



Guidelines for
Bulk Explosives Facilities
Minimum Requirements

Explosives Regulatory Division
Explosives Safety and Security Branch
Minerals and Metals Sector

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1 Introduction

1.1 Purpose

The aim of these guidelines is to outline the minimum requirements for sites and equipment used in the handling of bulk explosives. These guidelines will be used to evaluate the acceptability of licence or certificate applications and to evaluate sites during inspections. These guidelines cover Division 1 factories (factories with and without wash bays, and factories with temporary structures), Division 1 certificates (satellite site certificates, including satellite site certificates for demonstrations), Division 2 factories, and certificates for the mechanical and non-mechanical blending of ammonium nitrate and fuel oil (ANFO), and permissions for trials.

To manufacture bulk explosives and have bulk explosives delivered, a company must operate under either a licence or a certificate.

Not all details are provided in this document. Other federal, provincial or municipal jurisdictions may have an input (see section 29 of the *Explosives Act*). In general, and as a minimum, sites and operations should comply with good standards for a chemical plant or similar industrial site. Companies are expected to understand and maintain the principles of good housekeeping.

“Must” and “will” imply a mandatory requirement. Whenever “should” or “may” appear, companies have the option of following such directives but must be prepared to defend their decision not to abide by them.

1.2 Intent

These guidelines are intended to be used as a guide to meet the requirements of the *Explosives Regulations, 2013* for bulk explosives sites (hereinafter the “Regulations”).

Clean and well-maintained mobile process units (MPUs) have always been part of the conditions for the safe operation of bulk explosives sites and it was so stated in documents in the past.

The basis of all bulk explosives operations involving mobile process units, with the exception of a licence or certificate for the blending of ANFO (see section 2.6), is a factory with a wash bay. Without such a site, properly equipped with washing and support facilities, it is not possible to ensure the safe operation of mobile process units. Mobile process units must be kept clean to reduce the risk of fire and must be decontaminated, as required, to avoid accidents during maintenance. Mobile process units must also be well maintained in order to be safe to operate.

Licences or certificates for the blending of ANFO require that a site with washing and maintenance facilities be available to ensure that mobile process units are kept clean and maintained. However, some requirements for a licensed factory with a wash bay do not apply to operations allowed under a licence or certificate for the blending of ANFO.

These guidelines were developed in conjunction with industry, and companies are expected to follow them. Alternatives to these requirements may be considered by the Chief Inspector of Explosives. Proposals must meet the intent of this document and provide proof of an equivalent level of safety.

1.3 Other Documents

Although the guidelines set out the minimum requirements for a bulk explosives operation, they are not a complete compilation of all legislation or codes issued by federal, provincial and municipal governments by which companies must abide. The following list is presented as a guide to other documents or jurisdictions that must be considered and is not meant to be exhaustive:

- *Explosives Act and Explosives Regulations, 2013*
- Documents issued by and obtainable from the Explosives Regulatory Division (ERD):
 - Guidelines for the Pumping of Water Based Explosives (Pumping Guidelines)
 - Classification by PE (Potential Effects)
 - Requirements for Bulk Mobile Process Units
 - Explosives Branch Process Vehicle Inspection Check List Guideline for Completion of Factory/Manufacturing Applications
 - Classification and Authorization – General and Detailed Requirements for Type E Explosives
 - Fire Safety Plan Guideline
 - Site Security Plan Guideline
 - Key Control Plan Guideline
 - ERD Directives, issued as required
- *CAN/BNQ 2910-500/2015 Explosives – Magazines for Industrial Explosives*
- *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*
- National Building Code of Canada (to be used as a guide to ensure conformance with good engineering practices)
- Canadian Electrical Code (CEC)
- National Fire Code of Canada (NFC)
- *Transportation of Dangerous Goods Act and Regulations*
- *Canadian Environmental Assessment Act*
- Provincial labour and/or safety acts and regulations
- Municipal by laws and ordinances

1.4 Using the Guidelines

Companies should become familiar with the contents of these guidelines, and licence or certificate applications must keep the requirements of the guidelines in mind. Approvals will be based on these guidelines.

Applications and their approval can be broken down into four components: the licence or certificate forms, the authorized equipment list and/or the authorized client list, the company's internal procedures and documentation, and the additional terms of the licence.

1.4.1 The Licence

Forms F05-01A, F05-01B, F05-01C, F05-01D and F05-01E and the site and building drawings are the basis for approving an application. The forms and drawings describe the site, the facilities, equipment and operations. The forms and drawings are reviewed to check that the information they contain meets the guideline. Any exception to the guidelines on which there was agreement must be recorded in these forms. How to deal with mobile process units and customers is described in section 3.1.

1.4.2 Company Procedures and Documentation

A company must show that its operations are controlled through formal, written procedures and internal documents. These must meet minimum requirements described under section 3 (Documentation, Fees and Processing Time) and documentation must be in place before a licence will be issued. As a term and condition of the licence, a company must implement them and ensure they are being followed.

2 Scope, Limitations, Definitions and General Background Information

2.1 Scope

Sites and operations are subject to all existing regulations and codes. These guidelines do not supersede any other regulation or law, be it federal, provincial or municipal, or any codes specified in such legislation. Where alternative requirements exist, the more stringent of the two will apply.

Bulk explosives allowed under these guidelines must be authorized products that meet the requirements of the UN 1.5D classification, that is, they must not be sensitive to a high-strength detonator nor may they detonate in the UN series 5 bonfire test. Additionally, they must not be sensitive to available commercial ammunition. Proof that bulk explosives meet these requirements may be requested.

In general, a company is expected to know the properties and behaviour of its raw materials and its explosives products, whether as final products (e.g., classification for transport) or under processing conditions (e.g., minimum burning pressures).

Note: Although product and equipment trials are also included in the guidelines, it is understood that such trials may be permitted with other types of explosives, such as packaged products, that may not be 1.5D.

Licensed locations may be subject to a formal environmental assessment. The holder of a certificate or licence must satisfy the Chief Inspector of Explosives that possible contamination of the environment has been addressed. If an operation is to be located on Indigenous land or may have an impact on Indigenous treaty rights, consultations with affected parties will be necessary before a licence or certificate can be issued.

Licences or certificates will be granted to only one company per site. Installations located further from each other than the D7 distances for Potential Effect 1 Explosives (formerly 1.1/1.5 hazard classification) are to be considered as separate sites.

Sharing of facilities is not permitted and will only be considered on a case-by-case basis for emergency situations. One licence will be granted for a location, and the licensee will be held responsible. Sharing of magazine storage licences may be permitted, but control must remain with one company.

This guideline is for bulk explosive operations that are located above ground (as opposed to underground). Some manufacturing activities underground are subject to Division 3, Part 5, which exempts these types of operations from requiring a licence. Note, however, that there are many provincial/territorial requirements for underground operations which must be taken into account.

2.2 Grandfathering

All new sites must comply with or exceed the minimum requirements of this guideline. There are situations in existing licensed locations that would not meet the current requirements, but met the requirements at the time they were first licensed. Some of these situations have been allowed to continue and as such have been grandfathered. This does not apply to situations in which inaccurate information or a lack of information on a situation resulted in it being approved when it would not otherwise have been approved. In the case of existing locations that do not fully comply:

- Incumbent companies are grandfathered; however, when applying for licence renewal, the companies are expected to:
 - review operations annually and to propose suitable improvements and schedules, acceptable to ERD, needed to achieve conformity; or
 - carry out a risk assessment, acceptable to ERD, to show that the situation meets acceptable criteria. If accepted, it must be described in the licence; or
 - make changes needed to comply; or
 - explain discrepancies that are not significant and that can be accepted in the licence. If accepted, they must be described in the licence.
- Grandfathering granted to incumbent companies will not be extended to cover new companies; when applying for approval in principle or for a new licence, new companies are expected to:
 - make changes needed to comply; or
 - carry out a risk assessment, acceptable to ERD, to show that the situation meets acceptable criteria. If accepted, it must be described in the licence; or
 - explain discrepancies that are not significant and that can be accepted in the licence. If accepted, they must be described in the licence.

In general, grandfathering will not be continued if there is a significant change of scope in the operation or a significant change to the facility. Each site will be reviewed on a case by case basis, and documented individually. Sites will be encouraged to meet those requirements where operations deviate from these guidelines, at the first opportunity.

2.3 Definitions and Limitations

The following information is provided as a guide to the definitions and terms found in the *Explosives Act* and *Regulations*, Part 5 (Manufacturing Explosives) of the Regulations

2.3.1 Divisions in Part 5 of the Regulations

Division 1: Sections 55 through 105 explain how to obtain a Division 1 factory licence or a satellite site certificate. They also outline requirements for license or certificate holders and for workers at, and visitors to, a factory or satellite site.

Example: A licence for a factory with a wash bay.

Division 2: Sections 106 through 132 explain how to obtain a Division 2 factory licence or a manufacturing certificate. They also outline the requirements for license or certificate holders and for the workers at, and visitors to, the workplace.

Example: A certificate for the mechanical blending of ANFO.

Division 3: Sections 133 through 142 set out the manufacturing activities that do not require a factory licence or a manufacturing certificate and the requirements for people who carry out those activities.

Example: The pumping of explosives underground.

Only Divisions 1 and 2 are applicable in this guideline for the manufacturing of bulk explosives.

2.3.2 Definitions

Applicable definitions in Part 5, Division 1, of the Regulations include the following:

- “Division 1 Factory License” – means a licence that is issued under paragraph 7(1)(a) of the *Explosives Act* and authorizes the manufacture of explosives at a factory.
- “Process Unit” – means a building, structure, room, vehicle or place in which an explosives manufacturing operation is carried out at a factory.
- “Factory Magazine” – means a magazine that is located at a factory or a satellite site.
 - N.B.: Magazines used for storing finished products that are packaged for transport may be subjected to the requirements in the National Standard of Canada *CAN/BNQ 2910-500/2015 Explosives – Magazines for Industrial Explosives*.
- “Client Site” – means a blast site at which a mobile process unit is used to manufacture explosives away from a factory or satellite site.
- “Satellite Site” – means a site that is located away from a factory and is used to manufacture and temporarily store explosives for use at a blast site.
- “Satellite Site Certificate” – means a manufacturing certificate that is issued to the holder of a factory licence under paragraph 7(1)(c) of the *Explosives Act* and authorizes the manufacture of explosives at a satellite site.
- “Mobile Process Unit” – means a vehicle or portable machine that is used at a factory, a satellite site or a client site to carry out an explosives manufacturing activity.

- “Competent Person” – means a person who has been certified as trained in accordance with section 83 under a Division 1 factory licence or satellite certificate and under section 122(2) for a Division 2 factory licence or manufacturing certificate under the Regulations.
- “Division 1 Worker” – means a person who is at a factory or a satellite site to carry out a manufacturing operation or other kind of work (e.g., maintenance of facilities or repair of equipment) for the holder of a Division 1 factory licence.

Applicable Definitions from Division 2:

- “Division 2 Factory Licence” – means a licence that is issued by the Minister of Natural Resources under paragraph 7(1)(a) of the *Explosives Act* and authorizes a manufacturing activity referred to in subsection 83(2) at a workplace.
- “Manufacturing Certificate” – means a certificate that is issued by the Minister of Natural Resources under paragraph 7(1)(c) of the *Explosives Act* and authorizes an activity at a workplace referred to in section 107 of the Regulations.
- “Workplace” – means a building, room or area where an activity involving the manufacture of explosives, including their storage, is carried out.
- “Division 2 Worker” – means a person who is at a workplace to carry out a manufacturing operation or other kind of work (e.g., maintenance of facilities or repair of equipment) for the holder of a Division 2 factory licence.

2.4 Division 1 Factory Licences

2.4.1 Factory with a Wash Bay

A factory with a wash bay is a licensed facility and the base of operations equipped with all the facilities necessary to clean, decontaminate and repair mobile process units. It may support factories without a wash bay, satellite sites, client sites and factories with temporary structures. Trials and demonstrations may be conducted from a licensed factory.

The following operations are permitted at a factory with a wash bay:

- storage of mobile process units
- storage of explosives (bulk and non-bulk)
- storage of raw materials
- transferral of explosives and raw materials
- ANFO bagging
- emulsion manufacturing and cartridgeing to manufacture product for sale

Bagging from a mobile process unit to make packaged product may be allowed at a factory site but will be subject to additional requirements over and above those described in these guidelines. The operations permitted at client sites are as follows:

- approved chemical gassing as required
- doping with AN or ANFO
- charging a borehole with or without mixing or blending
- emulsifying AN solutions and a fuel base
- blending of ANFO

Mobile process units must be associated with a factory licence or ANFO certificate to ensure that the intent (see section 1.2, Intent) is met.

2.4.2 Factory without a Wash Bay

A factory without a wash bay is a licensed factory that is located close enough to a factory with a wash bay to allow it to function without a wash bay. This type of factory could support customer sites, trials and demonstrations. It should be within 250 km of a factory that has a wash bay.

A maximum of two mobile process units are allowed. The maximum amounts of AN and emulsion allowed on the site are subject to Q-D limitations. Fuel storage must meet the requirements set out in these guidelines.

The operations allowed at a factory without a wash bay are the same as for a factory with a wash bay.

No satellite site may be attached to a factory without a wash bay.

2.4.3 Factory with Temporary Structures

This type of factory is a licensed factory that moves with mobile projects such as the construction of roads, hydro lines or pipelines, or ones that are of short duration, such as some construction projects (e.g., air fields). This type of factory is also used to supply explosives during the initial start-up phase of a mining project. Such sites must be supported by existing, licensed factories equipped to properly service the mobile process units that would be located at this type of factory. A licence for a factory with temporary structures is granted when the company has provided evidence that the site is truly temporary in nature. The licence will be renewed for one term only or a maximum of two years. Ongoing contracts, for example, quarry blasting that might occur a limited number of times a year over several years, or major construction projects lasting a number of years, do not qualify. The distinction between a factory with a wash bay and a factory with temporary structures is the portable nature of the required facilities and structure(s).

