.

The Mine Manager will designate the following functions:

- Blasters;
- Blaster Helper; and
- Explosives Handler which is Orica personnel (to include reconciliation and inspection).

6.6 Issuing Explosives and Detonators

Only a Blaster will issue explosives and detonators for the Project. The Blaster will only issue explosives and detonators to other Blasters and/or Blaster Helpers and/or other authorized personnel. Explosives and detonators will only be issued for approved shot firing purposes and will only be issued for transport in approved containers. Containers will be in good condition, properly labelled, and contain nothing other than explosives and appropriate packaging. Explosives and detonators will never be transported in the same container.

The Blaster will ensure that all unused explosives and detonators are returned, inspected, and stored in magazines as soon as practicable upon completion of shot firing during the shift. Any explosives and detonators will not be left unsecured. The Blaster will complete the up-to-date magazine reconciliation during the shift and all records must be completed, signed, and dated and any discrepancies reported to the Mine Superintendent.

6.7 Transporting Explosives and Detonators to Pattern

An **Explosives and Detonators Transportation Procedure** has been developed for the movement of explosives and detonators onsite and is provided in **Appendix 13.6-F**. In summary:

- Personnel need to hold all required certifications, such as a valid BC Blasting Certification and a Transportation of Dangerous Goods (TDG) Certification;
- Use of a proper transport vehicle; and
- Ensure explosives and other blasting accessories transported are accurately tracked and returned to the magazines.

6.8 Using Explosives and Detonators

An SPP for drilling and blasting will be developed prior to the Operation Phase and kept current with all relevant reference material regarding the safe application and use of explosives and detonators for the Project. The SPP includes all rules and procedures in accordance with the Code and relevant legislation, licenses, permits, approvals, and industry accepted best practices. It includes instructions on the care and use of all associated equipment such as blasting machines, testers, cables, etc.; plus, it will include the latest instructions on existing and/or new explosives and detonator products used by the Project. The SPP will provide detailed instructions stemming from the risk assessment processes for all blasting products and the blasting design process. Some aspects that will be covered in the SPP are as follows:

- loading of holes with explosives;

- adverse weather conditions;
- noise;
- smoke, dust and flyrock;
- vibration; and
- misfires.

6.8.1 Loading of Explosives

Explosives will be loaded into holes from the explosive delivery truck (MMU) provided by Orica utilizing the procedures for loading of explosives as provided in **Appendix 13.6-G Orica Suggested Best Loading Practices**. The loading of explosives shall only be performed by qualified and designated personnel who are authorized by the Mine Manager. In summary:

- hole will be inspected for water conditions and overall integrity;
- depth of hole will be checked and checked against both the designed depth and actual drilled depth and provided to the operator of the explosive delivery truck;
- explosive blend will be selected based on water conditions;
- explosive loading methodology will be selected based on explosive type selected;
- loading rules developed by the Senior Mine Engineer and blasting personnel will be followed. In summary:
  - explosives will be loaded up to 1 m from the bottom of the hole, and first detonator will be placed in hole;
  - explosives will be loaded to 3 m within final design column height of explosives planned for the hole and the second detonator will be placed in hole; and
  - explosives will be loaded to designed height in hole.

6.8.2 Firing of Blast Patterns

TCL will develop a detailed procedure for the firing of blast patterns once the Project is in the Operation Phase. In summary the following steps will be observed:

- designs and reviews completed by designated individuals;
- notifications and signage;
- clearing circles set at 700 m for personnel and 350 m for equipment;
- clearing and guarding requirements;
- radio use;
- post-blast audits and inspections; and
- blast reports and videos.

6.8.3 Adverse Weather Conditions

Three (3) main types of weather conditions are a concern when dealing with explosives on site. They are:

1. heavy rain;

2. heavy snow; and
3. lightning.

6.8.3.1 Heavy Rain

Blasters onsite will be aware of weather conditions in the coming days for a loading of a specific pattern. If heavy rain is forecast by Environment Canada for the region, efforts should be made to avoid loading blast patterns during this period of heavy rain. Furthermore, efforts should be made to detonate all loaded patterns prior to the forecast rain event. In times of year when this type of weather is more likely blast patterns should be kept smaller and square to allow for blasts to be undertaken with minimal notice.

