
# EAGLE GOLD PROJECT

## EXPLOSIVES MANAGEMENT PLAN

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AUGUST 2014

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# 1 INTRODUCTION

StrataGold Corporation (SGC), a directly held, wholly owned subsidiary of Victoria Gold Corp., has proposed to construct, operate, close and reclaim a gold mine in central Yukon. The Eagle Gold Project (Project) is located 85 km from Mayo, Yukon using existing highway and access roads. The Project will involve open pit mining at a production rate of approximately 10 million tonnes per year (Mt/y) ore, an average strip ratio (amount of waste: amount of ore) of 1.45:1.0 and gold extraction using a three stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system over a 10 year mine life.

Construction of the mine will occur over approximately two years from Q2 2015 – Q2 2017 pending issuance of required licences and permits. The construction phase has been divided into two stages to accommodate permitting assumptions and seasonal constraints.

During operations, the open pit will be developed using standard drill and blast technology. Ore will be transported from the open pit by haul truck and delivered to the first stage crushing plant (the primary crusher), situated on the north side of the open pit rim. Waste rock will be removed from the open pit by haul truck and delivered to one of two waste rock storage areas (Platinum Gulch or Eagle Pup WRSAs) or will be used as haul road and infrastructure construction material.

Ore will be crushed to a passing 80 percent (P80) particle size of 6.4 mm in a 3-stage crushing process. All three crushing stages will be located north of the open pit. Ore will be conveyed between the primary crushing station and the secondary and tertiary crushing stations by covered conveyor or enclosed conveyor gallery. After the tertiary crushing stage, ore will be transported by covered conveyor to the Heap Leach Facility (HLF) area where the ore will be stacked on the heap leach pad via a series of portable conveyors and finally a radial stacking conveyor.

Gold extraction will utilize cyanide heap leaching technology as described in the Project Proposal. Similar technology was employed in Yukon at the Brewery Creek mine in the late 1990s, and has been employed successfully in other cold climates such as the United States of America (Alaska), Chile, Argentina, Turkey and Russia. Process solution containing cyanide will be applied to the ore to extract gold and then collected by the HLF leachate collection and recovery system.

Gold-bearing “pregnant” solution (pregnant leach solution [PLS]) will be pumped from the heap to the gold recovery plant. Gold will be recovered from the PLS by activated carbon adsorption and desorption, followed by electro-winning onto steel cathodes, and on-site smelting to gold doré. This process is referred to as the adsorption, desorption, and recovery (ADR) process. The gold-barren leach solution that remains after passing through the carbon columns will be re-circulated back to the HLF. The mining operations at the SGV Project will include the use of explosives for rock breaking. The predominant explosive used for ore and overburden removal will be ammonium nitrate, used to manufacture Ammonium Nitrate Fuel Oil (ANFO) and emulsion explosives (water gel).

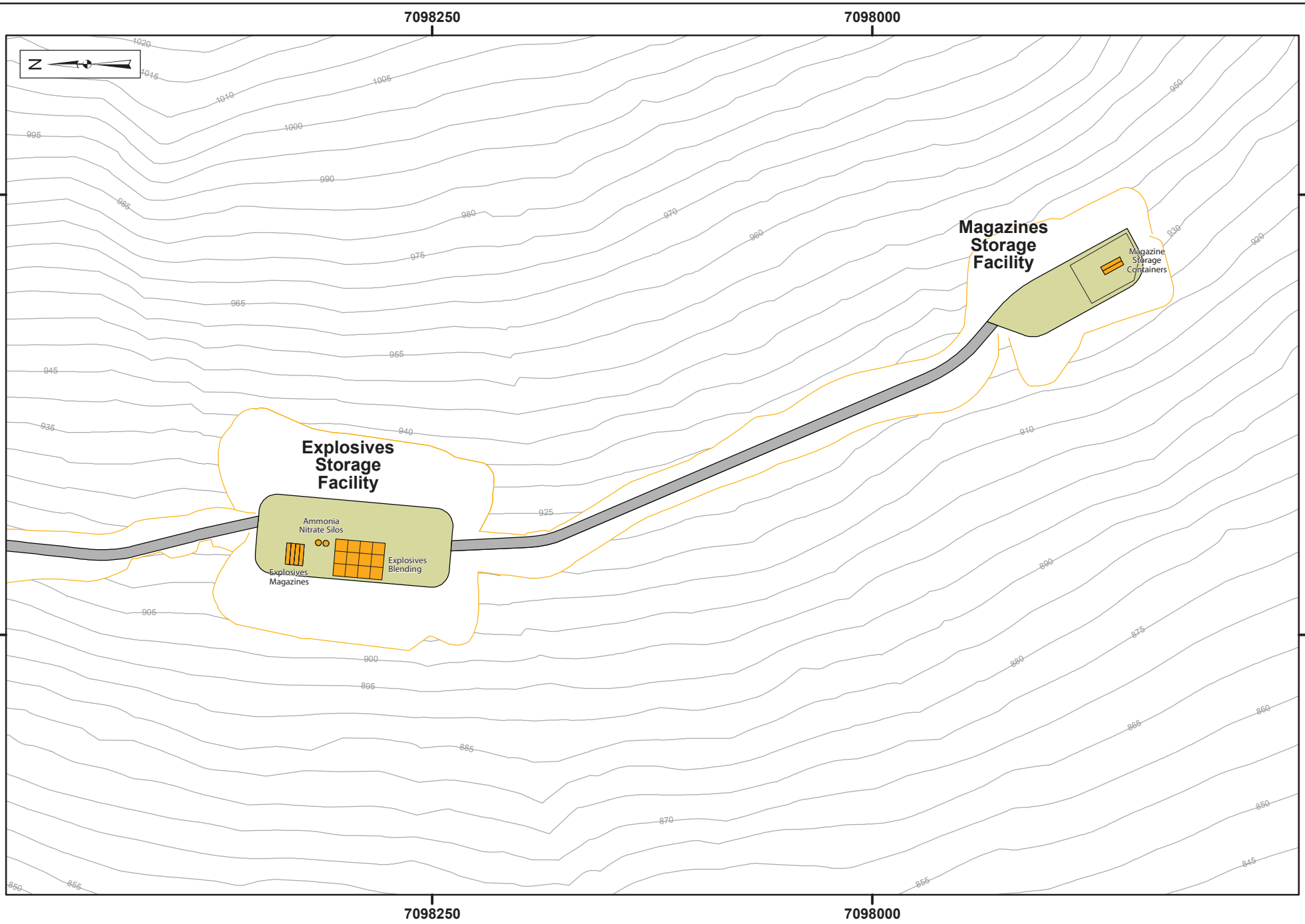
The purpose of this Explosives Management Plan (ExMP) is to describe how SGV intends to integrate the safe use of explosives into mine operations while minimizing environmental impacts. Control and use of explosives are covered by both Federal and Territorial regulations. Numerous permits are required for the use and storage of explosives, which will be obtained prior to mining. Operating procedures to ensure that explosives are

