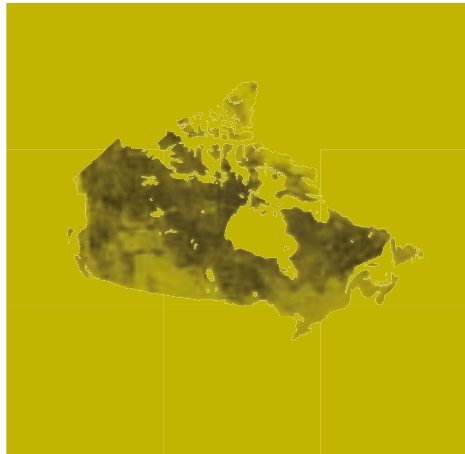
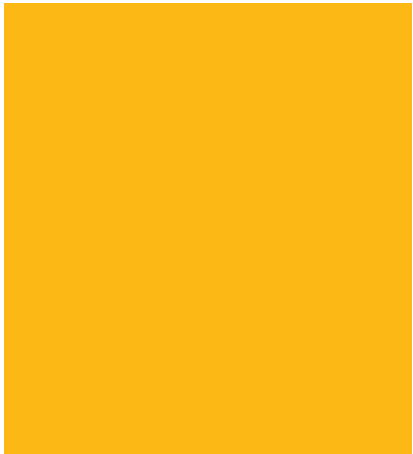




# EXPLOSIVES REGULATORY DIVISION

2002

REPORT TO STAKEHOLDERS



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

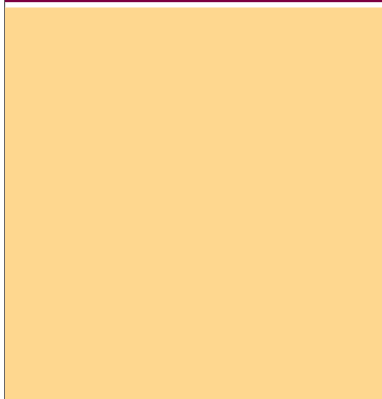




# EXPLOSIVES REGULATORY DIVISION

2002 →

REPORT TO STAKEHOLDERS



**C O N T E N T S**

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Chief Inspector of Explosives    iii

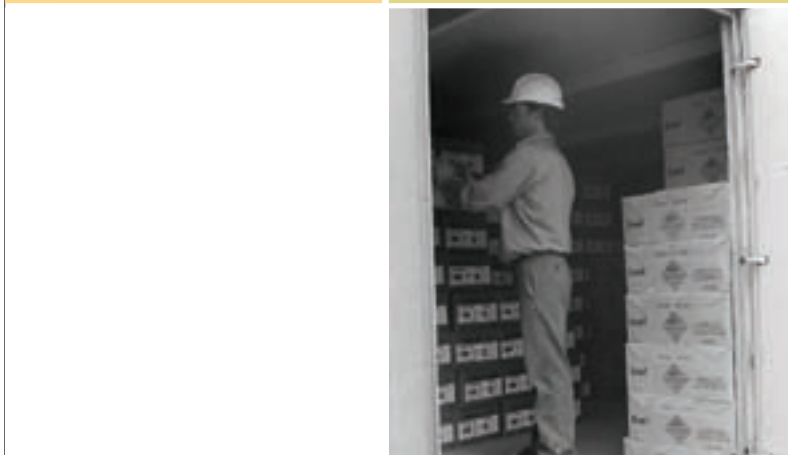
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## Message from the Chief Inspector of Explosives

*I remember as a young chemist at CIL's McMasterville explosives research laboratory reading the EMR Explosives Branch year-end report. I always found it interesting — a glimpse of a larger explosives world beyond the confines of the company for which I worked. It was a disappointment when publication ceased in the late 1980s.*



The Explosives Regulatory Division (ERD) of Natural Resources Canada's CANMET Mineral Technology Branch has been planning for some time to revive the publication, and I am happy to see the first of the new series ready for distribution. Those of you who remember the old report will see some similarities and some changes. This report contains information we hope will be of interest, but the format of future reports will depend on the feedback we get from you, the reader, for in the end this report is for you: to inform, to help, and perhaps to challenge. I am hoping that future editions will contain statistics on explosives production and consumption in Canada, as well as information on events and trends, both national and international.

