

SAFETY FOCUS



The newsletter of the Mines and Aggregates Safety and Health Association

Threats of Theft and Vandalism Change Explosive Storage Standards

Threats of theft and vandalism were the main reasons Canada's storage standards for explosives were changed. It had become apparent that with an ATV and a few power tools, contents of surface magazines could be easily accessed. Regular reports of vandalism from hunting ammunition were also presenting a problem.

Drawbacks with the standards came to a head in the late-1990s, when the Explosive Regulatory Division (ERD) of Natural Resources Canada noted that the standards had inherent design flaws that could no longer be defended. The ERD began working with the RCMP, and in 2001 developed the standards outlined in *Storage Standards for Industrial Explosives* to create theft-resistant, bullet-proof magazines. Of the ten types of magazines that were approved under the old standards, four of these designs were phased out

Requirements for Magazines Built Before May 1, 2001

Magazine Type	Steps Required
Type 1 (Block Wall)	Construction Updates Required
Type 2 (Stud Frame)	Phased Out
Type 3 (Stud Frame)	Phased Out
Type 4 (Steel)	Construction Updates Required
Type 5 (Modified Trailer/Rail Car)	Phased Out
Type 6 (Bin/Box/Cupboard)	Construction Updates Required
Type 7 (Metal Plate 2 Compartments)	Phased Out
Type 8 (Reinforced Concrete)	Construction Updates Required
Type 9 (Seismic Prospectors, Remote Area Contractors)	Construction Updates Required
Type 10 (Aluminum)	Construction Updates Required

*As per the Natural Resource Canada's Storage Standards for Industrial Explosives; changes were required by May 1, 2006. The standard can be ordered for free by calling Natural Resources Canada, Explosives Regulatory Division: (613) 948-5200

in Ontario in May 2006. The remaining six types, if built before May 1, 2001 required upgrades to walls, doors, door frames or locks by May 1, 2006 (see Figure 1).

Upgrades to doors, door frame and locks were due to a surge in powerful and easily-attainable consumer products; from 1996-2001 sales of ATVs tripled in Canada. "We became aware that

a clamp could be placed on a magazine door, and with a 4x4, it was possible to drive away and yank the door off," says Peter Hanley, Senior Explosives Inspector with the ERD. "Also high-powered, battery-operated hand tools were introduced to the marketplace, which again made it significantly easier to break into a storage magazine." The lock on

the magazine door was identified by ERD as the weakest link on the magazine; high-powered hand-held tools made locks easy to break at a relatively low cost.

The new standards also require that magazine walls are designed to withstand the force of hunting ammunition. "We received numerous reports during hunting season that magazines were being used for target practice. The Explosives sign on the magazine would have a bullet hole in the centre of the 'o' and the 'i' would be dotted," explains Hanley. "The wall design had to be upgraded to prevent a bullet from coming in contact with sensitive explosives like dynamite, which if hit, could detonate everything in the magazine." Explosives signage, directly on the magazine itself, has since been removed.

The construction, design and housekeeping standards set out in *Storage Standards for*

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Controlled Blasting Helps Control Safety Factors

Blasting is at the core of mining, but how much rock gets broken and how it gets broken plays an important role in the future safety of the area. Controlled blasting - easily identified by characteristically smooth walls with uniform lines - is the most stable form of blasting.

Done properly, controlled blasting helps reduce falls of ground; protects equipment and people; allows for easier installation of ground support; increases ventilation flow rates in underground mines; and boosts productivity while lowering mining costs.

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Controlled Blasting Helps Control Safety Factors

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Company standards for controlled blasting take a variety of factors into consideration. However in general, controlled blasting, whether on surface or underground, involves one or a combination of the following: drill holes located along the perimeter of the blast; less explosive used in buffer and perimeter holes, delays in the individual detonation of the blasts and close attention to drilling accuracy.

In most cases, holes drilled along the perimeter contain a smaller amount of explosive. This permits the amount of energy in the blast to dissipate near the edge of the blast. In the underground, the detonation of blast holes starts in the center and works its way towards the edge. This allows the rock from the blast to have an area to fall into as it moves along. On surface the blast can start at the edge and move along a bench, as the rock already has a large open area to move into.