handled safely, in a manner that minimises the chance of environmental contamination by explosives will be produced by SGV, and only trained competent staff will be allowed to work with explosives.

For the mining operations, bulk explosives will be manufactured onsite by a licensed contractor, who will provided a detailed operations manual for transportation, storage and handling of explosives. The recommended formulations are of commercial quality, industry-proven and accepted worldwide. The bulk explosives manufacturing will be operated by a contractor who has relevant mining experience. The contractor will also be providing down-the-hole delivery of the product to the blast hole by means of the facilities and equipment to be licensed and approved by National Resources Canada, Explosives Division.

In addition to the raw ingredients, the explosives contractor will provide commercial packaged explosives and accessories that will be transported to the mine site. This will include detonators, boosters, detonating cord and packaged explosives for specialty applications. These materials will be stored on site in approved explosive magazines until issued for use.

The location of the bulk explosive storage facilities and the explosive magazines is shown in Figure 1.1-1 Eagle Gold Layout Showing Locations of Bulk Explosive Storage and Explosive Magazines.




Legend:

- Cut/Fill
- Contour (5m)
- Building
- Road Bed
- Pad

StrataGold Corporation

0 25 50
Metres
Scale = As Shown

Projection: NAD83 UTM Zone 8N

Drawn By: SS

Date: 2014/07/02

Figure: 1.1-1

# EAGLE GOLD PROJECT
# YUKON TERRITORY

## Explosives and Magazine Storage Area

# 2 EXPLOSIVES PERMITS REQUIRED

The explosives section of the Permit and Authorization Guide for Yukon Activities has been reviewed and taken into consideration when designing this Explosives Management Plan. Various permits are required for explosives use, the emphasis is that the all documents submitted for various permits have comparable details. A brief summary of the permits and licenses required are listed below.

- Land Use Permit – Required under the *Territorial Lands (Yukon) Act*, *Land Use Regulations*.
- ANFO Permit – Required under the *Federal Explosives Act*.
- Factory License – Required under the *Federal Explosives Act*.
- Mechanical ANFO Certificate for manufacturing of explosive for immediate use under the *Federal Explosives Act*.
- Permit for Use of Explosives – Required under the *Federal Explosives Act*.
- Explosives Magazine Permit – Required under the *Federal Explosives Act*.
- Explosive Transportation Permits – Required under the *Federal Explosives Act*.
- Blasting Permit – Required under the Yukon Occupational Health and Safety Regulations.

Table 2.1-1 contains a summary of requirements with respect to different types of explosive facilities and the requirements for compliance.

SGV and the appointed explosives contractor will work with the Explosives Safety and Security Branch (ESSB) of the Explosives Regulatory Division to obtain the necessary permits and licenses for explosives manufacture, storage, and use.

**Table 2.1-1: Summary of Requirements from Guidelines for Bulk Explosives Facilities: Minimum Requirements by Natural Resources Canada (July 2010)**

| Requirements | Base Factory | Temporary Factory | Satellite Site | ANFO Mechanical Certificate | Demonstration | Trial |
|---|---|---|---|---|---|---|
| **Prerequisite** | Competence in explosives | Base factory proof of temporary nature | Base factory up to 800 km | For use within the owner quarry/mine | Base factory proof of demonstration | Base factory |
| **Document Issued** | Licence | Licence | Satellite certificate | ANFO certificate | Satellite certificate | Letter of permission |
| **Customer Sites** | Any number. up to 430 km Description day for over 300 km | One project. located near site | Any number. up to 200 km | Not applicable | One project may have multiple customers up to 200 km | Not applicable |
| **Time Constraints** | Annual renewal: 12 months | Single renewal 2 years maximum | Monthly:<br>1 month to base factory expiry | Annual renewal | Two months maximum | 6 months |