6.8.3.2 Heavy Snow

Blasters onsite will be aware of weather conditions in the coming days for a loading of a specific pattern. If heavy snow is forecast by Environment Canada for the region, efforts should be made to detonate all loaded patterns prior to the forecast snow event. In times of year when this type of weather is more likely blast patterns should be kept smaller and square to allow for blasts to be undertaken with minimal notice.

6.8.3.3 Lightning

The following clause from the Code outlines the legal requirements for dealing with electric storms on a Minesite associated with blasting.

> *Electric Storms*
>
> *8.6.16 The manager shall ensure that persons engaged in blasting operations underground are warned of an electric storm.*
>
> *8.6.17 A blaster shall not connect an electric blasting circuit during an electrical storm. Once an electric blasting circuit is connected, and should an electric storm occur, all persons shall be withdrawn to a safe distance from the blast site. Access to the blast site shall be guarded until the storm has passed.*

For the purposes of this document, an electric storm is defined as one that can be detected with the onsite lightning detector at TCL. The planned actions are as follows:

- electric storm in forecast greater than 24 hours in future: be aware of planned blasting functions to ensure they can be shot in under 48 hours if required;
- electric storm greater than (>) 65 km from Minesite and forecast to occur in the coming 24 hours: square and tie off existing pattern to be shot within 24 hours;
- electric storm between 32 and 65 km: tie off pattern as is and shoot pattern immediately;
- electric storm between 12 and 32 km: no further loading of patterns, and tie off any blast patterns and shoot pattern immediately or evacuate non-essential rubber-tire equipment and personnel at least 600 m from loaded blast patterns in their direction of fire and tracked equipment at least 400 m away from loaded blast patterns in their direction of fire, and no further loading of blast patterns that are drilled;

- electric storm between 5 and 12 km: evacuate all personnel and rubber-tire equipment at least 600 m from loaded blast patterns in their direction of fire and tracked equipment at least 400 m away from loaded blast patterns in their direction of fire; and
- electric storm < 5 km: maintain evacuation.

6.8.4 Noise

TCL will monitor the noise levels generated from proposed blasting practices to determine if further mitigations are required. The proposed blasting practices have the following mitigations incorporated into them to reduce noise levels:

- designated stemming material consisting of crushed PAG rock and/or non-PAG rock crushed to less than 18 millimetres (mm) with no stemming material finer than 3 mm;
- thickness of stemming material in each borehole determined by the diameter of the borehole, the depth of the borehole and results from previous blasts;
- individually delayed holes;
- electronic detonators to avoid multiple hole detonation;
- Nonel detonating line;
- low powder factor; and
- blasting to occur during the daylight hours.

6.8.5 Smoke, Dust, and Flyrock

TCL will monitor the smoke, dust, and flyrock generated from blasting practices to determine if further mitigations are required. The proposed blasting practices have the following mitigations incorporated into them to reduce smoke, dust, and flyrock levels:

- designated stemming material consisting of crushed PAG rock and/or non-PAG rock crushed to less than 18 mm minus with no stemming material finer than 3 mm;
- thickness of stemming material in each borehole determined by the diameter of the borehole, the depth of the borehole and results from previous blasts;
- individually delayed holes;
- electronic detonators to avoid multiple hole detonation; and
- low powder factor.

6.8.6 Vibration

TCL will monitor the vibrations generated from blasting practices to determine if further mitigations are required. The proposed blasting practices have the following mitigations incorporated into them to reduce vibration levels:

- individually delayed holes;
- electronic detonators to avoid multiple hold detonations; and
- low powder factor.

6.8.7 Misfires

Misfires occur when blasting agents do not detonate. Misfires can result from a variety of influences including environmental (water degradation), physical (de-sensitizing the explosive through separation) or chemical (inaccurate blending). These will be dealt with using applicable policies and procedures in accordance with relevant legislation. Where feasible, blasting agents that cannot be detonated should be collected and disposed of in a manner that reduces the likelihood of it entering the environment. In the unlikely event that a misfire occurs, the safest management action is to try and detonate the hole again. However, if this cannot be done, when a misfire is found in the face of digging and it has been determined that the detonators have not been detonated a Blaster will be placed in charge of dealing with the misfire which will involve using a vacuum truck and/or backhoe to recover the explosives and once the detonators are found they will be manually recovered by the Blaster.