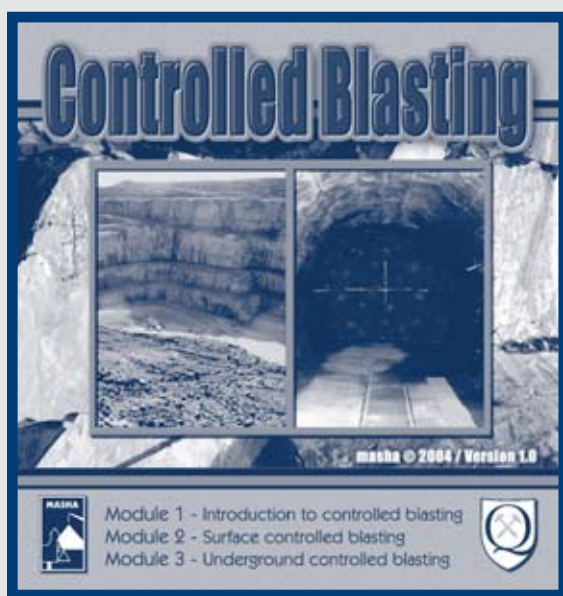
Falls of ground can occur when blasts cause fractures in the surrounding rock or when blasts expand existing fractures. The greater the number of fractures, the greater potential for loose to fall. Controlled blasting techniques aim to reduce the amount of damage to the surrounding rock by containing energy from the blast, in the designated area. This allows the work area to be surrounded by a more stable rock mass to help protect people and equipment working in the area.

On surface, a controlled blast helps maintain the natural strength of the rock and reduces the amount of the fly rock ejected from a blast. The parallel blast holes help create even walls and stable benches in pits and quarries.

In the underground, the smooth walls and backs left behind from the blast make for easier and more effective installation of ground support. Ventilation becomes more effective as the smooth surfaces provide less friction for air circulation.

Mining costs are reduced and productivity is increased as companies can target exactly what rock they wish to fragment. As a result, the mine does not create excessive waste rock that needs to be transported out of the mine and attention to producing appropriately broken ore can be maximized.

For more information:



MASHA's Controlled Blasting interactive CD comes complete with video clips, diagrams and charts, supported by sound narration and text. The CD walks the user through an introduction to the concepts of controlled blasting. Modules on both underground and surface mining go into detail on the methods and practices for controlled blasting.

Developed with Queen's University, the CD is an ideal training tool for workers new to explosives and controlled blasting methods, or a perfect refresher course.

To order visit www.masha.on.ca/products.aspx or call (705) 474-7233 ext. 279. Cost per copy is \$110 for MASHA members, \$330 for non-members, plus shipping and handling.

Transporting Explosives... In Bulk

Underground mines will have to change the way they transport bulk explosives. As of October 1, 2007, a new section regarding bulk explosives vehicles has been added to Regulation 854, Mines and Mining Plants.

Bulk explosives vehicles transport and deliver bulk explosives such as ANFO, water gel and emulsion explosives to the underground (a vehicle transporting stick powder does not qualify). Section 135.0.1 calls for: designated parking spaces, fire suppression systems and regular washing of bulk explosives vehicles.

Designated Parking Spaces

Bulk explosives vehicles, when not in use, now must be parked in a designated parking area. Mine site plans must indicate where these parking spots are located. The parking spaces must be located at least 60 metres (approx. 200 feet) from the following locations:

- Main access into or from a mine
- Any mechanical or electrical installations that are required to remain in service during a mine emergency
- Refuge stations or other areas where miners gather
- Fuel storage areas

A magazine can not be used as a parking area. Exceptions to parking space regulations apply when a mine is in a development or exploration phase. However, great caution should still be taken as to where to park a bulk explosives vehicle.

Power Washing

Build-ups of grease and oils can present fire hazards, something to avoid any day, but especially if transporting bulk explosives. In consultation with the Joint Health and Safety Committee or safety representative (if applicable), a schedule and procedure must be developed to regularly power wash bulk explosives vehicles. Before a vehicle heads to a garage for maintenance, regulations require all explosives and detonators are removed, and that the vehicle is thoroughly power washed to remove any explosive residue, grease or oil from the vehicle.

Fire Suppression Systems

All bulk explosive vehicles must have fire suppression systems.

For more information: See Regulation 854, Mines and Mining Plants; Section 135.0.1. Section 135.0.1 came into effect on October 1, 2007.