| Requirements | Base Factory | Temporary Factory | Satellite Site | ANFO Mechanical Certificate | Demonstration | Trial |
|---|---|---|---|---|---|---|
| | | | period | | | |
| **Environment** | EA and Spill Contingency Plan | Possible EA Spill Contingency Plan | Spill Contingency Plan | Spill Contingency Plan | Spill Contingency Plan | |
| **Allowed Process** | As per licence | Bulk delivery as per licence | Storing of a process vehicle storing of bulk explosive and/or raw materials, transferring of explosive of raw | Blend ANFO at borehole | Bulk delivery as per licence | As per agreement |
| **Explosives** | As per licence | Processing Class 1.5 storage as per licence | Class 1.5 | ANFO Class 1.5 | Class 1.5 | As per agreement |
| **Process Vehicles/Units** | As per licence and location list | As per licence and location list | 2 Process units as per location list ANFO mix vehicle | 1 Process unit | As per agreement | |
| **Buildings** | As per licence | As per licence | As per licence | | | |
| **Magazines** | As per licence | As per licence | As per licence | As per licence | As per licence | None |
| **Raw Materials, including AN and Fuel** | Stored on site | Stored on site | Stored on site | Stored on site | Stored on site | As per agreement |
| **Fuel Storage** | As per licence | As per licence | As per provincial regulations | 1 tank | As per provincial regulations | As per agreement |
| **AN Storage** | As per licence | As per licence | 1 unit, silo, tanker or tote | 1 unit | 1 unit | As per agreement |
| **Wash Facilities** | Permanent required heated for winter base sites within 250 km of another base site might have this requirement waived | Temporary. covered. heated in winter | None | Within 200 km | Temporary or weekly return to base | As per agreement |
| **Garage** | Access required | Access required | Access required | Access required | Access required | As per agreement |
| **Processing Time** | 30 days | 30 days | 10 days | 30 days | 10 days | 10 days |
| **Fire Smoking/ Welding Permit** | May be granted | No | No | No | No | No |

# 3 EXPLOSIVES MANAGEMENT PLAN OBJECTIVES

The objectives of the Explosives Management Plan can be described as follows:

- Communicate a methodical approach to explosives management for the Project;
- Ensure that infrastructure constructed for explosives is compliant with all applicable regulations;
- Ensure that structures are constructed to prevent any safety or environmental incidents relating to onsite explosives storage;
- Ensure that handling of explosives is done in a manner that will minimize the possibility of safety or environmental incidents;
- Prescribe safe and environmentally sound measures for disposal or destruction of explosives;
- Prescribe procedures for safe blasting;
- Prescribe procedures for dealing with spills of explosives materials; and
- Indicate the chain of responsibility for explosives management.

# 4 TYPES OF EXPLOSIVES TO BE USED ON SITE

SGV plans to use the following types of explosive equipment and supplies in blasting operations:

- Bulk ammonium nitrate fuel oil (ANFO);
- Emulsion (bulk and packaged);
- Non-electric initiation tubes (nonel tubes);
- Pentolite boosters;
- Electric detonators;
- Detonating cord; and
- Inline delays.

Descriptions of each type of explosive are provided below.

## 4.1 AMMONIUM NITRATE FUEL OIL (ANFO)

Ammonium Nitrate Fuel Oil (ANFO) is one of the possible blasting agents to be used for the Project. ANFO consists of a mixture of Ammonium Nitrate and Fuel Oil. The mixture will be 94% by weight porous, prilled Ammonium Nitrate that will act as an oxidizing agent and absorbent for the remaining 6% Fuel Oil.

ANFO will act as the primary blasting agent for an estimated 70% of blast holes.

## 4.2 EMULSION (BULK AND PACKAGED)

Emulsion explosives will be considered for wet conditions. Emulsion is water resistant and can be blended with ANFO for a product that is better suited to variable weather conditions.

SGV will use site mixed emulsion, which uses the same ammonium nitrate / fuel oil chemistry as ANFO, but differs in the physical form that the reactants become, and the final product is significantly denser than ANFO as well as being water-resistant. The end product is a mixture of emulsion and ammonium nitrate prill (usually 70:30, respectively). This is expected to be required for roughly 30% of blast holes.

## 4.3 NON-ELECTRIC DETONATORS

The explosives contractor will have the option to use a non-electronic detonation method. In this case, the initiation system is composed of a series of shock tubes connected to detonation devices. The shock tubes transmit shock waves to the non-electric detonators to initiate the blast.

## 4.4 ELECTRIC DETONATORS

If warranted electronic detonation may also be considered to increase the accuracy of firing times and programmable detonation, if desired. The precision timing provided by electronic detonators may allow for a more uniform muck pile when conducting controlled pit blasting in different rock units. A more uniform muck pile will reduce processing costs and losses associated with the presence of oversized material and fines.

## 4.5 PENTOLITE BOOSTERS

The explosives contractor may have to use pentolite boosters to detonate bulk explosives that are known to be booster sensitive. Pentolite boosters are considered to be stable 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.

## 4.6 DETONATING CORD

Detonating cord is a thin, flexible plastic tube filled with penta erythritol tetranitrate (PETN). Detonating cord may be used by the explosives contractor as a high speed fuse capable of detonating multiple charges almost simultaneously. This may be used to initiate pre-splitting blasts or for detonating large boulders simultaneously with the blast.

## 4.7 INLINE DELAYS

The proper inline delays will be selected by the explosives contractor as part of the design for each blast. The type of delay will vary depending on whether electric detonation or non-electric detonation is used.

# 5 EXPLOSIVES QUANTITIES

Based on a powder factor of 0.57 kg/$m^3$ or 0.21 kg/tonne of ore or waste, the anticipated explosives required are shown in Table 5-1. It should be noted that actual explosive quantities will vary depending on breakage effectiveness, rock type, rock hardness, explosives cost versus crushing costs, and overall refinements to mining operations.