TCL will monitor the number of misfires generated from blasting practices to determine if further mitigations are required. The proposed blasting practices have the following mitigations incorporated into them to reduce misfires from blasting operations:

- electronic detonators to allow checks of blast patterns;
- two (2) detonators will be put in all holes;
- best management loading procedures provided by Orica;
- explosive selection for water conditions encountered; and
- low powder factor.

6.9 Environmental Protection

Mine production targets are linked to nitrogen using ammonium nitrate-based blasting agents used in blasting. There is a direct relationship between the amount of blasting products used and the productivity of the mining fleet and the amount of nitrogen in the form of nitrate that is produced by a mine. The amount of blasting products that are used in blasting is not the reason for nitrogen release; it is the inefficient use of blasting products. The factors in the generation of nitrogen residue mentioned above are considered in the overall of nitrogen release. Environmental protection will be based on three (3) areas:

1. water management;
2. explosives management; and
3. monitoring.

6.9.1 Water Management

Water management is a strategy to reduce nitrogen leaching. By reducing water contact with explosives there is a reduced possibility for the nitrates to be transported to the receiving environment.

6.9.2 Interceptor Channels

Interceptor channels will be considered where feasible to capture non-contact water outside of mining disturbance to direct drainages that are not directly affected by mining around active mining areas.

6.9.3 Perimeter Channels

Where water flows into open pits, perimeter channels on catch benches or roads or benches where feasible will be used to divert water away from blasting activities.

6.9.4 Bench Dewatering

As groundwater cannot be captured through surface channels, it will need to be collected if feasible using sumps prior to bench development. For this Project the volume of groundwater does not necessitate the use of wells and only sumps will be used to reduce groundwater inflows to the active bench.

6.9.5 Explosives Management

TCL will review water conditions in all holes and will employ the best product for the water conditions present in the borehole. As mentioned previously, five (5) main blasting agents are available onsite, which in order of increasing water resistivity are as follows:

1. Heavy ANFO (Fortan Extra 35% through 50% emulsion);
2. Bulk Emulsion 70 (Fortis 70% through 99% emulsion);
3. Bulk Emulsion 100 (Fortis 100% emulsion);
4. Packaged Emulsion (Fortel); and
5. Sentel Powersplit.

In summary, the wetter the hold and more dynamic the water conditions, the more water resistivity is required, and the explosive selected should reflect these conditions.

6.9.6 Explosive Storage

ANP, emulsion, and blasting accessories storage is conducted in accordance with all applicable legislation. The areas are regularly inspected by Orica and TCL personnel for spillage and/or damage to containers, transfer equipment and/or vessels. Problems are rectified as soon as possible upon identification.

6.9.7 Reduction of Nitrogen Release

The following subsection summarizes the mitigation measures employed to reduce the amount of fugitive nitrogen emissions from the Project due to blasting.

6.9.7.1 Powder Factor Optimization

Powder factor is the ratio of explosive per a given amount of material to be blasted. The optimization of powder factor refers to the reduction of blasting agent use per unit volume or mass of rock blasted to achieve a desired result which is excavator productivity in the Project's case. The current plan has a powder factor of 0.50 kg/bank cubic metre (BCM). TCL will investigate methods to reduce the amount of product while still achieving an adequate productivity from the excavator. A reduction in powder factor results in less product being used and subsequent reduction of nitrates being introduced into the mining environment.

6.9.7.2 Explosives Loading

Explosives are loaded into the boreholes by the following methods:

- auguring where an auger is placed over the top of the borehole and discharges the explosive blasting agent into the borehole; and
- pumping where the end of a hose is placed at the bottom of a borehole. Explosives are then pumped into the borehole as the hose is progressively raised to fill the borehole.

The following guidelines will reduce the likelihood of nitrogen release through the explosive loading process:

- Correctly identify and handle static and dynamic water to determine product requirements and resulting loading methodology;
- Reduce the time loaded blast patterns are left loaded prior to be blasting which is also known as sleep time. Minimizing the sleep time of patterns reduces the time explosives and water is in contact with each other;
- Reduce the size of blast patterns in direct proportion to the amount of water that is found in the holes during the drilling process;
- Dewater borehole where possible via dewatering equipment;
- Keep patterns and loading square to the face in case increased water conditions are found during the drilling process so that pattern can be easily and quickly tied and detonated;
- Avoid loading patterns with explosives in extremely wet/rainy conditions and/or snow melting conditions to provide time for the pattern to be sufficiently dewatered if possible; and
- Use liners or equivalent products in boreholes if water conditions permit.