The requirements of a regular factory still apply, but the washing/maintenance facilities may be of a temporary nature for the purposes of cleaning a mobile process unit or for simple maintenance. Major repairs must be carried out at the supporting factory with a wash bay after the mobile process unit has undergone a preliminary decontamination at the factory with temporary structures and has been returned to its base of operations. Preliminary decontamination means the removal of all visible explosives from the mobile process unit. Piping and equipment do not necessarily need to be dismantled.

2.5 Satellite Site Certificates

2.5.1 Occasional and Temporary

Certificates are issued for sites that are occasional and temporary, as outlined in paragraph 7(1)(c) of the *Explosives Act*.

Satellite sites are mainly used for sites that do not require a permanent factory site since they only have a relatively low demand for bulk explosives.

“Occasional” refers to a site that is not in operation frequently, or, now and again, not continuous; for example, a site that is used no more than two days per week or no more than 20 days per year.

“Temporary” refers to a site that is operated for a period of time, but not permanently, for example, a site that does not operate longer than two years.

2.5.2 Certificates for Satellite Sites

Satellite sites are considered to be extensions of a factory, not the replacement of one, and therefore are not granted all the privileges of a factory. They may be issued only for occasional and temporary sites.

No more than two mobile process units are allowed. There are to be no more than two tankers or vessels with a total maximum storage capacity of 40 000 kg for water-based explosives. Additionally, a maximum of 100 000 kg of AN is permitted at the site. Fuel storage must meet the requirements of these guidelines.

The following operations are allowed at a satellite site:

- storage of mobile process unit(s)
- storage of bulk explosives and/or raw materials
- transfer of explosives or a raw material

The following operations are allowed at a client site served by a satellite site:

- approved chemical gassing as required
- doping with AN or ANFO
- the charging (with or without blending) of boreholes
- emulsifying AN solutions and a fuel base in a borehole
- blending of ANFO

Transfer sites are to be licensed as satellite sites. Transfer sites are any sites where bulk water based explosives or any bulk raw ingredient are transferred to an explosives mobile process unit.

A factory with a wash bay and a satellite site associated with it cannot be separated by a body of water other than that which can be crossed by bridges permitting the transport of explosives or by the use of barges or boats chartered specifically to move explosives.

Satellite sites may not be used for bagging or cartridging operations to produce product for sale. Limited bagging may be allowed for the purpose of removing explosives for decontamination, sampling, calibration and carrying to hard-to-reach boreholes.

The minimum period for a satellite site certificate is one month. Sites may be active, inactive, or no longer required. Fees are payable as per part 19 of *ER2013*. A site may be declared inactive

and then may be reactivated. Once a satellite site is no longer required, it must be decommissioned. The exact conditions required for the decommissioning of a site will vary from site to site, and each will be considered on a case-by-case basis.

2.5.2.1 Active and Inactive Satellite Sites

An active satellite site meets the above requirements; fees are payable at the time the application is submitted.

No fee is charged for an inactive satellite site; all explosives, mobile process units, raw materials, and explosives-related signage must be removed; physical structures, such as fences or empty silos, may remain.

If a site remains inactive for six months, it must be decontaminated, and a letter of assurance confirming decontamination must be submitted to ERD.

2.5.3 Satellite Site Certificate for Demonstrations

Demonstrations are trials of existing technology and products that are performed at new customer locations. These are permitted at satellite sites whose maximum duration is two months.

Limits are placed on duration to ensure that mobile process units are not away from a distant factory for an extended period of time.

The applicant must show that these are true demonstrations. Extensions or renewals of this certificate will be allowed only once and only if the applicant has provided an acceptable reason for the extension or renewal.

2.5.4 Client Sites and Distances (Factories or Satellite Sites)

The client site and the factory or satellite site cannot be separated by a body of water other than that which can be crossed by bridges permitting the transport of explosives or by the use of chartered barges or boats.

2.5.5 Product Trial Permissions

In order to conduct a product trial, permission must be granted to manufacture, store and use explosives that have not been authorized. A temporary product authorization for a specified period must first be obtained before a trial may be conducted.

Permission is also required to conduct trials of new equipment. Trials will be permitted only at or from licensed sites.

2.6 Division 2 Licences and Certificates

2.6.1 Manufacturing Licences and Certificates for the Blending of ANFO

Licences or certificates for the blending of ANFO by mechanical means are granted to the owners of mines or quarries that manufacture ANFO at a blast site near their mine(s) or quarry(ies). The blending is usually done on a mobile process unit and the ANFO is loaded directly into a borehole at a specified location, mine or quarry owned by the company to which the licence or certificate is issued. Fuel storage and AN storage must meet the requirements of these guidelines. An ANFO certificate does not provide for the inclusion of any permanent magazines; these must be covered by a separate magazine licence as set out in Part 6 of the Regulations.

The mechanical ANFO operation must be supported by a washing/maintenance facility located at a maximum distance of 200 km from the quarry or mine. Such washing/maintenance facilities need not be licensed factories. When the washing/maintenance facility is not at a licensed factory, no explosives may be present. Mobile process units going to it must first be emptied of all explosives, which must be loaded into a borehole and charged, along with any remaining quantity of AN.

There are no limits on the number of mobile process units that can be associated with an ANFO licence or certificate. These mobile process units may be used at multiple locations if within 200 km of the base, *provided they all belong to the same owner*. These locations must be identified in the licence or certificate.

An EA is not required for an ANFO certificate, but a spill contingency plan must be submitted to the ERD by the certificate holder.

Road work, pipeline construction, and construction projects do not qualify for licences or certificates for the blending of ANFO. These licences or certificates do not permit the bagging or cartridgeing of explosives.

In addition to licences and certificates for the mechanical blending of ANFO, it is possible to obtain a certificate for the non-mechanical blending of ANFO if the applicant plans to mix the ammonium nitrate and fuel oil by hand for immediate use in a mine or quarry.

2.7 General Background Information

This section provides information on items or requirements that are related to most bulk explosives licences or certificates.

2.7.1 Heel

“Heel” refers to the quantity of explosive product or raw material left in the mobile process unit that cannot be removed by pumping or auguring (note that running a pump dry must be avoided). When referring to the amount of explosive remaining on a mobile process unit in storage, the quantity of “heel” allowed is usually understood to be 250 kg (NEQ) or less. All mobile process units must be able to off-load unused explosives. In the case of mobile process units from which AN cannot be unloaded without being contaminated, and where a heel of more

than 250 kg NEQ remains, the quantity remaining must be indicated on the licence, and secure storage must be provided.

Off-loading, while possible, is not always desirable. If an MPU returns with more than a heel it must either be unloaded or parked with full Q-D, that is, as if it were fully loaded.

An area on the site plan must be designated for parking loaded MPUs if this activity is allowed by the licence.

2.7.2 Decontamination

“Decontamination” means to completely remove, clean or purge an explosive substance from a building, room, area, vehicle, equipment or container. It is recommended that all AN and Fuel is also completely removed, cleaned or purged.

An MPU that has been cleaned as per subsection 95(1) of the ER2013, and is unused for 6 months will be considered as “removed from service”, and must be decontaminated in accordance with subsection 95(2) of the *ER2013*.

2.7.3 Clean

The term “clean” means free of excess grease, oil or coal dust on the outside of the vehicle or in the engine compartment, or of explosives spills or AN dust on the outside, so that any fire hazard is reduced. The unit must display the appropriate dangerous goods placards and a dangerous goods Bill of Lading must be located in the cab of the unit.

An MPU is considered to be “cleaned”, according to the requirements in subsection 95(1) of the *ER2013*, if it contains no more than a heel (heel defined in section 2.7.1) on-board, and all process and delivery hoses have been either removed or “pigged clean”. “Pigged clean” means that a sponge is pushed through the process and delivery hoses by means of compressed air.

2.7.4 Disposal of Scrap

All explosives waste and explosives-contaminated material must be destroyed in a manner that does not increase the likelihood of an accidental ignition during or after the destruction.

In order to comply with the Regulations, each company must submit a list of the products that could potentially be bagged. These will be one of several kinds: straight ANFO, straight water gel, or emulsions and blends. It is suggested that the plastic bags be five inches or larger; the exact size should be specified. The bag is to be placed into a UN-certified box approved under the *Transportation of Dangerous Goods (TDG) Regulations*. The product must be labelled Special A, Special B, or Special C, etc., and will be authorized as such for each company.

For the disposal of bulk explosives waste on a secure mine site, the product must be bagged in plastic bags and transported from the factory site to the blast site for disposal. The bags of explosives waste must be transported in a plastic-lined, locked, wooden container, and the vehicle must display the appropriate signage and placards. The vehicle must remain on the mine site at all times while transporting the explosives and must not enter public roads or private roads with public access.

2.7.5 Quantity-Distance (Q-D)

Quantity-Distance (or Q-D) principles are outlined in *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*. In general, for bulk explosives sites, Annex C will apply.

2.7.5.1 Potential Effects

Potential effect is determined at the time of authorisation for each explosives products in Canada. Consult the list of authorized product to find out about the PE of a specific explosives product or article.

Consult with the document “Determination of Potential Effects for Explosives” for a more general view on potential effect.

2.7.6 Risk Assessment

Risk assessment is a formalized technique for answering the following questions:

- What can go wrong?
- What are the consequences and effects if something goes wrong, and are these acceptable?
- Are the safeguards and controls adequate to render the risk acceptable?

Quantified risk assessment answers the following additional questions:

- How often might it go wrong?
- What are the chances that the consequences will materialize?
- How dependable are the safeguards and controls that protect against the risk?

For some types of operations, the applicant may be asked to provide a detailed risk analysis to support arguments for deviations from licensing requirements such as those involving Q-D, and thereby provide assurance that the risk is acceptably low for these operations.

The other circumstance in which risk analysis is undertaken involves new operations requiring the delivery of bulk explosives at a blasting site without full Q-D. Quantity-Distance principles are some of the most effective safeguards or controls against explosive risks. Q-D is a consequence-based standard of protection that takes no account of how often things might go wrong but provides controls that operate 100 percent of the time, protecting as far as reasonably possible against the consequences of an explosion during the manufacturing or the storage of explosives. See Appendix B for a discussion of risk assessment-based derogation from Q-D requirements for bulk explosives delivery.

2.7.7 Ammonium Nitrate (AN)

Ammonium nitrate is included in the guidelines because its behaviour as an explosive requires that it be included when used in conjunction with explosives.

Although AN is usually classed as an oxidizer for transport, it is known to detonate under specific conditions, although these conditions may be difficult to define. Bulk explosives in which

AN is the major constituent and the equipment that is used to manufacture or handle bulk explosives are both regulated by ERD. Therefore, ERD is obliged to define the manner in which AN is handled in activities under the jurisdiction of the *Explosives Act* and Regulations.

AN solutions containing less than 92 percent AN are not considered to be explosive.

2.7.7.1 Fire in the Presence of Explosives and Ammonium Nitrate

Many of the requirements of this guideline are focused on minimizing the possibility and magnitude of a fire involving explosives and ammonium nitrate. This is based on many past occurrences involving fires transitioning to explosions, sometimes within 20 minutes or less. Such explosions have occurred during manufacturing, storage and transportation.

2.7.8 Magazines

Every factory magazine, (In-Process magazines), must also be constructed so that it is well ventilated and resistant to theft, weather and fire. Magazines for finished product must be constructed to meet the requirements of *CAN/BNQ 2910-500/2015 Explosives – Magazines for Industrial Explosives*.

2.7.8.1 Magazines Licensed by the Explosives Factory Licensee

Magazines are permitted on satellite sites. The magazine must be sited in according to the requirements of *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*. Magazines must be licensed separately from certificates if the magazines are to be used on a permanent basis, which is, extending beyond the duration of the manufacturing certificate, or if they are not being used for the purpose of manufacturing. If this is the case, information on the magazines, including licence number, must be supplied on Forms F05-01B and F05-01E, but not on Form F05-01D.

2.7.8.2 Magazines Licensed by Another Party

Magazines within D7 distances are permitted and must be sited according to the requirements of *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*. Access to the magazines and the factory site must be controlled at least at a D4 distance such that each party is aware of the presence of the other party. One party must assume control of the site, and there must be a letter of understanding to that effect, signed by all parties concerned, on the satellite site file.

2.7.9 Personnel Limits

One of the fundamental principles of operations involving explosives is to minimize the exposure of people by restricting the number of personnel to the minimum required to operate safely, for the minimum time. Various operation and building siting scenarios (including the number of personnel) are outlined in the quantity distance standard. Please refer to *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances* for the various activities and sites covered in the document.

2.7.10 Environmental Assessment (EA)

Applications for a new Division 1 Factory Licence or Satellite Site Certificate require information on the status of environmental assessment processes, either completed or on-going, where the scope of the project under review includes explosives manufacturing and storage. This information is necessary to determine if the completion of an environmental assessment process is necessary before Natural Resources Canada, together with other regulatory authorities, can proceed with a regulatory approval.

Under the *Canadian Environmental Assessment Act 2012*, the construction and operation of a bulk explosives plant and explosives storage does not require federal environmental assessment. However, explosives manufacturing and storage may be an ancillary or associated activity/component of a major project undergoing federal and/or provincial environmental assessment. Examples could be the supply of explosives for the development of a mine or a new quarry producing aggregate for the construction of a hydroelectric power project. If the proposed factory and the supply of explosives are within the scope of the project under review, Natural Resources Canada would not issue a licence or certificate until the environmental assessment process is concluded with a decision to allow the project to transition to the regulatory phase.