The past year has been a busy one for ERD, dominated by activities following the September 11th attacks. These have included the new security proposals in Bill C-17, the wide-ranging consultation process with stakeholder groups, and the reorganization and expansion of the Division to enable us to set up and run the new programs. In addition, our plain-language rewrite of the Regulations is almost complete and the radically reorganized set of Regulations will soon be appearing on our web site. Once posted, we invite you to participate in the consultation process and would appreciate your feedback.

To support ERD's expanded functions, we have hired three new inspectors and will be adding more. We also suffered a tragic loss with the death of Leo Saulnier, our most senior inspector. His knowledge and experience are sorely missed, as is his always sharp sense of humour. Leo will long be remembered by his colleagues here and internationally, as well as by many members of the Canadian explosives world.

Christopher Watson, Ph.D.





## 1. The Year in Review



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[www.nrcan.gc.ca/  
mms/explosif](http://www.nrcan.gc.ca/mms/explosif)

## 1. The Year in Review

### 1.1 New ERD Web Site

ERD has re-launched its web site ([www.nrcan.gc.ca/mms/explosif](http://www.nrcan.gc.ca/mms/explosif)). The site's new design and navigational system highlight the Division's major components: licensing and inspection services and education. Easy access to general information, such as ERD contacts and licensing forms, as well as specific information, including course schedules, is now at your fingertips.

New tools and links, such as "Frequently Asked Questions" (FAQs) and "What's New" pages, have also been added to assist stakeholders in obtaining information.

In addition, the site provides a helpful and comprehensive "Related Links" page that connects you to other Canadian and international regulatory bodies as well as to related associations.

To ensure that ERD's web site is working for you, the Division welcomes your comments and announcements of professional conferences/meetings. If you wish to submit such information, please send it to the attention of:

Explosives Regulatory Division  
CANMET Mineral Technology Branch  
Minerals and Metals Sector  
Natural Resources Canada  
1431 Merivale Road  
Ottawa, ON K1A 0G1

Facsimile: (613) 948-5195  
E-mail: [canmet-erd@nrcan.gc.ca](mailto:canmet-erd@nrcan.gc.ca)

or submit the information on-line at [www.nrcan.gc.ca/mms/explosif](http://www.nrcan.gc.ca/mms/explosif).

### 1.2 New Plain-Language Regulations Update

ERD is in the process of finalizing, with the Department of Justice, new plain-language Regulations. These new Regulations are divided into core and industry-specific packages that are not only meaningful and easy to access, navigate and read, but also effectively balance public and worker safety with business concerns for cost and competitiveness.

Sections of the new plain-language Explosives Regulations are ready for public and stakeholder scrutiny. These documents are available for review and remarks by either visiting ERD's web site at [www.nrcan.gc.ca/mms/explosif](http://www.nrcan.gc.ca/mms/explosif) or by contacting Juri Kasemets by e-mail at [jkasemet@nrcan.gc.ca](mailto:jkasemet@nrcan.gc.ca), by telephone at (902) 426-5158, or by fax at (902) 426-7332.



*ERD is taking a leadership role in protecting and securing Canada's explosives supply.*



### 1.3 Amendments to the Explosives Act — Bill C-17

In Canada, Natural Resources Canada administers the *Explosives Act* and its Regulations, which control the manufacture, importation, storage, sale, and some aspects of transportation, as well as the use of fireworks and pyrotechnic devices. Until now, the principal aim of the *Explosives Act* has been public and worker health and safety. Given the new reality that followed the tragic events of September 11th, it was determined that Canada's explosives legislation lacked some essential authorities required to provide an acceptable level of security for Canadians. A risk-based assessment of security needs identified some amendments to the Act that must be implemented to protect Canada's domestic explosives supply against criminal and terrorist interests. Highlights of the proposed amendments, which now appear in Bill C-17, are shown at the right (in green).

By strengthening Canada's explosives legislation, ERD will be taking a leadership role in protecting and securing Canada's explosives supply; without these stronger controls, Canada would appear to be a more attractive place to conduct illicit activities.

Other proposed amendments include the introduction of "continuing offences" (where each day that a contravention of the Act or its regulations takes place a separate charge can be laid) and changing the 12-month limitation period so that the clock begins ticking on the day the Minister becomes aware of the offence as opposed to the day on which the offence was committed (this is particularly relevant to cases of abandonment).

Additionally, a substantial increase in all fines and penalties administered under the *Explosives Act* is being sought to bring them into line with those found in other modern Canadian legislation.

Extensive consultations took place with public stakeholders, federal and provincial/territorial government departments, and the United States to ensure that the above proposed controls have minimal impact on the legitimate and lawful use of explosives while protecting them from unlawful activities.