**Table 5.1-1: Quantities of explosive required for targeted production**

| | | Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Production and explosives requirements | Production schedule | Ore Ktonnage | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 | 5,539 |
| | | Waste Ktonnage | 18,029 | 23,577 | 19,317 | 16,921 | 14,599 | 15,676 | 14,984 | 15,207 | 1,930 |
| | | Stripping ratio | 1.75 | 2.28 | 1.87 | 1.64 | 1.41 | 1.52 | 1.45 | 1.47 | 0.35 |
| | | Total Ktonnes | 28,354 | 33,902 | 29,642 | 27,246 | 24,924 | 26,001 | 25,309 | 25,532 | 7,469 |
| | | Ore tonnes per day | 29,500 | 29,500 | 29,500 | 29,500 | 29,500 | 29,500 | 29,500 | 29,500 | 29,500 |
| | | Days | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 188 |
| | | Waste tonnes per day | 51,511 | 67,363 | 55,191 | 48,346 | 41,711 | 44,789 | 42,811 | 43,449 | 10,279 |
| | | Volume per day | 30,004 | 35,875 | 31,367 | 28,832 | 26,375 | 27,514 | 26,782 | 27,018 | 14,733 |
| | Drilling | Holes per day | 110 | 132 | 115 | 106 | 97 | 101 | 98 | 99 | 54 |
| | Explosives | Daily tonnage | 17 | 20 | 18 | 16 | 15 | 16 | 15 | 15 | 8 |
| | | Weekly tonnage | 120 | 143 | 125 | 115 | 105 | 110 | 107 | 108 | 59 |
| | | Monthly tonnage | 513 | 614 | 536 | 493 | 451 | 471 | 458 | 462 | 252 |
| | | Annual tonnage | 5,985 | 7,157 | 6,257 | 5,751 | 5,261 | 5,489 | 5,343 | 5,390 | 2,939 |
| | | Annual ANFO deliveries @ 25t/load | 240 | 287 | 251 | 231 | 211 | 220 | 214 | 216 | 118 |

# 6 EXPLOSIVES PREPARATION

Due to the remote location, SGV will pursue a base factory licence versus a satellite explosives storage facility. This will allow the explosives contractor to manufacture the explosive on site and avoid the need to carry explosives on public roads. The quantity of explosives manufactured will be limited to immediate use. The explosives preparation will include:

- Delivery of raw ammonium nitrate, ammonium nitrate prill, emulsifying agent and gasifying agent;
- Ammonium nitrate melting and AN prill formation using a melt plant;
- Preparation of heavy ANFO for immediate use, if required, by mixing with diesel;
- Preparation of emulsion explosive for immediate use through mixing with emulsifying agent; and
- Filling of blast hole delivery trucks with appropriate explosive type.

# 7 EXPLOSIVES STORAGE

All explosives and accessories will be stored at the planned magazine site and explosive storage facility site. The magazine and the explosive storage facility are 300 m apart and roughly 1,800 m from any other infrastructure as per the distance requirements under the Federal Explosives Act and Regulations. A plan of the proposed explosive storage locations is shown in Figure 1.1-1.

## 7.1 AMMONIUM NITRATE STORAGE (AGRICULTURAL GRADE)

Due to the remote location of the mine, it is proposed that a melt plant is constructed and that ammonium nitrate prill is manufactured on site. In this case, agricultural grade ammonium nitrate, which is more easily obtainable and can be stored in bulk will be purchased and stored in a separate facility at the mine site bulk explosives storage facility as shown in Figure 1.1-1. This storage facility will be covered to prevent the ammonium nitrate from getting wet. The storage facility will comply with the following standards:

- Away from fire, heat, or explosion sources,
- Electrical equipment will be kept in good standard and constructed such that it will always be at least 1 m from ammonium nitrate,
- Switches and fuses will be outside of the facility,
- Ammonium nitrate will be stored a minimum of 1 m from the walls and roof of the structure,
- No other products will be stored in the building,
- The structure will be at least 8 m from any combustible materials,
- No smoking signs will be placed at the facility,
- No standing timber within 15 m from the structure, and
- Ammonium nitrate stacks will be limited to 50 tonnes or less.

## 7.2 AMMONIUM NITRATE PRILL 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° 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 the bulk explosives storage facility shown in Figure 1.1-1.

## 7.3 VOLUME OF STORAGE

It is estimated that up to 150 tonnes of explosive will be used per week during peak operations. Due to the remote location of the mining site, 300 tonnes of ammonium nitrate is proposed for storage. The storage will be in ANFO silos constructed by an experienced explosive supplier.

## 7.4 EMULSION PLANT

The emulsion plant will be adjacent to the ammonium nitrate silo, which will be constructed at the bulk explosives storage facility shown in Figure 1.1-1. It is proposed that emulsion is manufactured on site through mixing of Ammonium Nitrate with fuel and emulsifying agents at a rate of 5% fuel and 2% emulsifying agents. This will result in a maximum requirement for 1,000 litres of fuel per day, which can be transported from the bulk storage facility at the truck shop, as required, and 400 litres of emulsifying agents. It is proposed that a 5,000 litre tank of emulsifying agents is constructed on site, as it is not always necessary to blast with emulsion.

## 7.5 MAGAZINES

Two containers, constructed according to regulations, will be placed at the explosive magazine site as shown in Figure 1.1-1, which will be used as explosive storage magazines. The magazines will be used to store the detonators, shock tubes, detonating cord, boosters, cartridges and any old explosives prior to destruction. The layout of the magazine will be undertaken in line with explosive regulations and as such the following infrastructure will be provided:

- Pre-constructed detonator magazine for detonators (IEDs) and shock tubes, and
- Powder magazine for boosters and cartridges

The explosive magazines will be barricaded with rock berms and constructed 80 m apart allowing for 35,000 kg of storage in total in accordance with distance requirements for explosives storage facilities as specified in the Federal Explosives Act and Regulations.

# 8 ONSITE HANDLING

The explosives contractor will do all onsite handling, including operation of ammonium nitrate silos, ANFO plant, emulsion plant, and explosives magazine. Explosives handling will be done by qualified personnel using equipment designed for the handling and transport of such materials. Safe handling practices will apply to the handling and transport of explosives waste to the disposal site.