In the Yukon, Northwest Territories and Nunavut, explosives manufacturing and storage is an activity that may be subject to evaluation or screening processes conducted by impact review boards that determine if an environmental assessment or impact review is required. A proposed explosives factory or satellite site, for example, will be subject to a Designated Office Evaluation under the *Yukon Environmental and Socio-economic Assessment Act*, a Preliminary Screening under the *Mackenzie Valley Resource Management Act* or a Screening under the *Nunavut Planning and Project Assessment Act*. In these jurisdictions, applications for a licence or certificate should indicate the status of an evaluation or a screening process including confirmation that the project can proceed to the regulatory phase. In most cases, however, explosives manufacturing and storage is a component of a larger project (i.e. mine) that are typically subject to environmental assessment or impact review.

In some jurisdictions, Natural Resources Canada may report the issuance or renewal of a licence and certificate to impact review boards or agencies due to impact monitoring requirement.

2.7.11 Indigenous Consultation:

Natural Resources Canada will engage and, if necessary, consult Indigenous groups when a proposed bulk explosives plant or satellite site could result in adverse environmental effects affecting potential or established Aboriginal or Treaty rights. The Explosives Safety and Security Branch, therefore, reviews all applications for a new factory licence or satellite site certificate to determine if the engagement of Indigenous groups is necessary and may request additional information from the applicant to inform a decision on engagement or consultation.

When an Indigenous group is notified about an application, the applicant may be asked to provide basic information about the proposed facility and its location to the groups to ensure that there is sufficient information available at the time of engagement. Consultation, if requested, could involve the participation of the applicant in meetings with Indigenous groups and the

provision of responses to questions or concerns.

The department will also notify Indigenous groups about an application for a Factory Licence or Satellite Site Certificate whenever the proposed facility is a component of a major project that has undergone an environmental assessment process. Although information about explosives manufacturing and storage is included and assessed in the process, Natural Resources Canada will ensure that the opportunity for consultation is provided to Indigenous groups that have participated in the environmental assessment process. Consultation, if requested, will likely involve the proponent of the major project.

3 Documentation, Fees and Processing Time

The application for a licence or a certificate includes the following:

Forms F05-01A, F05-01B, F05-01C, F05-01D and F05-01E in addition to plans and drawings. In most cases an environmental assessment (EA) is not required for licences, but, at a minimum, a spill contingency plan, emergency response plan, site evacuation plan and a security plan are required for both licences and certificates. Supporting documentation, such as operating or maintenance procedures must be shown to be available, where applicable.

The ERD has implemented a new internet portal-based electronic licence management system (eLMS). This new system allows for licences to be renewed, amended and for new licences to be applied for. Some information from the previously used forms are manually entered into the portal when completing a licencing action (e.g. F05-01A).

In specific cases, other documents may be required to support the licence, for example, a hazard analysis or a risk assessment.

Note: Before a licence is issued, ERD may ask for copies of supporting documentation and may inspect the site to ensure compliance with the licence proposal.

3.1 Forms and Environmental Assessment

3.1.1 Plans and Licence or Certificate Forms

The licence or certificate forms and the plans or drawings describe the operation. Once approved, they become part of the conditions for the legal operation of a site. Approval is granted once the requirements set out in these guidelines are met.

3.1.1.1 Plans and Drawings

Several types of plans or drawings are listed on Form F05-01A. These are the Area Plan, Site Plan, Building Layout, Process Schematics, and Piping, Instrumentation and Equipment layout drawings. The area and site plans are the two that are considered mandatory.

Every drawing, sketch or plan must be drawn to scale, or be a reasonable approximation of actual distances and dimensions, and must include a legend. Engineering drawings to scale, with the scale indicated on the drawings, are preferred. The drawings should use a standard scale since size reduction may occur during copying. Small and simple sites (less than 10 items

on the plan) can be described by a sketch. All drawings, sketches or plans must be identified with a title, revision number and applicable date.

The area plan should clearly show the location of the site and any neighbouring vulnerable features or hazardous facilities such as dwellings, power lines, and other explosives operations within a radius of at least D8.

A site plan is required for each site. The plan must include: i) distances between operations, including washing/maintenance facilities, AN storage, fuel storage, vehicle parking areas, fences/barriers, and magazines; ii) distances to offices and welfare or administrative areas; iii) distances to roads and public thoroughfares; and iv) distances to dwellings and other assembly points, as well as operating pits, mine facilities, and similar installations. Distances must be in metres.

In some situations, the site plan can be used as an area plan as well, but it should identify all vulnerable sites, such as dwellings or areas where the public may congregate, within a D8 radius and must show any buffer zone between the operations and the surroundings.

Plans or drawings must clearly identify the company, proposed location, and licence number, if known. When applicable, layout sketches or plans should show emergency exits, and storage and workplace areas for individual magazines and buildings.

IMPORTANT: The building identification (number or legend) used must be consistent throughout all the plans, forms and other documents. Building layout plans are required for sites with multiple rooms or divisions, or to show equipment layouts. Process schematics or piping, instrumentation and equipment layouts are not usually needed for most simple operations but may be required for more complex operations.

3.1.1.2 Form F05-01A: Application – Factory or Manufacturing Certificate

The form must include the legal company name and a recognized location name for the site. The site location name must remain constant in all correspondence and references to the site. A letter authorizing an individual to sign on behalf of the company must be included for a new company or when there is a change in a licensing officer at an existing company.

Upon renewal, one copy of Form F05-01A should be included, with amended forms and/or updated reference documents for both the base site and all its associated satellite sites.

For each amendment request, a new Form F05-01A application is required to summarize and record the changes made to forms, drawings, and documentation. Each time a satellite site(s) is added, removed, amended or restarted, a new Form F05-01A application is required for both the base factory and the satellite site.

The same amendment numbers will be applied to the base factory and satellite site.

Drawings and documentation need not be resubmitted for renewals or amendments if they have not been changed.

Permission/Permit from Landowner and Authority Having Jurisdiction (AHJ): If applicable, it is recommended to obtain the required permission from the landowner and the proper operation permit from the AHJ for the location of the site.

3.1.1.3 Form F05-03: Licence and Terms and Conditions

This is issued by ERD. Form F05-03 grants the licence to a company at a site, noting the expiry date, and sets out the terms of the licence.

3.1.1.4 Form F05-01B: Site Description

Form F05-01B describes the physical aspects of the site, the site security, facilities and equipment, including the storage of pumpable explosives, mobile process units, fuel storage, AN storage, magazines, washing facilities, garages, or any other facilities, as well as any major piece of equipment, for example, pumps, located on the site.

Form F05-01B should start with a site description that includes access roads, gates, fencing, security, and other such general features. Following that, specific buildings and operations can be addressed. Geographical coordinates for at least one structure or building on the site should be provided on Form F05-01B.

Building descriptions should include, as applicable: dimensions, construction design and general details such as heating, material of construction, walls, roofs, floors, dividing walls, vent walls, firewalls, operational shields, barricades, floor finishing, fire protection installations, electrical classification and equipment, ventilation systems and equipment, services, lightning protection systems and static grounding systems.

Terms such as “approved magazine” or “approved equipment” should not be used. For example, in describing electrical installations, DO state “meets EEMAC 4” (if that is the case). DO NOT state “approved electrical installations” or “explosion-proof”, etc.

When documentation regarding equipment has been submitted to ERD for approval, it should be referenced by a date, for example, “information on heater submitted to ERD November 30, 2011.” If it is referenced by stating “submitted with this application”, then when the application is renewed or amended, that statement will no longer be valid.

Magazines should be described at a minimum, by giving the dimensions in meters (L x W x H) and magazine type as set out in *CAN/BNQ 2910-500/2015 Explosives – Magazines for Industrial Explosives*, for example, Type 4 magazine with its ERD tag number. This should be shown in the left-hand column.

Barricades, berms, or other natural protective features against explosions must be described, especially when the distances or types of distances shown on Form F05-01E require barricades, for example, D2 and D4. For all buildings or operations that are mounded, describe the type of mound and the directions in which the mounding is effective.

In the case of pumps, because pumping is a critical operation, the exact nature of the pump and its protective features must be described. The choice of pumps should be supported by a hazard review and/or testing to demonstrate that the pump/explosives combination is safe. Form F05-01B is also used to identify the location of AN unloading at rail sidings. The following is acceptable wording:

“AN storage in rail cars: (location of the siding) to load vehicles totally free of explosives, under

the control of Transport Canada, as per The Railway Association of Canada Circular No. DG-2, and with permission of local fire authorities. The Site Plan of the siding and the letters of permission from local fire authorities are referenced on Form 1 of the licence”.

3.1.1.4.1 Licenced Mobile Process Units:

Mobile process units are to be listed on Form F05-MPU. Process units must be reviewed before the units are put into operation in a licence. This is accomplished by submitting documentation for approval. Documentation for approval must fully describe required attributes using Form F05-MPU, schematics and photographs. This is explained in “Requirements for Bulk Mobile Process Units”.

A licence amendment is required when mobile process units are changed at a licensed site.

3.1.1.5 Form F05-01C: Manufacture and Storage of Explosives

The information required on Form F05-01C is as follows:

3.1.1.5.1 Manufacture and Storage:

Identify the explosives or articles proposed to be:

Manufactured or Processed: Identify products by manufacturer’s designation, proper shipping name, UN number, hazard classification, date of authorization or authorization file number (if available). “Manufactured” here is in accordance with the *Explosives Regulations (Part 5)* definition, and therefore includes explosives that are processed (e.g., pumped, augered, etc.).

Stored: Identify products by proper shipping name, UN number, and TDG hazard classification.

3.1.1.5.2 Client Information:

Provide the client name (where explosives are being manufactured for loading into boreholes), location, and contact information so that ERD may visit or contact the site. Include distances by road from the factory or from the satellite site to the loading operations at the customer site. Where applicable, describe special situations such as marine transport.

3.1.1.6 Form F05-01D: Manufacturing Operations Description

Form F05-01D must describe the operation and state the type and quantity of explosives in addition to personnel limits with respect to each specific process unit or magazine, as given on Form F05-01B. The operations of a mobile process unit at the approved site (with regard to number of personnel allowed, explosives on board, and distances to be observed) and at the customer site must be described.

3.1.1.6.1 Permitted Operations:

The operation(s) allowed in a particular building or on a mobile process unit (including at a client site) must be stated. When more than one type of operation can be conducted in a given area, the operations must be listed as being allowed to run either simultaneously (AND) or as alternatives (OR).

3.1.1.6.2 Quantities:

The type and quantity (in metric units or, in the case of detonators, in units) of explosive and of ingredients, including ammonium nitrate and fuel oil, used to make the explosive are listed. Waste explosives stored and any laboratory samples must also be listed. Any other flammables must also be included.

3.1.1.6.3 Personnel:

The number of people is listed either as workers or visitors (casual workers or visitors). Workers are considered by ERD to be personnel who remain in the particular area and are required to accomplish the particular intention of an operation. Visitors are defined as personnel who have a need to go into a particular area to carry out their duties, but are not normally required to carry out the intentions of the operations. Visitors may also be external, such as explosives inspectors or contractors. Personnel limits must be set at a minimum required to carry out the work.

When there are several operations at a site, each with its own personnel limit, there should also be an overall site limit. For example, a site may have five magazines or manufacturing processes each with a limit of three operators and two visitors; but this does not imply a combined limit of 15 operators and 10 visitors for the site as a whole, but rather a total of five operators and two visitors for the site.

3.1.1.7 Form F05-01E: Distances

In the left-hand column of Form F05-01E, in the column titled "Reference Number", each building/operations/location with explosives is listed. These are regarded as potential explosion sites (PES).

A PES is defined in *CAN/BNQ-2910-510/2015 – Explosives – Quantity Distances* as: the location of a quantity of explosives that will create a blast that could be associated with the projection of fragments or debris or a fire hazard if its contents should explode. A PES is a donor to the exposed site (ES) listed in the other columns to the right.

An ES is defined in *CAN/BNQ-2910-510/2015 – Explosives – Quantity Distances* as: a building in which people live, work or assemble; a public road, railway or other transportation infrastructure; a pipeline, electrical facility or power line, or any place in which a substance that increases the likelihood of a fire or explosion is likely to be stored including, but not limited to, a site containing aboveground or underground storage of carbon fuels, or a site containing explosives (magazine, tanker loaded with explosives, factory or mobile process unit.) It is useful to record the quantity (NEQ) of explosives in this column.

The second set of columns on this form should be used to show distance to ESs on site such as AN storage and fuel storage, as well as features outside the site, such as dwellings, etc.

The third set of columns is used to show distance to all explosives storage areas (e.g., magazines, emulsion storage), and the fourth set of columns to all process areas (e.g., wash bay, emulsion manufacturing building).

Form F05-01E must show the minimum distance to be maintained and the actual distance between a given building/operation/location and the building/operation/location/ activity listed in the column headings (process, magazines, etc.). This distance will depend on the quantity of explosives at the location listed in column 1 and can be found in the *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*.

When completing Form F05-01E, it is helpful to record the applicable Q-D type (e.g., D4, D7) used for the required distance so that misunderstandings can be quickly identified, for example, intra-plant distances are directly affected by the presence or absence of barricades.

3.1.2 Spill Contingencies

In the case of certificates permissions, and licences that do not require an environmental assessment, contingency plans for spill control and disposal are still required to be submitted.

3.2 Supporting Documentation

Although it is recognized that bulk explosives are less prone to accidental initiation than packaged explosives, the manufacture and handling of any explosive still carry inherent risks. Unwanted effects may be reduced by protecting people and facilities and/or by reducing quantities. The probability of initiation may be reduced by the careful design of equipment and facilities and by hazard analyses, by understanding the risks associated with the products, maintaining operations in accordance with the original design criteria, controlling changes, selecting and training personnel, and by preserving an acute awareness of general safety.

In support of the licence application, the documents or procedures set out below must be listed on Form F05-01A and shown to be available.

The Regulations require that procedures and special rules be drawn up by the factory licence holder in order to ensure the maintenance of proper discipline in the factory and the observance of the provisions of the Act, the Regulations, and the terms and conditions of the licence related to safety.

The format of these procedures is left to the individual companies. However, the documents must clearly detail the correct, acceptable and understandable way of carrying out a task. They must be titled, dated, the pages numbered, and must be approved by a member of the company's senior management.