6.9.7.3 Explosive Detonation

The complete detonation of explosive pertaining to nitrogen management is important because incomplete combustion results in the release of nitrates, nitrites, and ammonium.

Where possible, TCL will incorporate the following measures to ensure boreholes fire as intended:

- Minimize sleep time of explosives, and follow the explosive supplier's guidelines on product sleep times;
- Double prime boreholes;
- Use blast simulation software to optimize initiation designs;
- Perform quality checks on subsamples of explosives being loaded to ensure it meets product specifications;
- Use an electronic initiation system if practical to reduce the likelihood of misfires;
- Use higher viscosity emulsions with more water-resistant properties;
- Designated stemming material consisting of crushed PAG rock and/or non-PAG rock crushed to approximately less than 18 mm minus with no rock finer than 3 mm;
- Thickness of stemming material in each borehole determined by the diameter of the borehole, the depth of the borehole and results from previous blasts;
- Use proper stemming materials and thicknesses (as above), and techniques for holes to ensure sufficient confining pressures; and
- Use **Orica's Suggested Best Loading Practices** for emulsion and heavy ANFO provided in **Appendix 13.6-G**.

Investigate other technologies, techniques, and products with the potential to reduce nitrogen release into the environment as they emerge.

6.9.7.4 Explosive Disposal and Spill Management

To facilitate proper capture, containment, treatment and disposal of waste explosives and raw material waste in the appropriate manner.

- Orica and TCL will explore and implement controls for reducing explosives and explosives raw material waste during loading and at storage facilities using best practices for MMU operation, transfer of bulk raw materials and loading of boreholes;
- Spillage will be cleaned up and depending on its detonation expectations, should be placed into a borehole, or captured, treated, and disposed of in an acceptable manner;
- Contaminated ammonium nitrate spills will be cleaned up according to Orica policies and procedures;
- TCL will follow the **Waste Management Plan for Refuse and Emissions (S13.0-C20) (WMPRE)** which pertains to the above-mentioned actions; and
- Orica will operate and maintain a waste water evaporator that will be used treat waste water consumed in the maintenance and washing of the MMU's and explosive vehicles. All wash water will be collected and strained for solids and then directed to the evaporator. Solids from the evaporation process along with other strained solids will be bagged and lowered into the next available borehole for disposal.

6.9.8 Blasting Supplier Environmental Considerations

TCL will require Orica to follow considerations provided in **Appendix 13.6-H Blast Site Policy Environmental Considerations**.

7. MONITORING

Monthly and annual reports to the Mine Manager will be prepared by the Mine Superintendent, summarizing compliance with the requirements of the EMP, listing all exceedances, identifying incidents, or observed hazards related to explosives, and outlining the corrective action that has been taken or is scheduled to take place. Any corrective actions related to the magazines must be assessed against the requirements permit issued for the Explosives Facility and Explosive Magazine, and the Code, recognizing that both legal instruments significantly restrict any modifications or changes that can be undertaken without regulatory approval.

The following is a list of specific tasks related to monitoring:

- analyze Explosives Facility wash water for nitrogen species monthly;
- inspect Explosives Facility and trucks monthly;
- prepare Annual Explosives Report;
- prepare a monthly Blast Report that details items such as powder factor, explosives usage, drill hole information;
- prepare reports for each blast; and
- monitor all blasts.

The Mine Manager will report all reportable exceedances to the relevant authority. TCL staff or contractors will be strongly encouraged to report any inefficiencies to management for evaluation consideration.

7.1 Performance Objectives

In addition to extensive inspections and monitoring to ensure the objectives of the EMP are met, performance objectives and targets are set to guide the proper implementation of the EMP. They are shown in **Table 7.1-1**:

Table 7.1-1: Performance Objectives

Objective	Target
Number of misfires	Zero
Number of reportable explosive spills	Zero
Concentration of nitrates in Tenas Control Pond	Not to exceed permit limits
Concentration of nitrates at compliance point	Not to exceed permit limits
Blast Reports	All blasts
Third-party audit	Every third year
Valid blast tickets	Always have a valid blasting certification for all blasters onsite

8. REPORTING

8.1 General Reporting

Reporting completed by TCL will ensure consistent implementation of the EMP. Summary reports of monitoring activities and results will be compiled annually including the number of spills.