## 8.1 AUTHORIZED PERSONNEL

Only authorised personnel will be permitted to enter the magazine and explosives storage areas. The personnel will be listed in a register. A daily account of the persons entering the magazine will be maintained. The following are the type of personnel who will be permitted to enter the magazine and explosive storage areas:

- Appointed blasters;
- Explosive contractor employees;
    - Personnel involved in manufacturing explosives
    - Personnel required for explosive delivery
    - Personnel involved in site maintenance
- Blasting assistants;
- Security guards (external area only, no magazine access);
- Mine Manager;
- Mines or explosives inspectors; and
- RCMP

## 8.2 HAZARDOUS MATERIALS MANAGEMENT

All personnel who will work with explosives will be trained and competent on the procedures for handling explosive materials. Explosives are hazardous materials due to their corrosive nature, although limited contact with explosives is not a health hazard. The personnel will be required to wear personal protective equipment, to prevent accidental exposure to the explosives. This will include:

- Goggles for eye protection;
- Appropriate coveralls;
- Impervious gloves;
- Boots; and
- Dust masks if required.

Personnel will also be trained on spill containment and emergency procedures relevant to explosives and to general mine site operations.

## 8.3 HOUSEKEEPING

In order to effectively manage explosives on site it is imperative that areas used for explosive storage and magazines are kept clean, and not used for any other storage. Good housekeeping is required on a daily basis for the magazines and explosive storage areas. At the blast site, empty boxes used for explosive storage will be removed and burnt or otherwise disposed of in a safe manner. As far as practical, the truck delivering explosive to the blast drill holes will only be filled with the amount required for each blast. At the end of every shift, the outside of the truck will be cleaned. There may be a certain amount of explosive, referred to as the heel that the delivery system cannot extract from the truck. This will not be cleaned out of the truck unless the truck is no longer going to be used for explosive delivery, in which case the heel will be removed and disposed of appropriately.

Access to explosives magazines will be kept in good condition regardless of the time of year. Road maintenance in this area will be a priority, particularly during winter, as adverse weather conditions will increase the risk associated with transporting explosives.

## 8.4 EXPLOSIVES DISPOSAL

SGV is committed to the safe disposal of explosives when disposal is necessary. Safe disposal of explosives might be required if blasting material has been damaged during transport, or if it has deteriorated and become unfit for use. SGV or the explosives contractor will consult the manufacturer of the damaged explosives, or the Explosives Regulatory Division prior to disposal in an effort to minimize the associated risks. Damaged explosives will be packaged according to the Transportation of Dangerous Goods Regulations for transportation to a destruction site. Disposal of explosives will be done in accordance with SGV's commitments to environmental protection, and the associated regulations.

Intact emulsion explosives should feel smooth and pliable to the touch. If emulsion feels stiff or crusty, it has probably become insensitive and will likely fail to shoot. Wetness on the outside of the film cartridge or segregation of the ingredients indicates that syneresis has occurred and the product will likely fail to detonate.

Prolonged storage of bagged ANFO may result in leakage of fuel oil through the plastic. This creates a fire hazard within the contaminated magazine and, depending on the severity of the leak, it may be necessary to replace the contaminated floor sections. This will be prevented by turning over bags of ANFO to prevent oil migration and accumulation of oil on the bottom of the packaging.

Two methods of explosives disposal that will be employed are destruction by detonation and by combustion. The primary method of disposal will be to detonate small amounts of damaged explosives in a blast hole as part of a production blast. They can be placed in the bore hole under the collar or stemming. This will be done providing the explosives are still in good condition and can be transported to a production blast. Combustion is another method of disposal and will be done in a remote location, as there remains the chance of explosion during the burning process. During combustion, only one type of explosive is to be disposed of at a time. Special attention will be given to make sure no detonation devices are burned along with the explosives. Initiation devices are best disposed of by detonation at a location separate from the disposal site of the other explosives.

Under no circumstances will SGV abandon or bury explosives. Abandoning explosives is a serious offence under the Explosives Act, and any such action could be considered criminal negligence punishable under the Criminal Code. Explosives retain their properties for a very long time and will not be buried, as there would be serious risks associated with any subsequent activity at the disposal site.

# 9 BLASTING OPERATIONS

## 9.1 PLANNING

Each blast will be planned by the holder of a blasting certificate. The planning will involve determining as accurately as possible the quantities of explosives and accessories for each blast. The execution of each blast will be undertaken as follows:

- The mine plan will be assessed to determine which blast is being executed and the applicable dimensions;
- The holder of the blasting ticket will then examine the area for blasting, for misfires, unsafe face conditions above and below the bench to be blasted, and the blaster will ensure that the area into which the rock will be blasted is clear of any infrastructure or personnel;
- The blaster will then mark out the holes to be drilled according to the dimensions and the mine planning department instructions;
- After drilling of the holes, the blaster will then measure the holes to ensure they are drilled correctly and for determining quantities of explosives and accessories;
- The blaster will then plan the blast by calculating the appropriate amount of explosive, boosters, initiation systems components and other accessories;
- The explosives and accessories will be drawn from the magazines, and the ANFO truck will be loaded;
- The blasting site will then be manned by a blasting assistant to ensure that no unauthorised person enters the site, or no other activity takes place at the site that could interfere with blasting procedures;
- Blasting accessories will be delivered to the blast in an approved explosive transportation vehicle, with appropriate warning decals;
- The blaster will check the accessories are the correct quantities;
- Boosters and down the hole initiation systems will then be distributed to the holes;
- The blaster will then commence with charging of the blast with help from blast assistants;
- If using pumped emulsion, the blaster will ensure that the emulsion is allowed to rise prior to closing the holes with stemming;
- Once the holes are charged and the emulsion has risen, the stemming will be placed into the holes;
- At this point the blaster will contact the mining personnel for the evacuation of the mining area to begin;
- Once stemming is complete the blaster will connect the down hole initiation system with trunk lines;
- The blaster will then leave an assistant to guard the blast and then undertake a check on the progress of the evacuation, place guards at access points and lay the firing cable for initiation;
- A guard will also be placed at the far end of the firing cable;