Note: ERD does not approve procedures or drawings. Nevertheless, when appropriate, ERD will comment.

During an inspection, applicants may be requested to demonstrate the adequacy of these procedures by addressing the following questions: Are they available and understood? Do operators and supervisors follow the declared procedures? Are procedures routinely reviewed and revised? Are changes recorded? Are operators trained?

Copies of documents, procedures and records may also be requested prior to the issuing of the licence.

3.2.1 General Safety Rules

Companies must establish and apply documented safety rules addressing both general safety and safety particular to explosives manufacturing. The latter should include the identification of products and process hazards, the controls being exercised, and any other specific rules needed to protect personnel and installations. Safety rules specific to an operation must be posted and observed. Personnel – both site operators and management – must be trained and competent with them. Explosives inspectors may examine records and question personnel to determine how well the rules are known and applied, for example, are special safety-related procedures and records kept? Are preventive maintenance checks performed on pumps?

3.2.2 Inspections and Audits

Companies must have their operations internally inspected and/or audited. This means inspections or audits must be carried out by supervisors and management to ensure continuing compliance with the Regulations, licences, and their procedures, policies and rules. These inspections/audits must be described in written procedures. All action items and corrective actions taken must be recorded. Records of these inspections/audits may be requested by ERD during inspections or for submission with the renewal applications. An annual audit would meet the intention of the Regulations.

3.2.3 Memoranda of Understanding

When a company operates a site in a domain that is not under total control of the explosives company (e.g., on a mine or quarry property, on a road job, etc.), a Memorandum of Understanding (MOU) must be written and signed by all parties. The objective of a well-written MOU is to clarify the ownership of the domain/site, the responsibilities of each party on the site, to ensure good communications between all parties on the site, to note the facilities/operations present on the site, describe the access/egress control and security of the licensed site, and the scope of the explosives operations, including those of the mine/quarry and how they could affect each other. An MOU will usually include the development of a Joint Emergency Response Plan by all parties present in a domain.

MOUs describing approved operations and personnel limits are also needed for all client sites.

3.2.4 Procedures

Certain activities must be controlled by procedures in order to ensure that the correct and acceptable way of accomplishing a task is clearly and understandably detailed. Procedures should be developed by qualified personnel and expressed in such a way as to avoid confusion and ensure control at all times. Procedures should be reviewed periodically.

The following procedures must be available:

- Operating procedures for the site or process units, including any specialty or safety procedure;
- List of permitted maintenance tasks;
- Explosives burning ground and/or waste explosive disposal;
- Emergency Response Plan and Fire Safety Plan;
- Site Security Plan;
- Key Control Plan;
- Management of change procedures;
- Maintenance procedures;
- Miscellaneous safety procedures for tasks that are not normally part of day-to-day operations but that may be required occasionally (lock out/tag out, etc.); and
- Hot Work procedures.

Changes to the site security plan must be forwarded to the Chief Inspector of Explosives as soon as the circumstances permit. For changes to other procedures referenced on Form F05-01A, the licensee/certificate holder may wait until annual renewal of the licence/certificate before making the changes to the information on Form F05-01A; however, the latest procedures must be available at the site. The intent is not that ERD approve procedures, but that changes be reflected in the licence and that inspectors be able to verify that the latest procedures are used.

3.2.4.1 Operating Procedures

The procedures must specify any control limits for process variables and equipment. Safety critical parameters, for example, pump temperature or required preventive maintenance, must be highlighted in the procedures. Procedures must include sections on dealing with emergency situations and must list the materials, tools and equipment, including personal protective equipment, to be used.

3.2.4.2 Decontamination Procedures

Decontamination procedures should consider the following statements and include provisions to address them.

Decontamination of an explosives vehicle or explosives equipment requires that the equipment be completely free of explosives or oxidizers and is clean. This may require dismantling or removing pumps and pipework or other equipment. The design of the equipment should allow for this to be done safely. Tubular construction or hollow welded sections are very difficult to decontaminate and should be avoided. When the equipment is clean and free of explosives or other hazardous material, it must be inspected by a supervisor to verify that it no longer contains any explosives, and it be tagged to indicate the decontaminated status.

3.2.4.3 List of Permitted Maintenance Tasks

A company must prepare a list of which maintenance tasks it allows at a given site and which tasks must be carried out at a better-equipped facility. The list must specify whether decontamination is required and the nature of the decontamination.

3.2.4.4 Maintenance Procedures

Companies must have documented maintenance procedures for site equipment, both fixed and mobile, and maintenance records must be maintained.

3.2.4.5 Explosives Disposal and Burning Ground

The destruction of explosives must be identified on the licence since it is a manufacturing activity. Two operators must be present during the disposal of explosives or of packaging that may be contaminated with explosives. Initiation of disposal, whether by burning or detonation, must be done remotely. If burning is used, either a minimum of two burning pads must be provided, or the time between burns must be specified to ensure a cold, clean area for a new burn. The burning pad must be raked and cleaned before a second burn is attempted.

3.2.4.6 Emergency Response Plan and Fire Safety Plan

All sites must develop a formal Emergency Response Plan and a Fire Safety Plan. This should be done in accordance with the CAN/CSA-Z731 “Emergency Preparedness and Response” standard, and in conjunction with local authorities, with the operating mine and quarry personnel as appropriate, or with the contractors responsible for a project.

The Emergency Response Plan and Fire Safety Plan for the site need not be separate documents, but could each form part of the site’s Emergency Response Plan.

The plan should develop reasonable credible scenarios of possible events, including vehicle collision, fire on the site, explosion, fire encroaching on the site, spills, storms, and power failure, as well as security-related events. It should establish the criteria needed to trigger the response; give procedures, chronologically organized, to use during the response, including directing personnel to safe locations; list the resources available and needed during the response, including contact information such as names and phone numbers; and provide site plans showing safe locations.

3.2.4.7 Key Control Plan

Companies should develop a formal Key Control Plan to control access to all locations where explosives may be found on the site. A Key Control Guideline is available from ERD to assist with the development of a Key Control Plan.

3.2.4.8 Site Security Plan

The site must be assessed for security risks and a Site Security Plan must be developed for the site. A Site Security Guideline is available to aid development of a Site Security Plan.

3.2.4.9 Miscellaneous Safety Procedures

Companies must develop the procedures required by ERD and/or provincial safety regulations for any potentially hazardous tasks that an employee may be required to undertake. Employees need not know the details of each procedure but must know when they are required, and must be trained on the procedure prior to undertaking the task.

3.2.4.10 Hot Work

When the use of an open flame or a flame-producing device (matches and lighters, including electric) or equipment producing sparks is required (e.g. in welding shops, on burning grounds, in a maintenance garage), proper safety procedures are required.

Smoking is prohibited at all Division 1 and 2 licensed operations.

3.3 Fee Structure (Ref. ER2013, Part 19)

A fee is payable at the time an application is submitted.

If bank cheques are used, they must be made payable to the "Receiver General for Canada." All forms of payment must make reference to the licence or certificate number to which they are to be applied. Contact ERD for a listing of fees.

3.4 Processing Time

If the application is complete, the target processing time to review and issue the licence/certificate at ERD is as follows:

- For new factories and certificates: a maximum of 60 working days.
- For renewal and amendments: a maximum of 30 working days.
- For satellite sites, demonstrations and trials: a maximum of 30 working days.

If there are aspects that are unclear, or if additional information is required, then ERD will issue an information request within 14 days of receipt of the application. From receipt of the additional information or revised application, the target processing time will be 30 working days.

4 Sites, Facilities and Equipment

4.1 Licence or Certificate Site

This section contains general information related to any licenced bulk explosives site. Information presented in this section includes access control, the control of fire-producing devices, material storage, structures and services, as well as applicable codes.

4.1.1 Controlling Access to the Site (Fencing, Other Barriers)

Access to the factory or certificate site must be restricted and controlled. Limiting and controlling access to the site enhances both public safety and security of explosives by minimizing the exposure of persons who do not have any reason to be there. The measures in place to control site access must be described on Form F05-01B. If any of the measures stipulated in this section have not been implemented, the alternative must be described and justified on Form F05-01B.

All sites must restrict road access with a lockable gate at the entrance to the site perimeter. There must be barriers to prevent access at any other site access points. These may be man-

made barriers or natural barriers such as trees, difficult terrain, etc. Page-wire or chain-link fences may be an acceptable man-made barrier for permanent sites, but the exact fencing requirements may vary based on the types of operation and appropriate security measures to be taken due to the site's location. A snow fence is an acceptable alternative for temporary sites and certificates. Special consideration will be given for fencing in remote areas or areas in which the terrain makes erection of a fence problematic. Barriers may be erected around process locations rather than the perimeter of a large site. Man-made barriers other than a fence will be considered on a case-by-case basis.

Site gates must be kept locked unless the site is attended and the person or persons at the site can observe persons entering the gate.

Many bulk explosives sites are located on land that companies do not own or fully control. In the case of sites located at surface mines or quarries, when there is fencing and security for the entire site, the explosives operation has to make sure that it is delineated from the rest of the mine.

The barriers described will not be as effective in preventing access by persons on foot or with ATVs, motorcycles, snowmobiles, etc. Therefore, the perimeter of the site must also post signs warning against unauthorized entry. These signs may also have to meet the requirements of the province or territory.

In the vicinity of any structures with explosives, for example, magazines, process buildings, wash facilities, etc., signs must be posted to warn of the explosives. A sample of suitable wording follows:

DANGER – EXPLOSIVES
NO TRESPASSING
PENALTY – SECTION 18
CANADA EXPLOSIVES ACT
NO SMOKING – NO MATCHES

DANGER – EXPLOSIFS
ACCÈS INTERDIT
PÉNALITÉ – ARTICLE 18
LOI SUR LES EXPLOSIFS DU CANADA
INTERDIT DE FUMER AUCUNE
ALLUMETTES

Signs must be displayed on the fence around these structures or at a distance of 30 m from them so that a sign is clearly visible from any possible direction of approach. Such warning signs should be placed on the access road at D7 distances, or D5 when D7 is impractical.

4.1.2 Control of Fire-Producing Devices

A box for keeping matches and lighters or other fire-producing items must be provided before entry onto the site. The normal location for this box is at the gate entering the site, placed near a warning sign described in the previous section.

4.1.3 Storage and Control of Raw Materials

Except as allowed elsewhere in these guidelines, in order to control unauthorized access to raw materials, storage areas for AN, fuel oil, or other raw materials must be located within the fence of either licensed factory sites or sites covered by certificates. AN storage may be permitted outside the fenced area on a secure mine site if identified on the factory licence and approved by ERD.

Drums of petroleum products or chemicals must be tightly sealed, protected against corrosion and rust, and kept in a dry building or shed with an impermeable floor (or on a spill containment basin such as specially designed pallets). Solid chemicals in bags or other forms of packaging must also be kept in a dry building, shed, or container.

4.1.4 Services and Tools

A Division 1 licensed factory with either permanent or temporary structures must have an electrical power supply, lighting, water supply, wash equipment, and wash-water collection equipment. Sufficient tools must be provided to enable the safe removal or disassembly of contaminated pieces, piping and equipment for decontamination purposes.

4.1.5 Heated Washing Facilities

Most sites in Canada require permanently installed heating facilities for year-round operations. Sites without heating will have the terms of the licence restricted based on the historical average temperature above 0°C (zero) applicable to the area.

4.1.6 Codes

All standard industrial installations must comply with the Canadian Electrical Code (CEC), National Fire Code of Canada (NFC), and the National Building Code of Canada (NBC), or with any other code, such as commercial garage standards, or provincial or municipal requirements. When applied to bulk explosives sites, this generally covers non-hazardous locations with noted exceptions (primarily for some aspects of electrical wiring, see Appendix A).

The National Building Code contains the requirements with respect to health and fire safety, which depend upon the use to which a building is put and its type of occupancy. Unless highly combustible and flammable materials are present, this will usually mean complying with Group F, Division 2 classification (medium hazard industrial occupancy), which is typical for repair garages and service stations. Process buildings and larger sites are usually classed as Group F, Division 1 (high hazard industrial occupancy), with the requirements for structural fire protection generally not applicable, since fires involving explosives are not to be fought; as a result, water sprinklers are not called for.

Proof that installations comply with all appropriate codes may be requested during inspections by ERD or prior to the issuing of the licence.

Note: In these *Guidelines for Bulk Explosives Facilities*, maintenance garages wash bays are classified as Group F, Division 2, meaning, *medium hazard industrial occupancy* under the Building Code. This designation essentially recognizes maintenance **with no explosives** present. If heels are regularly permitted, as is often the case, then the structures should be classified as *high hazard industrial occupancy*, i.e., Group F, Division 1, meaning “an industrial occupancy containing sufficient quantities of highly combustible and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.” The Building Code goes on to define other hazardous substances.

This said, the Group F, Division 1, classification was not fully implemented in these guidelines because it also brings into play requirements such as sprinkler systems, and others, that ERD

did not want to see. Architects are involved in the design of such facilities, which can limit occupancy and add a host of other restrictions or requirements that ERD did not believe to be warranted. Nonetheless, ERD must recognize that explosives will indeed be contained in such structures, and thus they must have many of the non-combustible attributes that combustible structures, such as a wood frame, do not. The National Fire Code stipulates that ERD is the “authority having jurisdiction” and as such can determine what requirements are deemed necessary under the circumstances.

4.1.7 Other

Sites should have level surfaces large enough to allow turning of vehicles, including snow plows, and be large enough to allow easy clearing of snow.

4.2 Buildings in General

4.2.1 Construction

Buildings must meet good engineering practice and must be non-combustible, unless otherwise permitted. The structure must be adequate for the purpose, that is, durable, suitable for the local climate, fire resistant, and able to meet the other requirements of these guidelines. Pre-engineered steel buildings are preferred.