A **Spill Report Form** (see **Appendix 13.6-I**) will be completed for all reportable and non-reportable spills of explosives that occur on the Minesite, regardless of quantity spilled or location. Furthermore, **Incident Notification and Incident Investigation Report Forms** (**Appendix 13.6-J)** should be completed for all Incidents related to explosives onsite. The details will be passed on to a Supervisor and the Environment Department for analysis, including the identification of repeat spill locations.

8.2 Compliance Reporting

Compliance reporting will be subject to the Environmental Assessment Certificate (EAC), and *MA/EMA* permit conditions. The information gathered during monitoring practices will be summarized with information from other management plans into an Annual Environmental Management Summary Report and upon permitting completion, the Annual Environmental Reports as required by *MA/EMA* permits. Community engagement activities will be an aspect of the **Socio-economic Management Plan (S13.0-C16) (SEMP)**. The **SEMP** will have requirements related to reporting on community engagement programs.

In the event of an explosives spill that is reportable per the Spill Reporting Regulations, BC Reg 187/2017, which is any spill greater than 1.0 kg of explosives spilled in one (1) event, a report will be also submitted to the Emergency Management British Columbia (EMBC), formerly the Provincial Emergency Program (PEP), at 1-800-663-3456 within 24 hours of the spill event by the Environment Department. In the event of a misfire, the Mine Manager is to contact the Chief Inspector of Mines within 4 hours.

As mandated by the *Canadian Environmental Protection Act*, 1999, SC 1999, c 33 (GovCan 1999) (*CEPA)*, TCL will also report blasting related emissions data annually, if applicable, to the National Pollutant Release Inventory (NPRI) (Environment and Climate Change Canada [ECCC] 2020).

8.3 Internal Reporting

Details of the monitoring will be reported internally on an annual basis according to the adaptive management framework of the EMP. The report will provide results of monitoring, assessment of performance objectives, and including but not necessarily limited to recommendations for infrastructure repair or movement.

A report will be prepared for all blasts as provided in **Appendix 13.6-K Blast Report** and a copy of the final as-built of the Blast Report needs to be completed. If practical, a video of the blast is to be completed to assist with improvement in the future. Furthermore, a blast design will be completed for all blasts following the procedures provided and will cover aspects like:

- blast location;
- borehole diameter;
- burden and spacing;
- design lines such as toe, crest, mid-bench and coal seams;

- designer;
- sign off by Blaster and Mine Superintendent;
- loading instructions; and
- timing instructions.

TCL staff or contractors will be strongly encouraged to report any inefficiencies to management for evaluation consideration.

9. ROLES AND RESPONSIBILITIES

9.1 Mine Manager

The Mine Manager bears overall responsibility for all phases of the Project, and responsibility for onsite environmental monitoring and compliance. The Mine Manager reports to the executive steering committee for TCL and will coordinate with this group to ensure that Project objectives are being met.

The Mine Manager will:

- ensure that the requirements of the EMP are implemented and maintained;
- all designations related to the EMP will be made in writing by the Mine Manager;
- participate in risk assessments related to blasting and explosive use;
- ensure the EMP is reviewed and updated every two (2) years, or earlier whenever relevant circumstances change or when incidents occur that necessitate a revision;
- allocate resources to implement this plan for continued compliance;
- allocate and designate required people to effectively apply necessary controls;
- ensure all appropriate corrective actions identified through incident reports, hazard reports, reviews, and audits are implemented and verified in a timely fashion;
- report to Chief Inspector of Mines all Dangerous Occurrences as specified by section 1.7.3 of the Code;
- submit alerts for critical and Dangerous Occurrences within four (4) hours to Chief Inspector of Mines;
- report any incidents to relevant regulatory authorities, where required by legislation, licenses, permits and approvals, and
- provide to Chief Inspector of Mines a written report on investigation of significant incidents within one (1) month of incident.