## Bill C-17

- To control the acquisition and possession of explosives by requiring a background security check before persons can buy and/or handle explosives (a similar system has operated successfully in Quebec for 30 years);
- To introduce export and in-transit permit requirements to complement the current import-permit regime (this amendment will also assist in Canada's eventual ratification of the Organization of American States Inter-American Convention Against the Illicit Manufacturing of and Trafficking in Firearms, Ammunition, Explosives and Other Related Materials [OAS Convention], which Canada signed in November 1997); and
- To track, through a simple, non-obtrusive reporting system, the consumer sale of explosives precursors such as ammonium nitrate.

## Focus on emulsion classification and safety



### 1.4 Ammonium Nitrate Emulsions (ANEs)

Canada, like most other major explosives-producing countries, follows the UN classification scheme for explosives and other dangerous goods. The scheme, as it relates to explosives, was drawn up by a group consisting mainly of European countries with small explosives markets almost entirely using packaged products. The result was a test scheme that works well for traditional products like molecular explosives, dynamite, detonators, black powder and other propellants, but is not capable of properly classifying modern bulk explosives such as ANFO, emulsions and blends.

Take, for example, a typical bulk ammonium nitrate emulsion (70-80 AN, 15-20 water, 5-10 oil/emulsifier, unsensitized), which is widely used in Canada and all other major mining countries. Since it was rarely shipped across national boundaries, no real problems were caused by the UN classification scheme. Eventually these types of products made their way to Europe and problems began. They were classified in various ways (as explosives 1.1D or 1.5D, or as an oxidizer 5.1) by different countries: 1.1D in Belgium; 1.5D in Canada; 1.5D in Sweden (5.1 during transportation); 5.1 in the United States, Australia, and Norway (if in plastic or aluminum tanks); and as non-dangerous goods in the United Kingdom. This problem escalated further when Germany rigorously applied the UN test scheme to this type of product destined for export to Scandinavia and declared it to be a non-dangerous good. This classification discrepancy demanded action, which subsequently produced a UN working group to try to resolve this problem.

The working group came up with a proposed test scheme to differentiate between emulsions classified as explosives (1.5D) and those classified as ANEs (oxidizers, 5.1). This scheme (Test Series 8) contained a thermal stability test, a small-scale heat/confinement test (Koenen test), a gap test, and a larger-scale heating test (Vented Vessel or “Charlie Schulz” test). Unfortunately, this latter test showed that most products could be made to pass or fail depending on the amount of venting — sensitized products were more likely to pass. Today, only the first three tests are being used to classify products and most non-sensitized emulsion matrices could qualify as an ANE.

Opinions are still divided in this area. The United States and Australia regard non-sensitized emulsions as non-explosives and are comfortable with the 5.1 classification. Canada regards these products as 1.5D explosives. While they will pass detonator and gap-sensitivity tests at normal temperatures, in an accident involving a crash followed by fire they could become much more sensitive (heat, aeration) and thus are not suitable for an oxidizer classification. There may be formulations that are truly non-explosive, but the current test series cannot differentiate between them. For example, a recent formulation containing perchlorate and hexamine nitrate passed all four Series 8 tests, but few people are comfortable with classifying it as a non-explosive. The Canadian Explosives Research Laboratory (CERL) is assessing the minimum burning pressure (MBP) test as a means of differentiation — so far the results are encouraging.

Until the issue is resolved, Canada will continue to classify all such products as explosives, requiring all the provisions of the *Explosives Act* and *Transportation of Dangerous Goods Act* to be met.

# Improving Safety

*An international working group was formed to develop a default classification scheme for all fireworks*



## 1.5 New Global Classification for Fireworks

The horrific accident in Enschede, Holland, is an unpleasant reminder of what can go wrong. On May 13, 2000, 21 people were killed and over 800 were injured when a fire in a fireworks warehouse in a residential area spread to the fireworks themselves, ultimately resulting in detonation of the fireworks. The pressure from the explosion was sufficient to flatten half a square mile of the residential neighbourhood, leaving twisted hulks of cars, shells of houses, and hundreds homeless.

After the explosion, investigations determined that while the fire was initiated by an arsonist, the tragedy of the resulting explosion was the result of deliberate mis-labelling of the fireworks by the shipper. This incorrect labelling (1.4G instead of 1.3G) allowed 300 tonnes of the fireworks to be transported and stored under less-restrictive regulations. Thus, when the fire broke out, it spread quickly, was more violent than would have occurred with 1.4G fireworks, and quickly transited to explosions and, ultimately, into two detonations.