It is not uncommon for such building structures to house vehicles and equipment containing explosives, which, because of their inherent characteristics constitute a special fire hazard. As an example, this could be in the form of residue, a heel, or contaminated pumps/hoses resulting in the structure falling under Group F, Division 1 or 2, for hazardous rated buildings under the National Building Code of Canada (NBC).

In many parts of the country, there is a requirement to heat facilities, thus requiring that a structure be insulated. As a minimum, any insulation, be it rigid or a spray-on application, must meet a flame spread rating of 25 or less as defined in the NBC. Such a rating serves to resist a flame spread, thereby reducing the effects of a temperature rise in the event of a fire.

Buildings are to be constructed to meet Group F, Division 1 and the ERD requires mechanical protection or cladding on all walls and the ceiling of the building. This protection is to be corrosion resistant, and is included to facilitate washdown of the building.

There has been some interest shown in the use of “fire-resistant fabric” buildings. These fabrics are not “non-combustible,” however, and are not permitted for buildings with explosives, as explained in the preceding section 4.1.6 on Codes. The issue with fabric-covered structures is not compatibility or long wear; it is that they are combustible. The MSMA (Membrane Structures Manufacturers Association) website states that “structures will meet the building code classifications used in Part 9 and Part 3 of the National Building Code of Canada as combustible construction.” As explained in section 4.1.6, structures where mobile explosive vehicles with residue, heels, or pumps/hoses are commonly kept, decontaminated, and maintained are deemed under the National Building Code to be high hazard industrial occupancy and classed as Group F, Division 1. ERD, being the authority having jurisdiction, has permitted the use of fabric structures that meet flame resistance requirements for wash facilities and as garages at factories with temporary structures, but this was a concession that was never

meant to apply to regular factory sites.

In certain instances a factory site may be required for a limited time period, and the structures on it need not be permanent, but any proposal must be approved by ERD before implementation. Protection of the washing facilities from the elements is required. Membrane or fabric used in structures must comply with National Building Code Section 3.1.6, and specifically Section 3.1.6.5 for Flame Resistance, plus Sections 3.3 and 3.4. The material must conform to CAN/ULC-S109 “Standard for Flame Tests of Flame-Resistant Fabrics and Films” and NFPA 701 “Flame Resistance for Textiles and Films.”

Buildings and structures must be provided with adequate lighting, as specified by labour codes, for activities to be carried out, namely, washing, decontamination, disassembly, assembly, and routine process vehicle repairs.

Building egress must be in compliance with NFPA 101 Life Safety Code, Chapter 7. Buildings must be provided with two safety exits in addition to the roll-up doors or truck doors. The safety exit door(s) must be equipped with panic hardware. Exceptions may be granted in the case of small buildings such as sheds. Escape routes must be kept clear of obstruction. Safety exits should lead directly to the outside.

A sufficient area for spare parts and tools must be made available; with the exception of heavy pieces of equipment, storage on the floor is not acceptable. Tires and other flammable material must be stored in a separate area. Equipment not associated with explosives manufacturing, for example, personal cars, boats, vacation trailers, etc., requiring long-term storage, must not be kept on the licensed site.

Magazines must comply with the requirements of the *CAN/BNQ 2910-500/2015 Explosives – Magazines for industrial Explosives*.

4.2.2 Barricades

Barricades must be provided as required by the Q-D Principles. No barricade is required where only a heel of explosive is present in the vehicle.

4.2.3 Use of Brass and Copper

Brass and copper must not be used anywhere where they could come into contact with ammonium nitrate or solutions of ammonium nitrate or ammonium nitrate-based explosives (see section 4.9.2, Handling of AN). If brass and copper are unavoidable (e.g., some fire extinguishing systems), they must be protected by paint. Painting must not interfere with the function of parts, such as nozzles.

An exception may be copper grounding cable used on the exterior of buildings for lightning protection.

4.3 Parking Areas

A planned area for the parking of mobile process units, including ANFO units, must be provided. This may be indoors or outdoors. Given that the following sections require that parking be at least 25 m from AN and explosives and 25 m from any source of potential fire, it is difficult to have indoor parking when explosives are in the building.

4.3.1 Location

A process vehicle with no more than a heel on board can be regarded as having zero NEQ for Q-D requirements to vulnerable locations that are part of the licensed operation. Normal Q-D requirements to outside vulnerable locations must still be met. This applies to requirements for taking on AN or fuel, or for minimum set-off distances from fuel, etc. However, a vehicle is still a potential source of fire and must be parked at least 25 m from stored explosives or AN.

If more than a heel is present (i.e., greater than 250 kg), Q-D must be taken into account.

Site layouts should take into account operational emergencies requiring unscheduled storage of loaded process vehicles.

4.3.2 Parking of MPUs

Empty MPUs with a heel of less than 250 kg NEQ may be parked on a licensed site as though they were empty but not decontaminated.

Often an MPU will return to the factory with more than a heel on board and sometimes it may have to park fully loaded (e.g., if the blast is cancelled after the vehicle has been loaded) in which case it must be parked meeting Q-D. The site license must include a suitable area designated for this parking, shown on the site plan. ERD believes it may be safer to park the vehicle overnight with more than a heel than to pump off the excess product. If multiple vehicles are parked with more than a heel, the maximum vehicle NEQs must be added together for Q-D purposes unless the vehicles are separated. (i.e., D2 barricaded or D4 unbarricaded using the maximum NEQ of the vehicles).

While a vehicle is parked, the AN and explosives bins and hoppers must be locked, and the battery must be isolated. The keys to the vehicles must be kept in a secure place to prevent theft of partially loaded vehicles.

4.3.2.1 Parking of Pre-loaded MPUs

If the explosives are loaded the night before, then the vehicles must be equipped with a GPS tracking and communication system including an anti theft system. This activity must have been approved on the site licence. Generally MPUs should not be loaded sooner or with more product than is required, but in some circumstances pre-loading may be permitted by licence depending upon the justification, site location, site security, quality of site operations, frequency and the procedures proposed to control this activity.

4.3.2.2 Parking of ANFO Process Units at Customer Sites

This is allowed under the following conditions: (i) that it is for overnight storage only; (ii) that the unit is empty and it is possible to show that the unit is empty of all AN; (iii) that the parking area is identified on the site plan; (iv) that written approval from the customer is presented; and (v) that the approval of ERD has been obtained beforehand.

4.4 Number of Units

Any number of vehicles up to the total listed on the licence may be located at a factory with a wash bay.

For satellite sites, only two “active” process vehicles are allowed.

One ANFO certificate is issued per ANFO mix vehicle. Otherwise, the number of units is limited by the explosive quantity, the available distances, and the NEQ.

4.5 Tankers, Tanks or Silos for Pumpable Explosives

This part deals with containers that are in use for the storage of pumpable explosives (typically emulsion or water gel). Storage means that the explosives are held unattended. This type of container may be a tank, a silo, a road tanker, or a road tanker removed from service. Intermediate bulk containers (IBCs) or totes are not included because they are essentially packaged product that must be stored in a magazine.

4.5.1 Location

Siting must take into account the Q-D Principles. Multiple units may be grouped together if circumstances, including available distances, allow. Barricades are required as per the Q-D Principles.

4.5.2 Installation

The installation must be structurally sound and must be supported on a non-combustible structure.

If road tankers are to be temporarily installed (i.e., a tanker of emulsion is used for unattended storage, not refilled on site, but replaced by another tanker), the wheels must be blocked, the king pin must be locked, and jacks should be used.

If road tankers are used as a permanent installation (i.e., not temporarily installed as above, but refilled on site) the tires must be removed. Non-coded vessels may not be used on the road, but may be used as permanent storage on bulk sites.

Concrete or steel pads must be provided for dollies. At temporary locations, other solutions may be considered.

If intermodal portable tanks are used for storage, please refer to CAN/CGSB 43.151.

4.5.3 Construction

Silos and tanks must meet industrial specifications and be in good condition. All highway tankers, unless permanently installed, must conform to Transport Canada CSA B620 standards as referenced in CAN/CGSB 43.151 and must be in good mechanical condition. Highway tankers must have periodic inspections, refer to CSA B620 for the frequency of each test.

The surface of the tank that is in contact with the explosive must be able to withstand the constituents of the explosive and must be non-porous and easily cleaned. Stainless steel is a good material for most existing emulsion or water gel explosives. Mild steel is corroded by the nitrate salts in the explosive. Polyethylene is a suitable material for water-based explosives, but it must be structurally able to withstand the elevated temperatures at which emulsion explosives are manufactured and stored.

Any material used in or around the tanks must be compatible with the explosive. No brass or copper may be used in contact with AN or AN-containing mixtures (see section 4.9.2, handling of AN). Where insulation is used, it must be non-porous in nature, that is, will not absorb explosives in the event of a spill.

Emulsion storage tanks must be constructed in a manner that prevents accumulation of explosives and raw material in cracks and cavities. There must not be any enclosed containment areas such as framing support pockets. Any pocket area must be provided with a vent and drain or weep area in order to allow for decontamination.

In many parts of the country, there is a requirement to heat AN emulsion. The heating of AN emulsion silos may be via a water / glycol circulation or an electrical heat trace type system. Both heating systems must comply with the appropriate electrical requirements, (see section 4.1.6 and appendix A). The use of double- or multiple-walled tanks are not permitted.

Venting must be provided.

4.5.4 Security

All points of access (e.g., manholes and discharge valves) to explosive tanks, tankers, silos, etc., must be locked (not only with cam lock lug rings) when not attended.

ANE storage must meet the requirements in subsection 63(4) in the *Explosives Regulations, 2013*. The intention of this requirement is met for bulk ANE storage located on secure, access controlled mine sites. These are considered to be locked by secure location. Appropriate caps and plugs are mandatory.

4.6 Combustible Liquids

This section deals with combustible liquids, which, as per the National Fire Code, are liquids having a flash point at or above 37.8°C and below 93.3°C. This includes fuel oil, diesel oil (flash point 37.8°C), and kerosene (flash point 65°–85°C).

In all cases, the storage tanks must meet applicable regulations and codes for tank construction, installation and dyking requirements.

4.6.1 General Fuel Storage Requirements

For fire protection purposes, the location of above-ground combustible fuel storage must be a minimum of 25 m away from AN, from explosives storage, or from manufacturing buildings. The tank must also be located at a lower elevation than explosives or AN storage. Special circumstances or alternatives that would prevent a leak or loss of containment towards explosives or AN will be considered.

Under no circumstances must the combustible liquid be able to flow towards buildings in which explosives may be found, in the event of a leak. The fuel supply must have two independent shut-off valves between the storage tank and the point of discharge in the structure. Brass valves must not be used in areas where brass is incompatible with the explosives or raw materials.

Accidental siphoning from the process fuel tank must be prevented. Feeds must be by means of a pump with automatic shut-off valves to prevent loss of contents in the case of siphoning. Shut-off valves must fail in the closed mode (shut in the event of power failure).

Fuel storage should be done in compliance with NFC and other provincial regulations. Equipment fueling stations must be at least 25 m away from explosives.

4.6.1.1 Fuel Storage for Transfer to Mobile Process Units

The storage must be placed to permit the vehicle from which or to which fuel is being transferred to be not closer than 25 m to AN or explosives. That distance is also for fire protection purposes.

Unless referenced on the site licence, sites must have their own fuelling facilities for both vehicle and process use, and the following conditions apply:

- Fuelling locations must be adequately separated from other site facilities such as AN and emulsion storage;
- Mobile Process Units must be fuelled before explosives are loaded; and
- Site emergency response plan must include fueling and associated emergency response scenario.

If mine fuel facilities are used, the following conditions apply:

- Mobile process units must be fuelled before explosives are loaded; and
- Emergency response procedures for explosive incidents must be available and must have the agreement of the mine.

4.6.1.2 Combustible Liquid as Raw Material Feed

When used as feed or head tanks for process purposes, limited fuel storage may be located in the operating building. A zone electrical classification may be applied accordingly.

4.6.1.3 Combustible Liquid as Fuel Feed to Equipment

It should be noted that the requirement for the location of fuel stored to supply equipment powered by internal combustion engine (e.g., generators and compressors) is more stringent than the above. This requirement is outlined in section 4.19, Equipment Powered by Internal Combustion Engine.

4.6.2 Fuel tank installation

Fuel tanks and their installation must meet the environmental considerations as set out in the Canadian Council of the Ministers of the Environment (CCME) Code: *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* and shall also comply with other local, provincial and territories codes and regulations.

4.6.3 Use of Waste Oil

Approval for use in surface applications of waste lubricating oil in bulk ANFO products, and in bulk ANFO products mixed to form ANFO-emulsion blends and bulk emulsion products, can be considered when:

- the waste oil is generated, characterized and used at the same location, i.e., same province;
- approvals have been received from the provincial authority having jurisdiction over the use and transport of waste oil;
- its use is described in the Factory Licence;
- the products are authorized and include the limiting percentages of waste oil (not more than 50% waste oil may be used in the oil phase); and
- explosive product use and sale is restricted to the factory site where the waste oil originated.

This policy limits the use of waste oil to the waste oil generated at a mine site and ensures that oil from all types of sources is not used unless the composition and the source are known and characterized. Accordingly the following requirements are placed on the sources of waste oil:

- a specification against which waste oils can be tested and evaluated; this specification must define:
 - composition, i.e., expected contents as well as what is not acceptable (e.g., hydrocarbons, a small quantity of additives, a little water, traces of heavy metals would be expected, but glycols or chlorinated hydrocarbons would not),
 - viscosity limits (very viscous oils may cause problems with application and adsorption),
 - flashpoint limits (i.e., low flash point can affect pumping safety);
- test methods so that the oil can either be accepted or rejected before it is blended with virgin oils and before their use;
- companies must develop guidelines for use and testing of waste oil and its blends. The guidelines must include testing or certification of pre-blend waste oil prior to use, defining limits for water and glycol, checking for AN absorption, and conducting routine visual

checks for any observed separation of the oil in the blends. Records must be available for inspection.