9.2 Mine Superintendent

The Mine Superintendent reports to the Mine Manager and assists the Mine Manager with implementing and maintaining the EMP, including reporting of Incidents. The Mine Superintendent will:

- conduct inspections of the Explosive Facility and Explosive Magazine and assess compliance against all EMP requirements and relevant legislation, licenses, permits and approvals;
- prepare monthly reports to the Mine Manager summarizing what corrective actions were recommended and approved, and the status of the corrective actions;
- update risk assessment whenever there are significant changes related to the use of explosives for the Project or after any significant occurrence involving explosives;
- participate in risk assessments related to blasting and explosive use;
- keep magazine license in good order;
- conduct Incident Investigations for any reportable quantity discrepancies reported for explosive storage areas onsite;

- arrange for safe disposal of defective explosive products through Orica per **Appendix 13.6-E**;
- report breach of magazines to the Mine Manager;
- sign blast designs;
- monitor smoke, dust, flyrock, vibrations, noise levels, and number of misfires generated from blasting practices and determine any changes that are required; and
- order explosives, detonators, and accessories.

9.3 Environmental Coordinator

The Environmental Coordinator is responsible for the day-to-day management of the Project's environmental programs and permits. The Environmental Coordinator reports to the Mine Superintendent.

The Environmental Coordinator will:

- report internally on monitoring, performance objectives, and results of all regulatory reporting;
- conduct inspections of the Explosive Facility and Explosive Magazine and assess compliance against all EMP requirements, relevant legislation, licenses, permits and approvals; and
- assist with preparing monthly reports to the Mine Manager summarizing what corrective actions were recommended and approved, and the status of the corrective actions based on these inspections.

9.4 Health, Safety, and Human Resources Superintendent

The Health, Safety, and Human Resources Superintendent is responsible for the day-to-day management of onsite health and safety. The Health, Safety, and Human Resources Superintendent reports to the Mine Manager. The Health, Safety, and Human Resources Superintendent will:

- conduct inspections of the Explosive Facility and Explosive Magazine and assess compliance against all EMP requirements, relevant legislation, licenses, permits and approvals; and
- prepare monthly reports to the Mine Manager summarizing what corrective actions were recommended and approved, and the status of the corrective actions based on these inspections.

9.5 Blaster

The Blaster will:

- maintain valid Blasting Certification and TDG Certificate;
- maintain a valid class 5 driver's license;
- pass annual criminal record background check;
- receive all new inventory of explosives and detonators, and ensure they are delivered immediately to the magazines;
- issue explosives and detonators to Blasters for approved shot firing purposes;

- maintain an up-to-date reconciliation of the explosives and detonators contained in the magazines and detonator houses for each visit whereby explosives or detonators are issued or received from within;
- maintain the magazines in a clean and well-organized manner, in accordance with all relevant legislation, licenses, permits and approvals;
- inspect all explosives and detonators to ensure they are in good condition;
- transport, use, and return explosives and detonators in accordance with the EMP and all procedures, guidelines, and forms; in accordance with the onsite Blaster's Manual; and in accordance with all relevant legislation, licenses, permits, and approvals;
- sign blast designs;
- supervise the delivery of explosives into the magazines;
- contact the licensed supplier the day of delivery of explosives, detonators and accessories to confirm their arrival time;
- physically confirm that the explosives are of the correct type, have the correct labelling and their date of manufacture is current, and they have not been damaged;
- confirm that the detonator manufacture date on the packing carton does not exceed the appropriate expiry, and they are of the correct type, and they have not been damaged;
- confirm that quantities received are correct against the delivery waybill;
- record all necessary information into the magazine log record book and ensure the inventory is reconciled regarding the quantities of delivered products;
- will ensure that all unused explosives and detonators are returned, inspected, and stored in magazines as soon as practicable upon completion of shot firing during the shift;
- will ensure all explosives and detonators will not be left unsecured;
- will complete the up-to-date magazine reconciliation during the shift and all records must be completed, signed, and dated and any discrepancies reported to the Mine Superintendent; and
- will be aware of weather conditions in the coming days for a loading of a specific pattern.

9.6 Senior Mine Engineer

The Senior Mine Engineer will be responsible for:

- sign off on all blast patterns;
- develop loading and timing rules for blast patters; and
- design of all blast patterns.