Following this disaster, and under the auspices of the UN Committee for the Transportation of Dangerous Goods, a working group was formed to develop a default classification scheme for all fireworks. A number of countries, including Canada, are represented in the working group, with the Dutch taking the lead. Following numerous classification tests, a conservative scheme was proposed, including the classification of small Roman candles as 1.3G. Small Roman candles are usually classified as 1.4G even though they rarely meet the criteria for 1.4G — no flaming projections further than 15 metres. Many countries objected to this cautious classification, stating that small Roman candles do not present the same hazards as a 1.3G classification would suggest. In other areas, however, there was more agreement, such as the classification of all large shells (over 200 millimetres) as 1.1G.

Work will continue over the coming years to reach an agreement. It is important to remember, however, that this is the default classification — a more favourable classification may be obtained by additional testing and appropriate packaging.





## 2. About the Explosives Regulatory Division



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## 2. About The Explosives Regulatory Division

### 2.1 Who We Are and What We Do

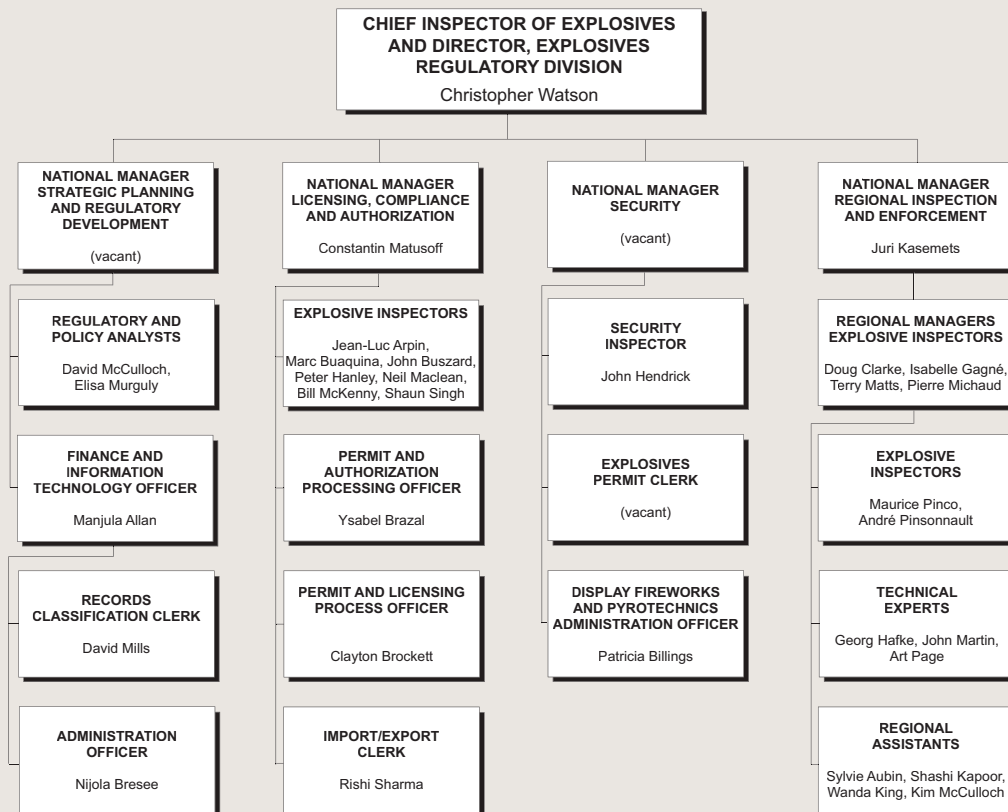
The Explosives Regulatory Division (ERD) is part of the CANMET Mineral Technology Branch within the Minerals and Metals Sector of Natural Resources Canada. The Division's headquarters is located in Ottawa with regional offices in Vancouver, Calgary, Ottawa, Varennes (Quebec), and Halifax.

ERD is responsible for administering Canada's *Explosives Act* and Regulations. With 23 inspectors and 11 support staff, ERD provides services and support to all facets of the explosives industry, including manufacturers, importers, distributors and users of blasting explosives, pyrotechnics (special effects), fireworks (family and display), ammunition, propellant powders, and toy pistol caps, as well as safety-oriented types of explosives (e.g., safety flares, airbag inflators). ERD's principal priority is the safety of the public and all workers involved in the explosives industry throughout Canada.