4.7 Explosive Fuel Phase

This section deals with the raw material used in the manufacture of explosives (e.g., emulsion in the fuel phase) that does not fall into the category of either combustible or flammable liquid. The flash point of this fuel is typically 165°C or greater, and this fuel must usually be heated.

This fuel may be located either inside or outside a structure in which explosives are processed, the limitations being that the storage vessel(s) must be constructed and installed according to good engineering practice and dyked as per the requirements in section 4.6. The vessels must also be located separately from the explosive matrix and AN or AN solution so that, in a fire situation, the burning fuel does not engulf these materials.

4.8 Flammable Liquids

This section deals with flammable liquid which, per the National Fire Code, is a liquid having a flash point below 37.8°C and a vapour pressure of not more than 275.8 kPa at 37.8°C as determined by ASTM D323.

The storage of large quantities is not dealt with here because it is not permitted at a bulk explosives site.

Small quantities of flammable liquid must be in a CSA-approved flammable liquids storage cabinet. The cabinet is to be installed and maintained based on the requirements of the manufacturer.

4.9 Ammonium Nitrate Prill Storage and Handling (Ref.: ER2013, Part 20)

This section deals with the storage of solid ammonium nitrate prills and any reference to AN here means ammonium nitrate prills.

AN storage must take into consideration the risk of an explosion initiated by a nearby detonation, the risk of fire transitioning to explosion, the security of the AN from theft for illicit purposes, and the prevention of environmental contamination.

4.9.1 Locations

This section deals with the location for AN storage relative to explosives, other hazardous materials, and vulnerable sites. A guideline for the storage of more than 100 tonnes of AN at remote locations (self-contained locations that cannot readily be accessed from a road that connects to populated areas) is found in Appendix D.

The first consideration is to find a location for AN storage that is far enough removed from explosives so that the AN does not have to be considered an explosive. This distance depends on the amount of explosives, and the minimum separation distance can be found in *CAN/BNQ*

2910-510/2015 Explosives – Quantity Distances.

In some cases, for example when AN is fed from a silo to an explosive operation in a structure, AN cannot be located far enough away from explosives to be considered non-explosive, and half of the quantity stored must be added to the total NEQ of the site and located according to *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*.

When a vehicle with explosives is brought to the AN storage, the AN is considered an explosive at 50 percent of its weight, and the entire quantity of explosives on the vehicle plus the AN must be situated according to *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*.

When not considered an explosive, the quantity of AN is not limited by the Explosives Regulations, but other regulations may apply.

AN storage must be located at least 25 m from and on higher ground than combustible liquid or explosive fuel phase storage. Special circumstances or alternatives that would prevent the flow of fuel towards the AN will be considered.

Ammonium nitrate is a water pollutant. Environmental considerations may be required.

4.9.2 Handling of AN

The guidelines in this section are intended to address the following concerns with the handling of AN: environmental contamination by spillage, contamination of the AN, and avoidance of fires.

- Any areas on which AN is transferred must be fitted to provide a catchment area for spilled AN from which the AN can be readily collected. As an example, loose gravel or sand would not fit this description.
- Spilled AN must be immediately picked up to be disposed of in an environmentally acceptable manner.
- If the immediate collection of spilled AN is not possible, the storage or handling area must be underlaid by a water-impermeable cover that collects and stores any runoff water. This water must then be disposed of in an environmentally acceptable manner.
- AN transferred via dumping (e.g., from a trailer or tanker to an auger or bucket elevator feed hopper) must be protected from exposure to liquid and from other contamination (stones, etc.).
- Equipment used to transfer AN (e.g., augers, bucket elevators, pneumatic blowers) may be hydraulically or electrically powered, but must not be powered by a gasoline engine.
- Equipment used to transfer AN must not contaminate the AN, for example, equipment that may leak oil or that has been used for other materials and not decontaminated.
- No brass or copper may be used where it may come into contact with AN prills or solution (to prevent possible formation of the explosive compound tetra-ammine copper(II)nitrate).

4.9.3 Storage of Bulk AN

Bulk AN prills can be stored in a number of ways. No matter what the storage method, the AN must be kept dry and free from contamination, and the storage must be vented. The types of storage that have been encountered are discussed below, with some guidelines. The design and construction of any container or structure must meet good engineering practices and all applicable codes and regulations.

As with explosives, threaded fittings and places where AN can be trapped are to be avoided. There have been incidents involving the explosion of AN trapped in places to which a welding torch was applied.

4.9.3.1 Road Trailers, Tankers, Railcars

Road vehicles used to store AN must meet Transport Canada requirements with regard to brakes, lights, etc., and mechanical fitness must be demonstrated (i.e., CMVSS).

If road tankers or trailers are to be temporarily installed (i.e., a tanker or trailer is used for storage, not refilled on site, but replaced by another tanker or trailer), the wheels must be blocked, the king pin must be locked, and jacks should be used.

If road tankers or trailers are used as a permanent installation (i.e., not temporarily installed as above, but refilled on site), the tires must be removed.

Concrete or steel pads must be provided for dollies. At temporary locations, other solutions may be considered.

4.9.3.2 Silos

Mild steel is corroded by nitrate salts. Some silos are made of mild steel with an internal epoxy coating. If this coating is not maintained with further coats, the abrasive AN wears away the coating, exposing the mild steel, which will corrode at a rapid rate. This has resulted in at least one catastrophic failure. Therefore, the integrity of mild steel silos should be verified from time to time.

Stainless steel stands up well to AN.

4.9.3.3 Shipping Containers

There are shipping containers that have been fitted to transport, store and transfer bulk ammonium nitrate. These have a polymer liner bag with reinforcement around the bag.

These containers appear to be an acceptable means of storage for AN, provided they meet transportation requirements.

4.9.3.4 Buildings or Warehouses

Buildings or structures must meet the requirements NFPA Standard 400 (Hazardous Materials Code, 2016 Edition).

4.9.4 Storage of AN in Tote Bags

Storage of large quantities of AN tote bags in remote areas must meet the requirements outlined in sections 4.9.1 and 4.9.2 of this guideline, and Appendix D. If the packages are to be stored in open air, then, in addition to being under laid as described in section 4.9.2, they must be covered by a tarpaulin or other means to keep precipitation away from the packages. The storage areas must be clearly indicated and delineated to prevent any accidental incursions.

Any open-air storage of totes in remote areas will likely be an item of concern.

A storage area layout that has been approved in an Environmental Assessment must be adhered to, or the proponent must obtain alternate arrangement approved by the organization that prepared the EA.

4.9.5 Security

All points of access (e.g., hatches, discharge points) for ammonium nitrate in containers (silos, shipping containers, tankers) must be lockable and locked when unattended. All points of access to buildings or structures in which ammonium nitrate is stored must be lockable and locked when unattended.

Exceptions to this requirement may be possible for bulk AN prill storage located on secure, access controlled mine sites. These are considered to be locked by secure location.

4.10 Ammonium Nitrate Solution

This section deals with the storage of AN solutions used in the manufacture of explosives (e.g., emulsion oxidizer aqueous phase).

This AN solution may be located either inside or outside a structure in which explosives are processed, provided that the storage vessel(s) is constructed and installed according to good engineering practice and dyked as per the requirements in section 4.6, and is located separately from combustibles so that, in case of a fire involving the fuel phase material, the fire does not propagate to the other materials.

4.11 Washing Facilities

A factory that serves as a base for mobile process units must have a wash facility that is capable of decontaminating any mobile process unit that is based there.

Each base factory must have permanent washing facilities in a building to ensure cleanliness and proper decontamination of mobile process units and other explosives equipment. Factory sites with temporary structures may have temporary washing facilities in a temporary structure. The washing facilities must have an impermeable floor/base that allows wash water and residues from washing to be collected and dealt with in an environmentally sound manner. The facilities must be protected from the elements to avoid additional volumes of water from precipitation that might be contaminated and require disposal.

4.11.1 Location

Washing facilities may be separated from or located together with maintenance facilities. Locating washing and maintenance facilities together will reduce flexibility under certain circumstances.

4.11.1.1 Combined Washing/Maintenance Facility

The combined facility must comply with Q-D requirements, taking into account the amount of explosive and the possible exposure of people.

If only a heel is present, Q-D need not be taken into account to other internal to the site buildings and magazines.

The combined facility must be at least 25 m from any explosives storage to reduce the risk of fire propagating to the storage.

Personnel limits must be set at a minimum required to carry out the work.

Personnel not directly involved or not essential to a particular hazardous operation at the site with explosives, such as office clerks, must be located at D7 distances.

4.11.1.2 Separate Washing Facility, ANFO Trucks, Mobile Base

The washing facility must comply with the same location requirements as described above for the combined facility:

For non-water-proofed explosives,

- allow mobile/portable temporary facility to serve as a base factory for ANFO only operation;
- ensure that there is an acceptable catchment area, for example, Instaberm, not tarp on the ground, with collection sump;
- ensure shelter over the catchment area;
- ensure hot water and heater capability; and
- essentially any of the good practices required of a factory with temporary structures.

4.11.1.3 Separate Maintenance Facility

If a contaminated mobile process unit is brought to the facility, it must comply with the Q-D requirements outlined under the combined facility.

If only decontaminated units are to be brought to the maintenance facility, no restrictions apply. The facility may be sited anywhere, including outside commercial garages. Decontamination procedures must ensure that no explosives remain on the vehicle.

4.11.1.4 Washing/Maintenance with Explosives Storage

The storage of bulk explosives under the same roof as maintenance or washing facilities will be considered on a case-by-case basis. This, however, will entail restrictions on the operations. Designs for such arrangements must take into account ignition and spread of fire (a minimum of a one-hour firewall) and the possible consequences of an explosion on the surrounding property.

4.11.1.5 Mechanical ANFO Certificate

For washing/maintenance facilities operating under a certificate for the mechanical blending of ANFO, the explosive Q-D does not apply when no residual explosive is present and when any AN has been removed from the hopper before being brought to the facility.

A facility for washing the mobile process unit must be present on site. There must be a catchment area that either collects the wash water for environmentally acceptable disposal or directs it to an existing water collection pond or basin that is capable of dealing with oily water containing ammonium nitrate. The water treatment or disposal method must be described on F05-01B of the certificate application.

4.11.2 Other

No combustible material or contaminated parts are to be stored in the washing/maintenance facility ex: tire or other flammables. If parts are stored in the washing/maintenance facility, they should be in enclosed cabinets or otherwise protected from debris caused by the high pressure washing activities.

4.12 Washing System

4.12.1 Location

A washing system must be available for use at any time.

See Appendix A for a schematic of the typical electrical requirements of wash systems and their locations.

4.12.1.1 Fuel-Fired Wash System

A fuel-fired wash system, employed as part of a garage/maintenance facility, must be contained in a separate enclosure (room) with, at a minimum a one-hour rated dividing firewall and a one-hour rated ceiling between it and all other facilities. This may be located inside the garage itself or attached to the main garage/maintenance structure.

The storage tank for fuel must be located in accordance with the fuel tank requirements. Systems using gasoline or other low boiling point hydrocarbons (flash point below 100°F or 37°C) must not be used.

Note: Consult the National Building Codes of Canada Appendices A and D, for the appropriate wall/ceiling configuration.

4.12.1.2 Electric Wash System, EEMAC 4X

A wash system using an electric heater that meets EEMAC 4X electrical classification may be located within a garage facility without a wall/ceiling/door structure separating the two.

4.12.1.3 Electric Wash System, Other Than EEMAC 4X

A wash system using an electric heater that is not EEMAC 4X must be located in a separate room. The electrical classification within a separate room must consist of good industrial wiring and enclosures consistent with the Canadian Electrical Code (CEC).

4.12.2 Requirements for the Separate Room

The door to a separate room may open into the washing area but must be rated for a minimum of one hour and have an auto-closure installed. The door sill must be raised a minimum of 5 cm (2 in) across the bottom of the door opening. The wall, at grade level (floor), must be caulked all around when gypsum board is used in the wall construction for a one-hour fire rating. A small opening, the size of a hose only, is permitted through the wall to allow the wash hose(s) to pass through. The electrical classification between rooms must not be compromised. For example, a hose cannot pass through an open door between rooms of different electrical classifications.

Note 1: A separate door entrance from outside of the garage, that is, from outdoors, into the wash facility room is permitted without the auto-closure and 5-cm raised door sill requirement. However, there must not be any direct passage from the separate room to the garage.

Note 2: Caulking is not necessary at grade level when hollow concrete blocks are used for one-hour fire-rated wall construction.

4.12.3 Performance

The washing system must be proven to be effective to clean mobile process units of oil and grease and to decontaminate mobile process units of all explosives under all climatic conditions of operation.

4.12.4 Waste Water and Scrap

Waste water and scrap explosives must be collected and disposed of in a manner approved by the provincial or other responsible environmental authority.

4.13 Lunchroom and Welfare

A lunchroom and washrooms may be provided as required by provincial regulations.

4.13.1 Location

Such facilities may be located next to the operations if used only by the factory personnel or by visitors, such as truck drivers and delivery persons. The number of visitors must conform to the visitor licence limits approved on F05-01D.

The lunchroom for workers at a process building may be located within the building provided it meets the requirements outlined in section 4.12.2 (requirements for a separate room) if it contains electrical fittings not meeting EEMAC 4X and the number of personnel using it are within the licence limits approved on F05-01D.

4.14 Office

Office space may be provided as required. Note that if the office space is part of the process building, it must meet the requirements outlined in section 4.12.2 (requirements for a separate room) if the offices contain electrical fittings not meeting EEMAC 4X.

4.14.1 Location

The office may be located next to the operation if used only by the personnel directly connected with manufacturing. Personnel limits specified in F05-01D apply. Visitors, such as truck drivers and delivery persons, are permitted within the visitor licence limits approved on F05-01D.

If used by personnel not essential to a particular hazardous operation at the site (e.g., accounting, sales personnel), offices must be located at D7 distances.

4.15 Other Storage – Inert Material, Chemicals and Contaminated Parts

Sufficient and proper storage for inert materials, chemicals and contaminated equipment or parts must be provided.