About Safety Focus

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Handling, Transportation and Care of Explosives

The emphasis with explosives is usually focused on the process of blasting and setting up a blast. However, the risks of transporting and handling explosives should not be overlooked. Procedures for getting explosives to the blast site and then removing unused explosives must be followed closely to avoid potentially critical incidents.

At a Glance New Regulations Effective Oct. 1, 2007

Regulation 854, Mines and Mining Plants

Section 125(4)(a): The employer shall, in consultation with the joint health and safety committee or the health and safety representative, if any, establish a procedure for; identify the location of explosives that are being kept in explosive storage areas other than magazines.

Section 135(e): When explosives are transported underground by means of a motor vehicle or train, the motor vehicle or train shall display and operate a flashing red light whenever explosives are being transported.

In 2005, the Ministry of Labour received more than 40 reportable incidents regarding workers, and occasionally the general public finding blasting caps, b-line, explosives, and nonel fuses outside of assigned storage areas and magazines. In one incident the explosives found were more than 30 years old. It's often during the transportation, care, and handling of explosives and their accessories that they become inadequately stored, lost or improperly disposed of.

Regulation 854 states requirements that must be followed in order to safely store and move explosives around a mine site. New requirements for storing and transporting explosives were made on October 1, 2007 (see box) explosives.



Transportation

On surface, vehicles that carry explosives must first be in good working condition and free of other work materials - explosives cannot be transported with other goods or materials. The vehicle must then be equipped with visible red signals or flags on the front, back and sides; all metal parts on the vehicle that could come in contact with containers of explosives must be covered with a non-sparking material such as wood or tarps; and a functioning BC Fire Extinguisher must be on board.

Once this is done, explosives can be loaded into the vehicle and secured in a manner that prevents the load from becoming dislodged. Up to 5000 detonators can be stored with the explosives, provided the detonators are in a separate and secure container. Once explosives are loaded in, the vehicle must be attended at all times. En route, the vehicle can only carry the number of people necessary for handling the explosives.

In the underground (as of October 1, 2007), all motor vehicles and trains carrying explosives must have a red flashing light. Explosives inside motor vehicles and train cars must be stored in suitable containers and speeds cannot exceed 10 km/h.

Handling

Before moving explosives, planning must take place to ensure no handling delays occur on route. The most direct and safe route must be taken, without side trips, or any other work tasks involved. In the underground, arrangements must be made to ensure the motor vehicle or train has the right-of-way. Planning and communication should ensure that moving explosives away from the shaft collar, entrances to underground workings, or the shaft station is a top priority.

Explosives that are not used cannot remain unattended in a mine. They must be returned to a proper storage area or magazine. Planning should take into account how to return unused explosives to a safe location. In efforts to reduce unattended explosives, which can end up in garbage bins or muck piles, new regulations require companies have procedures to identify the location of explosives that are stored in and outside of magazines at the worksite.

Care

Once safely stored in a magazine, care must continue to be taken with explosives to ensure the safety of all workers. Magazines must be inspected by a competent person on a weekly basis, and remain clean and dry at all times. Regulations require a first-in, first-out system to ensure that oldest explosives in the magazine are used first. Detonators cannot be stored with explosives, they must be in a separate container at least eight metres from explosives.

Company procedures, established with the Joint Health and Safety Committee, should clearly outline when and how to dispose of defective explosives.



For more information see Regulation 854, Mines and Mining Plants:

Section 127: Control and Inspection of U/G Magazines
Section 128: Operation and Housekeeping of Magazines
Section 131: Transportation on Surface

Section 134: Handling Delays
Section 135: Transportation Underground.



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Industrial Explosives can be inspected at a provincial level, by the Ministry of Labour (MOL) or at a federal level by the ERD. Inspections include looking at construction requirements as well as housekeeping and storage issues. Gerry Allan, Provincial Mining Specialist for the MOL explains: “We generally look at the doors to ensure they are up to standard, as well as cleanliness and ensuring the proper fire breaks and berms are in place. We would also want to see the paperwork, to ensure they have given notice of their magazine to the ERD and explosives are marked and in the proper containers.”