- Once satisfied that the mining area is evacuated the blaster will return to the blast and place the initiating detonator, connect the firing cable to the detonator and leave to the far end (safe firing point);
- At the firing point the blaster will make contact with all the guards at the mine access points to check that the area remains evacuated
- The blaster will then sound an alarm and initiate the blast;
- Once the blast has been completed, the blaster will re-enter after the dust and smoke has dispersed;
- The blaster will then check the blast for misfires and cut-offs and dangerous bench face conditions;
- If safe, the blaster will inform the mining crews that they can re-enter; and
- If not safe, the blaster will take action by either:
    - Re-firing misfired holes or cut-offs;
    - Marking any misfired holes and barricading the area as per regulations; and
    - Supervising any process for making the area safe (bench face hazards).

## 9.2 SAFETY PROCEDURES

There are several precautions that will be in place for the safety of the workers in the mine. While the mine supervisor holds senior authority over the workers, blasters have complete authority to control all activities at the mine site during blasting. The blaster therefore will personally oversee the evacuation to a safe distance of all personnel working within 500 m of the open pit, prior to blasting. Key factors which will be implemented for ensuring that evacuation processes are well managed include:

- Effective communication with mine personnel prior to blast;
- Clearly defined safe distances from blast site;
- Effective barricading of entrances to blast sites;
- Blaster will only leave the blast site last after checking that the site is clear and connecting the initiating detonator;
- Blaster will confirm that all blasting guards are in place and that all is clear prior to initiating the blast, and
- Alarm used will be designed to be heard by all personnel within 500 m of the blast to be executed.

Other factors that will ensure safe blasting include:

- The area to be blasted will be prepared to the satisfaction of the blaster;
- A smooth floor will provide a safe work area for the drilling and blasting crew;
- The blast pattern will be staked by the mine surveyors and blaster in accordance to the engineers' design;
- Access to the blast pattern will be attained from the blaster in charge;
- The pattern will be drilled in the sequence prescribed by the blast supervisor;

- Loading will be under the direction of the blaster in charge of the pattern;
- The blaster will follow the loading quantities of the engineered design;
- Modifications due to field conditions will be noted and reported;
- The explosives contractor will deliver the bulk product to the hole and track the quantity; and
- The blaster will sign for the delivery and file all paperwork for each blast undertaken.

## 9.3 EXPLOSIVES TRANSPORT EQUIPMENT

The explosives contractor will transport the explosives from the manufacturing facility to the blast site using a truck designed for the safe delivery of ANFO. The truck used for product transport will be capable of delivering explosives blends suited for both wet and dry conditions. The ANFO truck will meet all conditions specified under the Occupational Health and Safety Act (OHSA) of Yukon. Placards will be displayed on the side of all explosives transporting equipment as per the Transportation of Dangerous Goods Shipping Regulations.

The explosives delivery truck will be equipped with a metering system that will enable SGV to reconcile the amount of explosives used with the amount of explosives delivered to site. This reconciliation will be an integral part of maintaining responsible explosives use on the Project.

Explosives delivery equipment will be managed under a strict maintenance program. The program will be designed to prevent mechanical failures that would endanger personnel or have a negative effect on mine production.

Electric detonators, when used, will be transported to the blast site in a separate vehicle than the ANFO. The detonators will be stored in a closed metal container lined with wood, or other suitable material. The container will be secured to the vehicle to prevent unintentional unloading during transport.

The following inspection, as required under the OHSA, will be performed on each vehicle prior to the transport of any explosives.

- Fire extinguishers are filled and in working order;
- The electrical wiring is completely insulated and firmly secured;
- The fuel tank and feed lines have no leaks;
- The chassis, engine, pan and bottom of the conveyance are reasonably clean and free from surplus of oil and grease;
- The brakes and steering apparatus are in good condition; and
- The conveyance is in sound mechanical condition.

## 9.4 ADVERSE WEATHER CONDITIONS

Safety precautions will be employed during adverse weather conditions. The blasting supervisor will be able to advise personnel on the best way to proceed based on the severity of the adverse weather. Under no circumstances will blasting take place during an electrical storm. The blast site will be evacuated, and no electrical detonation equipment will be connected.

Snow removal will be a priority along the explosives transportation route. In the event of a snowstorm, the road between the explosives storage area and the blast site will be cleared of snow in preparation for blasting activities to resume. Road maintenance will be important after freshet and periods of heavy rainfall. Erosion due to water movement will be corrected in an effort to extend the functional life of the explosives transport route.

Adequate lighting will be made available at the blasting site in preparation for foggy conditions. Explosives equipment will be equipped with proper high visibility equipment, and proper communication measures will be employed to alert mine personnel of the presence of explosives. The blasting pattern will be clearly marked and control measures will be strictly enforced during the handling and connecting of detonation devices.

## 9.5 SMOKE, DUST AND FLY ROCK

While smoke and dust are common to every blast, some by-products of blasting include gases such as CO, CO2 and NOx, which in higher concentrations can be harmful to humans and wildlife. The gas concentrations are related to product quality, which can degrade due to factors such as groundwater conditions, length of time between loading and blasting, or the manufacturing process. Fortunately the gases disperse quickly.

The blaster will not give the “all-clear” until completely satisfied that the gases have dispersed and that the area is safe to approach. At that time, the guards will be removed allowing access to the area. Fly rock from blasting is potentially dangerous to personnel close to the blasting site and can be minimized by best practices in blast design, and stemming. The blaster and blasting supervisor assess the potential for fly rock in every blast, and from that they determine the blasting danger zone, and to where guards and personnel will be evacuated.