4.15.1 Location

Such areas must be located in a manner that does not increase risk to the explosive operations.

4.15.2 Contaminated Parts

These sections refer to equipment or parts contaminated with explosives or explosives residues.

Contaminated pieces, such as pumps, must be locked away in a suitable location (an explosives magazine is not required for this) until decontaminated. Storage areas may be located either by a garage, by an emulsion tanker, or by another licensed area such as a magazine. Pieces should be as clean as possible before storage. Any explosive picked up must be disposed of in an acceptable manner. The storage container must be made of material that is easy to clean or lined with an impervious lining.

Contaminated material, such as bags or cases, must be set aside in a safe, locked area for prompt disposal.

All contaminated pieces should be marked as being contaminated (including a date) until decontamination.

4.15.2.1 Connecting Hoses

This section refers to hoses that are used to transfer emulsion or water gel explosives.

Normally there should be one hose in regular use. This hose should be blown out after use and closed with end caps to prevent drips.

Hoses not in regular use should be blown out, closed with locked end caps, tagged and dated, and locked away in a suitable location (an explosives magazine is not required for this) until decontaminated.

4.15.3 Waste and Scrap

All waste and scrap materials must be handled according to the principles of good housekeeping. Containers must be labelled to identify contents. Note that TDG regulations apply to transportation of dangerous goods, such as explosive scrap on public roads, and they need to be handled accordingly.

4.16 Laboratory

Base factories should set up small laboratories to conduct quality control of the products being delivered. They may be located at a convenient location.

Proper (hard-wired) electrical connections are required, as applicable, with the receptacle located above the work bench.

If explosives are present, they must be stored in a locked cabinet or in a locked room when not being handled. The building and room containing such explosives must have appropriate warning signs. If refrigerators are used for explosives, they must conform to of EEMAC 4X requirements. (Consult ERD for appropriate modifications.)

An electrical heater must conform to EEMAC 4X standards in the case of a baseboard-type unit that is to be installed above the work bench. If an electrical heater unit with a fan is considered for above the work bench, then the fan motor must meet Totally Enclosed Fan Cooled (TEFC) requirements, that is, with no exposed arcing.

4.17 Clothes Washing/Laundry

Clothes that have been soiled with the constituents of normal bulk explosives such as oil or ammonium nitrate may be washed as any industrial work clothes. If the washer and dryer are located in a garage area, they must be installed 5 cm above grade to meet hazardous electrical requirements.

4.18 Electrical Requirements

A schematic for the electrical classification is given in Appendix A as a guide only. Specific situations should be addressed with ERD.

Typically, for garage/maintenance facilities, the EEMAC 4X classification is appropriate. The

International Standards (IP Protection Classification equivalency) is IP66 (totally protected against dust and strong jets of water).

For process production areas, the Class 2, Zone 2 electrical classification must be adhered to at all times when electrical heaters are installed inside the process area. When ammonium nitrate prills are handled as part of the process, then the lighting must also meet the higher Class 2, Division 2 electrical classification for hazardous locations. When no AN prill handling is involved in the process, then the electrical classification for lighting only may be reduced to the lower EEMAC 4X classification. Typically, where motors are used for pumps and agitators/mixers, these must be the Totally Enclosed Fan Cooled (TEFC) type, with no exposed arcing contacts. The attached electrical enclosure must meet the minimum EEMAC 4X standard for electrical enclosures. Specific situations may warrant area “zone” classifications of a higher electrical class, within an open-concept production area, to meet special situations.

Portable power tools normally used in a garage are generally not classified for EEMAC 4X. They must be stored in a closed cupboard and not brought out until the garage or process units in the garage have been decontaminated. Extension cords should be flexible, heavy duty usage cord for an outdoor wet (or damp or dry) location to compensate for abrasion. Extension lights must meet EEMAC 4X.

Existing facilities built to the EEMAC 4 standard need not upgrade subject to the condition that EEMAC 4 enclosures be painted and well maintained and do not show signs of corrosion. Facilities built to a higher electrical classification need not be changed to EEMAC 4X.

4.18.1 Electrical Room – Motor Control Centre (MCC)

The most acceptable arrangement is for the MCC to have access from the outside, that is, no entry from the manufacturing side, to avoid the risk of a fire originating in the MCC and spreading to the side containing explosives. A one-hour fire rating is required between the room and the explosives areas.

However, it is recognized that some larger sites may require a direct entrance, usually due to operational controls via programmable logic controllers (PLCs) located in the MCC. This arrangement must be comprised of a one-hour rated firewall, a one-hour fire-rated door with auto-closure, and a 5-cm raised curb along the wall, including a 5-cm sill across the door opening.

4.18.2 Power Supply

The primary power supply must be located so that it can be cut off by switches at one or more central points away from the danger area. Overhead power transmission lines and service lines must not pass within 15 m of a building or over a building containing explosives. The switch gear must be located outside the building in a weather-proof enclosure or separate motor control centre (MCC) with entrance from the outside. Power source lead-ins must be located underground at least 15 m from the building with no overhead electrical (i.e., no masts) connections permitted. There must be a main power cut-off switch located on the last electrical pole.

4.18.3 Grounding

All equipment in explosives areas, including equipment with internal combustion engines such as generators, must be grounded as per the *Canadian Electrical Code* (CEC). Grounding through the plug is neither equivalent nor acceptable. Grounding cables must be connected directly to the equipment and to ground bars outside the building. Facilities must have ground fault interruption systems for all receptacles in the garage.

4.18.4 Separate Rooms for Electrical Equipment

When called for, a separate room may be required for other equipment not meeting the EEMAC 4X electrical rating, such as a hot-water heater, deep-water well pump, compressor, or the main electrical panel.

Note 1: The electrical panel may be mounted either inside or outside the garage. When inside (and not within a separate room), it must meet the EEMAC 4X electrical classification. When outside the building, that is, outdoors, it must be enclosed in a weather-tight enclosure. The latter installation, mounted outside the main garage, is preferred.

Note 2: The separate room housing the equipment noted above may also contain a fuel-fired wash system.

The separate designated area is not to be used for any general storage.

Where permitted by ERD, larger facilities incorporating process production area(s), facility heating systems, electrical MCCs, and garage/maintenance facilities all under one roof must have separate designated areas with, at a minimum, a one-hour fire rating between them.

When separate rooms are used with higher and lower electrical classifications, each of the rooms must have a one-hour (minimum) rated firewall, a one-hour (minimum) fire-rated door with auto-closure, and a 5-cm raised curb along the wall, including a 5-cm sill across the door opening.

Note 1: This issue can be avoided by providing only external access to the electrical or MCC area.

Note 2: Consult ERD before proceeding with a detailed proposed design.

4.18.5 Controls

All process controls must have operation and maintenance manuals. Controls should include the following: all wiring should be labelled and referenced to drawings; process controls should be located in EEMAC 4X enclosures with sealed wire entries; junction boxes and push-button stations must not be damaged. All electrical circuits should have breakers or fuses that reset manually. All buttons and switches should be labelled, and all valves should be labelled and easy to access.

4.19 Equipment Powered by Internal Combustion Engine (Generators and Compressors)

Large generators, compressors or other equipment must be at least 15 m from explosives. The fuel to service these must be located a minimum of 25 m from explosives or from an explosives building. Generator/fuel combination must be located a minimum of 25 m from the explosives. Fuel storage must be designed to meet environmental considerations as set out in the *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* and also comply with other local, provincial and territories codes and regulations. Special permission will be required for internal combustion equipment using any fuel except diesel. The equipment must be equipped with fire extinguishers.

Small, portable internal combustion-powered equipment with fuel tanks smaller than 6 L may be located as convenient, but in a manner that does not pose a fire hazard for the explosives or oxidizers. They must be fuelled before use away from explosives or oxidizers. Gasoline or propane powered equipment is not allowed inside an explosives building. Fire extinguishers must be located nearby.

4.20 Hydraulic Systems

Hydraulic lines and fittings should not leak. Lines must be protected with sleeves at sharp edges or where lines pass through openings. Lines should be located so that, in the case of a fluid leak, the leak will not catch fire on any hot surface.

4.21 Pumps

Pumps (make, model and safety devices) used for pumping explosives or AN solutions must be approved by ERD. Companies should abide by the recommendations of the Pumping Guidelines (a copy of the Guidelines may be obtained from ERD). A hazard review and/or testing of the pump explosives combination may be required prior to approving the pump. Each progressive cavity pump must have its own log to record all maintenance and any work done on it, and a log is recommended for other pumps as well. Ref.: *ER2013, Section 68 (8)*

Records may be requested during inspections by ERD prior to the authorization of a process pump and/or vehicle, or prior to the issuing of the licence. Pumps and process units that do not have available up-to-date logs or records must be removed from service until either the required preventive maintenance has been performed or the required records are available.

4.21.1 Progressive Cavity Pump (Fixed and Mobile Locations)

If a progressive cavity (PC) pump is used for pumping explosives, it must have:

- mechanical or lip seals;
- NO packing glands;
- a solid rotor;
- oil-resistant stator and seals;
- drive guard(s); and

- at least two of the following pump safety shutdown systems, engineered to protect against no-flow pumping:
 - pressure trip,
 - flow switch,
 - temperature trip,
 - thermofuse,
 - five minute timer.

Rupture discs are not regarded as a safety shut-down system. A worn pump, when deadheaded, may not generate enough pressure to rupture the disc. Rupture disks are designed to provide protection against initiation caused by adiabatic compression.

Thermofuses are encouraged, but may not protect against dry running.

Other protection against no-flow pumping will be accepted if it has been demonstrated to be effective. If a temperature trip is used, it must be within 5 cm of the end of the rotor. If the PC pump will be operating above 400 psi, protection from initiation caused by adiabatic compression is required.

Pumps used to transfer explosives must have a five-minute timer, as well as two safety devices, since transfer pumps are sometimes operated without direct supervision. Compressed air diaphragm pumps used to transfer explosives which are under direct supervision do not have to have the five minute timer and the two other safety devices.

A testing program must be in place for all the safety shut-down systems. A pump maintenance and testing program log must be available. Pumps for which the safety systems are found not to be functional must be removed from service until corrected. Pumps may not be put into service until safety systems have been tested, and this must be repeated on a regular basis.

Maintenance and/or repairs that require disassembly of progressive cavity pumps used to pump explosives must be carried out by competent technicians.

4.21.2 Other Emulsion or Water Gel Pumps

Pumps other than progressive cavity pumps may require less instrumentation, but should be instrumented in accordance with their potential for self-heating when deadheaded or running dry. The exact nature of the instrumentation must be based on a hazard analysis and/or testing and/or the Guidelines for the Pumping of Water-Based Explosives issued by ERD

4.22 Augers

Augers must have outboard bearings with 25 mm spacing between the end of the auger and the bearing. The 25 mm spacing must be an air gap between the mounting bolts that secure the bearing to the end of the auger. That air gap allows for visual inspection of the integrity of the seal at the end of the auger and also allows AN prills not to be trapped and forced into the bearing and/or the grease of the bearing. For vertical auger arrangement, for the bottom bearing, a fling disc must be installed between the end of the auger and the bearing to ensure that if the seal fails, the AN will not fall into the bearing by gravity alone. The augers should also have reverse flights or paddle sweepers to keep product from the auger seals. Augers should

have stainless steel contact surfaces, sealed shafts to prevent build-up of explosives inside, and drive guard(s), including at the free ends of the bearings. Mild steel augers are not permitted if aluminum is present.

Records may be requested during inspections by ERD prior to the authorization of a process pump and/or vehicle, or prior to the issuing of the licence.

4.23 Heating and Furnaces

For all furnaces and heating unit shall be equipped with a high-temperature limiting control to ensure the heating core and elements do not overheat. If oil or gas is used, a 10-lb dry chemical fire extinguisher must be mounted in the furnace room. A fire extinguisher is recommended in other electrical heating situations.

Oil-fired furnaces or boilers must be installed in separate rooms with a one-hour fire rating. The room must have no direct access from the building or part of the building that contains explosives. If this requirement cannot be met, then the unit must be located in a fire-resistant building located at least 8 m from the dangerous building. Guidelines for fuel storage are provided in section 4.6.1. The building that contains explosives must be protected by a fire damper activated by a fusible link or other safety device to close and seal the duct as near to the furnace as reasonable. The operation and installation of fired units must be covered by an operating procedure (see section 3.2.4).

Electrical heating must comply with the appropriate electrical requirements (see section 4.1.6). Electrical heating can be done in a number of different ways:

- A convection heater mounted horizontally or an electric air heater blower unit, commonly known as a unit heater;
- A heat exchanger outside the building that circulates a hot water/glycol solution into:
 - unit heaters mounted in the building; or
 - in-floor heating.

Any interior unit heaters must be mounted above any possible explosive materials (preferably at ceiling level) and must have mechanical protection and adequate standoff from combustible surfaces.

Before installing any heating system, it is suggested that detailed plans and specifications, along with proof that the proposed installations comply with all appropriate codes, be submitted with the application for review and comment. Proof that the proposed installations comply with all appropriate codes may be requested during inspections by ERD or prior to the issuing of the licence.

4.24 Mobile Process Units (MPUs), Including Units for ANFO Mixing

A separate guideline has been written for mobile process units: "Requirements for Bulk Mobile Process Units", which is available free of charge, electronically.

ERD requires all MPUs to meet all appropriate aspects of the CMVSS and B620 tank requirements regardless of where the unit is used (on public or on private roads, such as mine

sites).

All MPUs are expected to meet TDG standards for construction and placarding, even on closed and gated sites. All new MPUs coming into service must meet TDG large means of containment standards and placarding, even on closed and gated sites (e.g., mines).

Mobile process units must meet the F05-MPU description submitted for them during authorization at all times.

Mobile process unit(s) must be listed on form F05-01B of the factory licence where it is operating.