Only authorized welding shops are permitted to construct these specialized magazine doors. ERD inspectors frequently conduct quality assurance audits of these workshops to ensure compliance. When examining magazines at worksites, Hanley looks at a variety of issues: if,

upon approach, warning signs have faded; if brush has grown back from originally being cleared; if the door design is from an authorized shop; if storage capacity of magazines is being exceeded (see Figure 2); as well as security systems, key control and site surveillance to name a few.

Special attention should be paid to Type 6 magazines; which are classified as bin, box or cupboard styles. They generally hold a smaller amount of explosives, which makes them more portable and vulnerable to theft. To pass inspection, Type 6 magazines must weigh 200 kg when empty or be firmly secured to the ground. If a Type 6 magazine experiences a break and enter, it must be removed from the worksite within two months and replaced with a more secured container.

Threats of theft and vandalism can also be avoided by simply not storing explosives on site.

Figure 2: Table of Magazine Capacities

Nominal Outside Dimensions (metres)			Nominal Capacity	
Length	Width	Height	By Weight (kilograms)	By Standard Case (25 kg) or By Detonator Case (max. 1000 per)
A) Magazines Serviced From Outside Only				
1.2	0.9	0.9	250	10
1.2	1.2	1.2	250	10
B) Walk-In Magazines				
1.2	1.2	2.3	500	20
1.5	1.5	2.3	1250	50
1.8	1.8	2.3	2500	100
2.4	2.4	2.3	5000	200
3.7	2.4	2.3	7500	300
4.9	2.4	2.3	10000	400
6.1	2.4	2.3	12500	500
6.1	3.7	2.3	20000	800
7.3	3.7	2.3	25000	1000

Note: For larger magazines, use a factor of 1.2 m² of floor area for each 1000 kg of explosives.

Source: Storage Standards for Industrial Explosives

“We are finding more and more mining operations are avoiding the complications of compliance by not storing explosives at their sites,” says Allan. “Explosive

companies can deliver on an as needed basis, which would cut down the liability and risk for the mining company.”

Keeping the Lights on in Storage Magazines



Storing explosives near electrical currents clearly is not the best match. However, sometimes magazines require electricity for lights or fans, or a heating system, and any magazine located outside is potentially at risk of a lightning strike. Section 129 of Regulation 854 now requires that electrical equipment and wiring follow the same standards as outlined in *Storage Standards for Industrial Explosives* and standards outlined in the Storage Standards for Industrial Explosives (OESC). Section 129 also states that explosive storage areas must be protected against lightning.

Location, location, location

The best way to prevent lightning strikes on storage magazines is to choose a proper location for the magazine. To minimize the risk of lightning strikes, *Storage Standards for Industrial Explosives* states the magazine must be at least 15 metres away from overhead transmission lines. A master emergency cut-off electrical switch and ground rod must be installed on or before the last pole of the transmission line. If electricity is required in the magazine, the transmission line must approach the magazine from underground.



Wiring

Wiring in storage magazines has to match up with standards outlined in *Ontario Electrical Safety Code* (OESC), Division II, Class 2, Hazardous Locations. This classification assumes the explosives storage area will be an area where combustible dusts are not normally in suspension; this is typically true if explosives are packaged and in a ready-to-use format. If companies feel there is a chance that combustible dusts or vapours may be present in their storage magazine, upgrading to Division 1, Class II electrical standards should be considered.

When possible, *Storage Standards for Industrial Explosives* calls for wiring to be located within the wall structure, and switch boxes should be located on the outside of the magazine. The wiring circuit must have a ground fault interrupter. Acceptable permanent wiring can be either: aluminium rigid conduit or plastic-coated flexible armoured cable (TECK 90).

Acceptable Heating Temperatures

The risk with heating a storage magazine is overheating a storage magazine, especially with explosives that are stored in an in-process state. The thermal stability of all products stored in the magazine must be determined when they are in a natural state as well as in the event of a spill, equipment malfunction or physical damage to the wiring system. Once this is determined, the storage magazine can only be heated to 80 per cent of the thermal stability of the most volatile product.

For more information: See the *Ontario Electrical Safety Code*, and Natural Resource Canada, Explosive Regulatory Division’s *Storage Standards for Industrial Explosives*.



If you're going to do it right... use red flags and lights



On surface, a **clearly visible red flag** is required on all vehicles transporting explosives. Vehicles underground now require **a flashing red light**.



This is not only for your safety - it is **THE LAW!**