### 9.5.1 Fly Rock Prevention

As far as possible, fly rock will be prevented through blast design. In order to minimise fly rock, blast design will consider the burden versus bench height. To reduce fly rock, SGV will ensure that the burden to height ratio will be between 3 and 6. Any blast with ratios lower than this will result in the explosive energy being directed upward, whereas at higher ratios the explosive energy is directed horizontally (generally into the pit). If the ratio is too high, accuracy of drilling may become an issue, which can result in fly rock through under burdened holes close to the free face.

## 9.6 MISFIRES

Modern day blasting technology when handled by trained and competent personnel is designed to reduce the possibility of misfires, through construction materials, sensitivity of explosives and precise initiation systems. Nevertheless there is always a residual risk of misfires, for which a procedure will be put in place to prevent further injury due to unexploded explosives.

Misfires will be dealt with as specified in the OHSA Regulations. If there is evidence or suspicion that a misfire has occurred when using electronic detonation equipment, a minimum of 10 minutes will be allowed to elapse from the time the blasting cable is disconnected and short circuited.

The personnel tasked with dealing with a misfire will kept to a minimum and restricted to personnel trained for blasting or on handling of explosives.

The blasting certificate holder will direct the removal of as much material as possible in an effort to assess the situation. Equipment for handling misfires will only be used as directed by qualified blast personnel. The blaster

will ensure that the lighting of the blast site is adequate, and the proper safety precautions have been taken to prevent accidental detonation.

When a misfire is suspected, the area will then be roped off using non-metal markers in a manner approved by the supervisor. The minimal distance for a misfired hole to be marked off is 8 m around the collar of the hole. A misfired mixture of ANFO will be washed out of the hole in preparation for another blasting attempt.

If drilling is required following a misfire, the blaster will determine the location, direction, and depth of any hole required for blasting the misfired charge. The blaster making this decision is to remain on site and supervise the drilling of this hole. The new hole will be drilled a minimum distance of 1.5 m away from the misfired hole. The location of any remaining misfired shot will also be recorded at the end of the shift.

## 9.7 VIBRATION

Vibration induced by blasting can result in damage to building structures and infrastructure. Due to the remote location of the mine, there are no public structures, which could be affected by blasting. The mine will take caution however, to keep vibration low to ensure that engineered structures, such as pond and the HLF embankments, and the process plant are not affected by blasting induced ground vibration. The predominant means of limiting ground vibration is to keep critical infrastructure away from the mine. Secondary to that is to ensure that the blasting is planned such that a limited explosive charge is set-off instantaneously. This is achieved through millisecond delays between each hole in the initiation system. Two different delays are often used to ensure that a blast timing system limits the number of holes, which instantaneously detonate.

The graph in Figure 9.7-1 below highlights the relationship between peak particle velocity, explosive charge (shown as number of holes per delay) and horizontal distance from the blast.

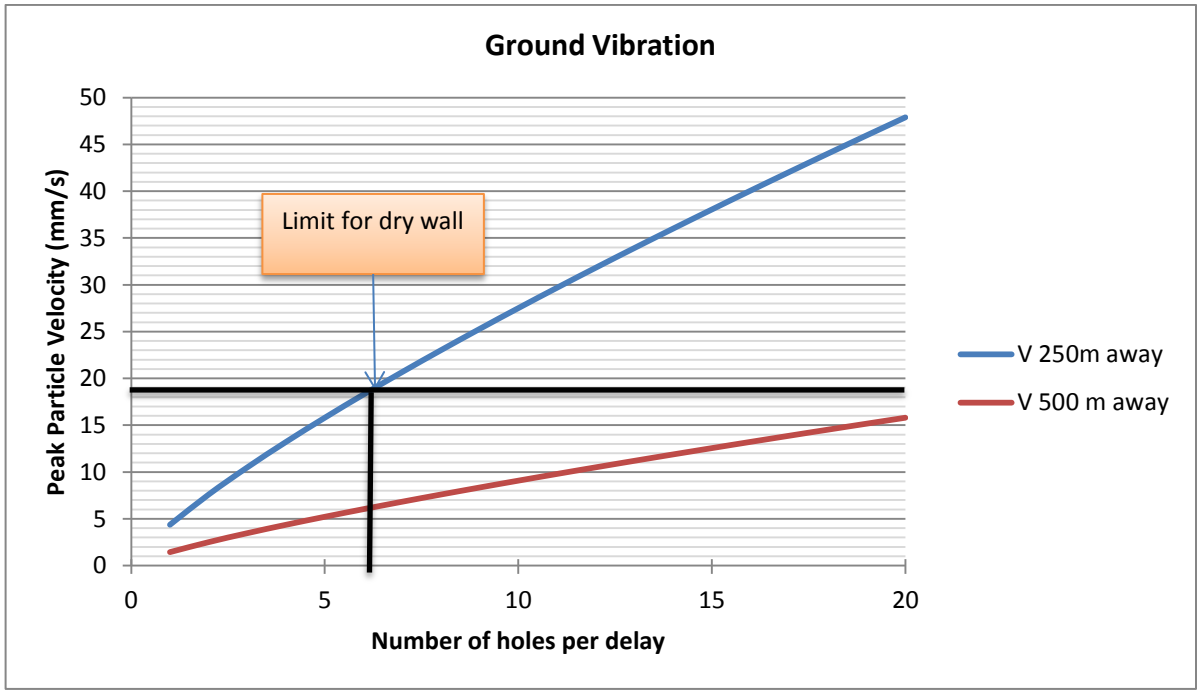



**Figure 9.7-1: Peak Particle Velocity Relationship with Number of Holes per Delay and Distance from Blast**

For a typical 50 hole blast, expected to be undertaken daily at Eagle Gold, Nonel tubes with 25 millisecond delays and 17 millisecond trunk lines will be used for the timing of the holes. A staggered blast pattern will be employed.