9.7 Employees and Non-Orica Contractors

Employees and non-Orica Contractors will be responsible for:

- following safe storage and handling procedures as approved by the Mine Manager;
- compliance with the Code; and
- reporting all Incidents or Near Misses involving explosives to their Supervisor.

9.8 Visitors

Visitors will:

- follow directions of their designated site escort; and
- understand and comply with visitor induction program related to blasting.

9.9 Orica Personnel

Orica personnel will:

- maintain the Explosive Facility and Explosive Magazine;
- deliver correct quantity and quality of explosives to site and to the borehole;
- maintain all required compliance records and requirements for the Explosive Facility and Explosive Magazine;
- assist TCL with blast design and monitoring;
- be responsible for Explosive Facility and Explosive Magazine security;
- conduct weekly explosives inventory reconciliation;
- prepare and maintain an Explosives Reconciliation Procedure; and
- ensure licenses for the Explosive Facility and Explosive Magazine are maintained.

10. COMMUNICATION

Communication of the EMP at TCL will be based on the internal requirements and primarily through this EMP and relevant SPP. Any significant change to the EMP onsite will be communicated to all Minesite employees and contractors through a site-wide email, announcements over all radio channels by Minesite supervision and bulletins posted around the Minesite.

10.1 Training and Awareness

Use of explosives on the Minesite requires special handling and training procedures. All employees, contractors and subcontractors who are managing explosives for the Project need to understand this EMP and relevant SPP. Furthermore, all blasts onsite must be performed by a BC Blaster with a valid Blasting Certificate.

10.2 Employee and Contractor Training

Employees are required to review all relevant SPP and their associated training modules at the start of employment and on an annual basis. Employee training is tracked and managed by a software application as required under the TCL **EMS**.

Contractors will review the relevant SPP at the start of their contract and on an annual basis if contracts are longer than 13 months in duration to ensure their compliance with these requirements. Visitors will receive an overview of the relevant SPP during their visitor induction session prior to accessing the site or from their Contract Manager. Visitors are restricted to being under the direction of TCL employees for use of TCL roads and will be escorted by TCL personnel onsite or accompanying TCL personnel in their vehicles.

10.3 Visitor Training

Visitors will not be required to be knowledgeable of this EMP as they will be under the direction of TCL employees and will not be allowed to be in a situation involving explosives.

11. EVALUATION AND ADAPTIVE MANAGEMENT

11.1 Evaluation

A review of the EMP will be completed by the Mine Superintendent on an annual basis to compare data, trends, and implementation of the management plans and their objectives. This process will include a review of the management plan deliverables and input received from all relevant stakeholders.

11.2 Adaptive Management

A philosophy of adaptive management will be adopted to ensure that management plans and mitigation measures are consistently meeting or exceeding performance targets. This will be achieved through periodic reviews of the EMP and the results of monitoring programs.

TCL will work towards continual improvement at all Mine Infrastructure to reduce waste and ensure appropriate handling of all materials. The Mine Superintendent will investigate improvements in any trend and assess whether the practices responsible for the improvements can be applied to other areas of the Project. This includes decreasing explosives usage and looking for potential improvements in blasting agents.

Deteriorating trends will be studied to determine the root cause. When the cause is identified, the Mine Superintendent will propose a suitable corrective action to the Mine Manager. Examples of corrective actions could include:

- finding alternate forms of blasting agents to reduce nitrate production or improve blasting results;
- additional training of employees and contractors on procedures;
- enhancement of maintenance or monitoring measures; and/or
- additional supervisory oversight.

11.3 Continual Improvement

TCL will amend the EMP as required using the TCL EMS and based on annual evaluations and feedback from stakeholders. Any proposed changes will be sent out for review by all relevant stakeholders before being finalized and implemented into the EMP.

12. CHANGE MANAGEMENT

Changing any part of this EMP requires a formalized process to be used as per the TCL **EMS**. If significant changes to objectives, management plan structure, operational milestones, communication and/or information management are being planned, it is required that the Management of Change (MOC) procedure of the **EMS** be followed. Minor edits and/or updates to this EMP will be controlled through version control and content approval functions.

13. CONCLUSION

Management of explosives at TCL is important for the safety of all personnel onsite and regarding vibration, noise, and dust emissions offsite. Through implementation of this EMP and relevant SPP, TCL will ensure the safety of employees and the public.

14. REFERENCES

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