4.24.1 Loading of Mobile Process Units

4.24.1.1 Reloading of Mobile Process Units

Reloading can only occur based on the requirements of sub-section 94(2) of the *Explosives Regulations, 2013*.

4.24.1.2 Reloading of Mobile Process Units With AN

Provided the Q-D requirements are met, process units may be reloaded with AN close to the client site, but outside the 15-m radius. This must take into consideration the possibility that AN may behave like an explosive.

4.24.1.3 Loading ANFO Process Units at Rail Sidings

Note that this section does not apply to mobile process units handling bulk water-based explosives.

ANFO mobile process units may be brought for loading at rail sidings under the following conditions:

- Site applications must include a map providing the general location and distances to nearest buildings and roads (if within 1 km). The application must reference the designated factory licence or satellite site to which the MPU is attached.
- Only sites approved by the rail carrier may be used, and written permission of the rail carrier must be provided to ERD along with permission of the appropriate local authorities. The conditions prescribed in the Railway Association of Canada Circular No. DG-2 must be followed. A maximum of two rail cars of AN may be present during unloading.
- Only one mobile process unit may be at the site (defined as within 100 m of the rail car being unloaded) at any time. The MPU must contain no explosives. Augers must be cleaned out before loading by running AN through them. Oiling systems must be fitted with check valves to prevent oil leaking into the augers. Gas-powered vehicles and gas-powered motors are not allowed at the transfer site during loading.
- No other activities may take place within 100 m of this site. No other raw materials may be stored at this site. No more than two people may be at the transfer site.

- The AN handling equipment must meet the requirements of these guidelines. Spills of AN or fuels at the transfer site must be cleaned up immediately and properly disposed of.
- An Emergency Response Plan must be developed for the operation.

4.25 Forklifts and Pallet Movers

4.25.1 Electrical Forklifts and Pallet Movers

These must conform to the EE rating when in a process building. ES-rated forklifts may be used with packaged explosives in magazines.

4.25.1.1 Charging

Charging of forklifts is allowed if the area meets Canadian Electrical Code requirements for adequate air exchange, proper engineering standards have been followed to vent excess hydrogen, no other flammables are present, and lights and fans meet Class 1, Zone 1 electrical ratings.

Forklifts have to be charged in a separate room with a one hour fire protection wall. The door, charger and ventilation fan are wired to prevent charging while the door is open. The door of the charging room must be kept close at all time.

4.25.2 Diesel Forklifts

A type DS forklift may be used inside and outside with the added safety features of these Guidelines.

Type D forklifts may only be used outside – never in a process building or in magazines. It must have the additional safety features and be accredited by Underwriters Laboratory of Canada, or Underwriters Laboratory Inc. or Factory Mutual.

4.25.2.1 Fire Extinguishers

Two fire extinguishers of at least 4A 40:B-C rating, one of which is permanently mounted to discharge directly onto the engine, must be provided. A preferable alternative to the latter is an engineered fire extinguisher system.

4.25.2.2 Electricals and Venting

An easily accessible manual battery disconnect switch located within 30 cm of the battery, or as close as possible to isolate the battery, and a non-spill safety vent valve of sufficient size to prevent a pressure increase under fire conditions on the oil tank(s) must be provided.

4.25.2.3 Operations

The forklift or pallet mover must not to be stored in the building or room where explosives are being handled. Refuelling must be done outside the building. If the fuel is exhausted while the

vehicle is in the building, the forklift must be moved manually. When the equipment is used inside, doors must be open to provide ventilation. When used in a process area, forklifts must, in addition, have spark arrestors, and the exhaust must be directed away from the explosive. Type D forklifts may be used only in the outside yard.

4.25.3 Propane Forklifts

Only Liquefied Petroleum-Gas Safety (LPS) power-rated propane forklifts meeting the additional safeguards for the exhaust, fuel and electrical systems, as approved through testing by nationally recognized laboratories, may be used. Propane forklifts must be used outdoors only, and all usage must be approved by the Chief Inspector of Explosives.

Appendix A – Electrical Schematic

GARAGE

CEILING /LIGHTING: EEMAC 4X Assumes no hazardous vapours or dusts.	
MAIN GARAGE AREA: EEMAC 4X – MCC preferred outside garage. – All receptacles EEMAC 4X. – All extension cords and portable electrical equipment, EEMAC 4X – Ground fault required for all receptacles. – Bldg. grounding required.	
– Poly coated flexible armoured cable wiring. – Bury cable last 15 m with main power cut-off switch on last pole.	EEMAC 1 – Separate room for wash systems, compressor, etc. – 1-hr. fire-rated walls/door and ceiling with 5-cm raised door sill.
FLOOR AREA: Up to 5 cm; Class 1, Zone 2 (new system) or Class 1, Division 2 (old system).	
SUMP AREA: Class 1, Zone 1 (new) OR Class 1, Division 1 (old)	

PRODUCTION (PROCESS) AREA

CEILING/LIGHTING/HEATING: Class 2, Div. 2 Assumes dusting on lights a problem, re: temp. of AN dust. Housekeeping important.	
MAIN PROCESS AREA: EEMAC 4X TEFC MOTORS – As above for garages with exception of no MCC panel(s) permitted unless enclosed in 1-hr. fire rated separate room. – Hazardous “Zones” may need to be established. Consult ERD HQ for guidance. – Bury cable last 15 m with disconnect at last pole.	
FLOOR AREA: Up to 5 cm; or Class 1, Zone 2 (new) or Class 1, Division 2 (old).	
SUMP AREA: Class 1, Zone 1 (new) OR Class 1, Division 1 (old)	

Refer to section 4.16 for the electrical requirements for laboratories.

Appendix B – Risk Assessment and Q-D Derogation

Q-D is a very reliable safeguard against the consequences of an unplanned explosion. Allowing operations closer than normal Q-D distances to members of the public increases their risk of injury from an unplanned explosion. One of ERD's primary duties is to protect the public from the hazards of explosives. ERD must, therefore, be extremely careful before sanctioning anything that will increase the risk to the public. Ideally, ERD would like to be convinced that the proposed process with Q-D derogation is safer than the alternatives. An equivalent level of safety must be demonstrated. The following approach, using quantified risk assessment, has been successfully taken for construction jobs close to public roads.

For the closer-than-normal-Q-D process, all the scenarios that could lead to an explosion are identified and quantified, and a conservative value for the explosion frequency is established.

A comparative risk assessment could be carried out between the use of packaged product (that requires no Q-D derogation) and bulk product that, because of quantities, would be inside Q-D distances, and the assessment used to justify the use of a bulk product. With the safety systems in place for bulk product to control the identified hazards, the risk from each method may be similar, which would establish that ERD was not greatly increasing the risk to the public by allowing such a bulk operation.

A value for broadly acceptable risk to the public must be established and agreed upon with ERD in line with published risk data. (A more severe target is then chosen by the company for all jobs where they would apply for Q-D derogation.) When applying for derogation from normal Q-D, the company must be able to demonstrate that the operations will meet these broadly acceptable risk values with a significant safety margin to compensate for the uncertainties in the risk assessment process.

Note: As a guide, derogation for Q-D will not be given when there are schools, hospitals or vulnerable buildings with many occupants within the prescribed distance or when an acceptable level of risk in the industry is not met.

At each site where derogation is applied for, the population exposed to the explosion risk is identified. For road jobs, there are normally good traffic density surveys that will supply data of the traffic by day and by hour. This information is used to prove to ERD that the public risk from operations at the site meet the risk target the company had already agreed upon with ERD. This step of a quantified risk assessment is sometimes called a consequence analysis. ERD then decides the merits of the argument and whether or not to grant the privilege of derogation.

At each step in the process, ERD must be convinced that risk assessment is comprehensive and that values are reasonable. With any quantified assessment, there is uncertainty in the values chosen. The greater the uncertainty, the more conservative the figure must be to compensate.

Where a derogation from normal Q-D rules has been granted, the work will still have to meet all the terms and conditions stated in section 99 of the *Explosives Regulations, 2013* except for distances to the general public. Most risk assessments of the likelihood of mobile process unit explosions identify fire as the main cause and find that there will be a considerable time between the outbreak of fire and possible explosion. The joint emergency response plan should

take this into account and include provisions for quickly stopping road traffic. It is unlikely that there would be time to evacuate houses.

Appendix C – Table of Options

This table is not meant to cover all requirements and does not include any exceptions, but is presented to give a summary of the various options and how they compare.

Requirements	Factory with Wash Bay	Factory with Temporary Structures	Satellite Site	Certificate for Blending of ANFO	Satellite Site for Demonstrations	Permission – Trial
Prerequisite	Competence in explosives	Factory with wash bay, proof of temporary nature		For use within the owner quarry/mine	Factory with wash bay, proof of demonstration	Factory with wash bay
Document Issued	Licence	Licence	Satellite certificate	Certificate for blending of ANFO	Satellite certificate	Letter of permission
Customer Sites		One project, located near site		Not applicable	One project may have multiple customers,	Not applicable
Time Constraints	Annual renewal	Single renewal; 2 years maximum	Monthly; 1 month to base factory expiry period	Annual renewal	2 months maximum	6 months
Environment	EA and Spill Contingency Plan	Possible EA, Spill Contingency Plan	Spill Contingency Plan	Spill Contingency Plan	Spill Contingency Plan	Factory with wash bay must have EA and Spill Contingency Plan

Requirements	Factory with Wash Bay	Factory with Temporary Structures	Satellite Site	Certificate for Blending of ANFO	Satellite Site for Demonstrations	Permission – Trial
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 or raw materials	Blend ANFO at borehole	Bulk delivery as per licence	As per agreement
Explosives	As per licence	As per licence	40,000 kg bulk and packaged as per licence	ANFO PE 1	PE 1	As per agreement
Mobile Process Units (MPU)	As per licence and location list	As per licence and location list	2 MPUs as per location list ANFO MPU	1 MPU	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	100,000 kg	1 unit	1 unit	As per agreement

Requirements	Factory with Wash Bay	Factory with Temporary Structures	Satellite Site	Certificate for Blending of ANFO	Satellite Site for Demonstrations	Permission – Trial
Wash Facilities	Permanent required, heated for winter, sites within 250 km of another factory site with wash bay may 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	New: 60 days; Amendments / renewals: 30 days	30 days	30 days	30 days	30 days	30 days

Appendix D – Storage of Large Quantities of Ammonium Nitrate

When ammonium nitrate is not stored at the required distance from explosives, then ERD considers that half the total weight of the ammonium nitrate is explosive for the purpose of assessing distances to vulnerable locations (Q-D). *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances* gives the distance that AN must be from explosives in order to be considered non-explosive for Q-D assessment purposes. This distance depends on the quantity of explosives and whether there is an effective barricade (defined in the manual based on the quantity of explosives) between the explosives and the AN. The quantity of AN stored at a site is usually less than 100 tonnes; amounts of AN larger than 100 tonnes will be regarded as large quantities and are subject to this Appendix.

There are situations where, particularly in remote locations, a large quantity of AN must be shipped in and stored. The storage of large quantities of AN is not without attendant hazards and risks, especially at remote locations such as mine sites or northern communities where emergency response or evacuation may be complicated by the location and elements.

As mentioned in these guidelines, environmental assessments (EA) are required in order to issue an explosives factory licence. Among other things, an EA looks at Emergency Response Plans and an estimate of the effects of a worst-case scenario such as spill, fire or explosion. The location of a large AN storage facility would certainly be considered during the EA process.

Based upon well-documented catastrophic incidents involving large stockpiles of AN, most recently at Toulouse in France, ERD recommends that AN storage and explosives operations be situated according to the following criteria:

1. The normal explosives plant quantity safety distance requirements, as *CAN/BNQ 2910-510/2015 Explosives – Quantity Distances*, from locations where explosives may be found to the airport, camp, mill, roads, pits, mine operations and AN storage facilities; and
2. Quantity-distance requirements based upon 50 percent of the peak storage capacity of AN quantity and a scale factor of 9.6 (corresponding to a distance between D4 and D5) to calculate the separation distances from the AN storage location to the airport, mill and camp areas.

The 9.6 scale factor was chosen based on the following consideration:

- The type of damage typically found at these distances would limit damage and injuries to people, buildings and the airport;
- The fact that AN does not normally behave as an explosive; and
- The separation distances are calculated using the estimated peak stock levels attained for only a few months during the year during reception of AN on winter roads.

Example: Assuming the net equivalent explosive quantity to be one-half of the total AN of 10 000 000 kg, or 5 000 000 kg, a 1640-m separation affords safety distance protection equivalent to between D4 and D5, or blast over pressure values of between 3.15 psi and 1.35 psi,

respectively, from an explosive event at a 10 000 000-kg AN storage facility.

Note: Safety distance [metres] = scale factor x (net explosive quantity kg).^{1/3}

In addition to the above, ERD recommends the following:

1. Community and/or mine site emergency response and evacuation procedures be developed to ensure that they adequately cover fire and/or explosive events at a bulk AN storage facility;
2. The design of the AN storage and handling facilities and equipment include all reasonable means to prevent and control fire, and that local authorities review and approve the design and construction of the building and its equipment (see references below);
3. If totes are to be used, then limit the amount of AN stored in any one pile or area. For example, subdivide or split the AN tote bag storage into several areas of no more than 200 tonnes, separated by approximately 10 m . Additionally, to further separate the stocks in these 200-tonne piles, use 1- to 1.5-metre aisles between each 50-tonne pile or area.

The following are useful references:

- NFPA Standard 400 (Hazardous Materials Code, 2010 Edition).
- Chapter 1145 of the *Canada Transportation Act: Ammonium Nitrate Storage Facilities Regulations* – Regulations respecting the design, location, construction operation and maintenance of storage facilities for ammonium nitrate and ammonium nitrate mixed fertilizers. [It is available from the Justice Web site (<http://laws.justice.gc.ca/eng/>) in .pdf format].
- *Good Practice Guide: Storage of Solid Technical Grade Ammonium Nitrate* (SAFEX Good Explosives Practice Series, GPG 02 rev01, SAFEX International).