## 9.8 REPORTS AND RECORD KEEPING

As part of permit and licensing requirements for explosive use, meticulous record keeping will be undertaken. In particular the following records will be kept:

- All permits and licences for inspections;
- Certificates of blasting crews;
- All records of regular facility inspections;
- Design plans for magazines and explosive storage facilities;
- Explosive delivery records (weigh bills);
- Magazine stock taking records;
- Records of explosive withdrawals from magazines and explosive storage facilities;
- Climate data for explosive storage facilities and magazines to ensure that temperature thresholds have not been exceeded;
- Blast records showing date, blast number, blast layout, explosive quantities used and name of person initiating the blast; and
- Records of any disposal of explosives.

These records will be kept in an orderly state and kept in a safe dry area. The records will be easily accessible for inspections and will be cross referenced to ensure that the records can be used in an accident or incident investigation.

## 9.9 SPILL CONTAINMENT

SGV will assess the spill containment action required for any incident. Prior to the manufacture of ANFO, Ammonium Nitrate (AN) will be present on the mine site. AN is water soluble and has the potential to dissolve in water and be entrained in runoff or infiltrate into groundwater, which could affect nearby water supplies. In the event of a spill, the AN will be cleaned up immediately and disposed of accordingly. Spilled ANFO will be collected and disposed of in the same manner as other explosives waste produced on site. Loading sites will be kept clean by shovelling spilled ANFO into the nearest blast hole for detonation. Water quality monitoring locations will be monitored to determine the downstream effect of explosives use. Water quality will be analyzed to ensure all water leaving the mine site is in accordance with the most current water use license.

## 9.10 CONTINUOUS IMPROVEMENT

SGV is committed to the safe and environmentally appropriate usage of explosives. Blasting practices will be reviewed periodically and compared with industry best practices to identify areas of improvement. As described in the Environmental Monitoring and Adaptive Management Plan, water quality monitoring will be an essential

part of determining the environmental effect of using ammonium nitrate based explosives; monitoring data will provide input to improve the safe and environmentally sound usage of explosives. SGV will work with the blasting contractor to select products and produce blast designs that prove to be the most efficient and environmentally stable.

# 10 ENVIRONMENTAL CONSIDERATIONS

Though the management of explosives for safety reasons will be methodical to the point where spills and harmful emissions from explosives are effectively eliminated, robust procedures will none the less be in place in case of unforeseen events. This includes the provisions in the following sections.

## 10.1 BERM AROUND STORAGE FACILITIES

For safety and environmental considerations, a berm of at least 1.5 m in height will be placed around the magazines and explosives storage areas. This berm is in addition to berms constructed around explosives magazines, as they have a different function. The berm around the area will be used to deflect an explosion within the magazines and to contain any spills that occur within the magazine and explosive storage areas. The berms will be constructed such that water will accumulate in a sump or diversion ditch, and this water will be collected as mine contact water, by design, and prevented from entering natural water courses.

## 10.2 SPILL CONTINGENCIES

Releases of ammonium nitrate or its breakdown products into surface or ground water can occur during or following the blasting process. These issues are best managed through a well thought out and responsible blast loading plan, which are coordinated with the Operations Water Management Plan and the Spill Contingency Plan. As such a standard operating procedure for blast loading will be developed to minimize the potential for ammonium nitrate to become associated with water. Additionally SGV will require that a specific spill contingency plan for explosives is developed by the explosive contractor and incorporated into the Spill Contingency Plan. The plan developed by the explosives contractor will indicate the manner of containing and disposing of any spilled explosive and/or affected soil.

## 10.3 OLD EXPLOSIVES

Though every effort will be made to deliver to site only the quantity of explosives that will be used in a timely manner, there is the possibility of unusable old explosives occurring on site. The explosive contractor will be required to develop a procedure for disposal of old explosives that are expected to have lost some or all of the explosive potential.

# 11 NITRATE MANAGEMENT

The largest risk to the environment results from the hydroscopic properties of ammonium nitrate. Once mixed with emulsion (diesel and emulsifying agents), it becomes hydrophobic and will not readily dissolve in water or contaminate water bodies. The manner in which nitrates will be managed, to prevent the release of nitrates into any water resource on the mine site is outlined in the following sections.

## 11.1 PREVENTION OF SPILLS AND HOUSEKEEPING

SGV will require the explosive contractor to ensure relevant personnel are trained and competent in handling of explosives. Standard Operating Procedures will be drawn up to ensure that spills are minimised and, if they occur, are handled appropriately. Any minor spills, which occur at the truck loading areas, will be required to be cleaned up immediately and the contents disposed of by including the spilled material into blast holes prepared for immediate blasting.

## 11.2 BERMS AROUND STORAGE AREAS

At the explosive storage facility and at the magazines, large berms will be placed for safety reasons and to prevent the release of affected water from the explosives storage site. All affected water will be contained within the berms. Water collected within explosive storage areas will be managed in accordance with the Operations Water Management Plan

## 11.3 WET HOLES CHARGED WITH EMULSION

Where water is encountered in blast holes, emulsion explosive will be used to prevent dissolving of explosive in water and will detonate under water. Any emulsion spilled during charging of blast holes will be disposed of in the blast holes, prior to blasting, such that it will be destroyed during blasting.

# 12 REFERENCES

Bajpayee, T.S., Verakis, H.C., Lobb, T.E., An Analysis and Prevention of Fly Rock Accidents in Surface Blasting Operations.

Explosives Regulatory Division. Explosives Safety and Security Branch. Minerals and Metals Sector. Guidelines for Bulk Explosives Facilities: Minimum requirements. July 2010. Revision 5.1.