### 2.2 ERD Structure

ERD has reorganized its structure to enhance its capacity to respond to emerging workload and program-delivery requirements. The functions that ERD has traditionally performed will still be provided. New functions for the Division include an enhanced security focus and the implementation of a Strategic Planning and Regulatory Section. An overview of ERD's new structure is provided below.

#### ERD Program Structure and Organization





## 2.3 Our Participation in National and International Activities

ERD is known worldwide for having excellent regulatory practices. To ensure that its explosives policy development and program design and delivery look ahead of the curve, ERD is involved in a number of initiatives. With the launching of a pilot project called the Global Explosives Regulatory Module (G.E.R.M.), the Division hopes to facilitate secure communications between international regulators regarding new regulatory practices and emerging technologies and trends. This will enable ERD to respond proactively to these new trends and to evaluate and implement innovative regulatory approaches.

ERD is also involved in meetings and ongoing dialogue with key U.S. regulators, such as the U.S. Bureau of Alcohol, Tobacco, Firearms, and Explosives, as well as with other national and international organizations, including Transport Canada and the United Nations, to ensure that new programs strike a proper balance between social and economic interests.

In addition, ERD employees are committed to continuous learning and have attended a number of courses and conferences on new technology and safety concerns so that they continue to provide current and quality technical advice to the public and their stakeholders.



### **Working for Canadians**

Committed to continuous learning, new technology and safety concerns — providing current and quality technical advice to the public and their stakeholders.



## 3. Product Authorization and Our Partnership With CERL



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## 3. Product Authorization and Our Partnership With CERL

### 3.1 Product Authorization and Classification

Any explosive that is to be imported into Canada, or manufactured, transported, possessed or used in Canada, must be authorized (the most up-to-date list is available on ERD's web site) or be covered by a permit, certificate or special authority issued by ERD. A testing protocol has been established for the authorization and classification of Class 1 materials (explosives), which helps to establish the UN classification. Following a review of submitted specifications for a product, this testing protocol may be initiated if further assurances are required or if the product is new in the field. Testing is used to determine the safety of the product and conformity with the manufacturer's specifications. These tests establish criteria for storage, transportation (which is done on behalf of the Transportation of Dangerous Goods Directorate), and general use of the product.

ERD works in partnership with the Canadian Explosives Research Laboratory (CERL), which, in addition to many other activities, provides the technical support for testing of explosives submitted for authorization. In 2002, a total of 3045 new products were classified and authorized for use in Canada.

**Table 1  
Product Authorization Data for 2002, Including  
Number of Applications and Approvals**

Product Authorization	Applications	Products Test Requests	Approved
Blasting explosives and accessories	191	32	120
Propellant, percussion caps, ammunition, and other	150	63	309
Fireworks and pyrotechnic articles	1 462	147	2 128
Perforating charges	183	14	488
<b>Total</b>	<b>1 986</b>	<b>296</b>	<b>3 045</b>

Note: Many applications contain more than one product; therefore, the number of approved products is greater than the number of applications.



Accelerating rate calorimeter used to evaluate the thermal hazards of explosives.

Technologist taking air sample readings inside an interior explosives containment chamber at CERL.



## 3.2 A Word From CERL

The Canadian Explosives Research Laboratory (CERL) within the CANMET Mineral Technology Branch of Natural Resources Canada is the only Canadian government laboratory dealing with commercial explosives and equipment for use in hazardous locations, and one of the few in the world. The lab, with a staff complement of 21 scientists and support personnel, is located in Ottawa.

In addition to explosives testing for ERD, CERL provides services to manufacturers and distributors of various explosive products, including blasting explosives and accessories, ammunition, propellants, fireworks, and industrial pyrotechnic and explosive devices.

With state-of-the-art laboratory facilities and extensive testing capabilities, much of the work at CERL is aimed at protecting Canadians not only by improving the safety of explosives during their manufacture, transportation and use, but also by reducing the harmful effects of explosions. CERL's work is diverse with many different applications, from testing whether equipment can be used safely in explosive atmospheres to reducing the effects of accidental or terrorist blasts.

CERL offers client services in four distinct areas: Explosives Certification, Explosives Applications, Explosives Research, and Hazardous Locations Testing. Each of these areas is described briefly below while more detailed information can be obtained from CERL's web site at [www.nrcan.gc.ca/mms/cerl](http://www.nrcan.gc.ca/mms/cerl).

### 3.2.1 Explosives Certification

With the goal of providing rapid and cost-effective certification services to enable products to be authorized by the Chief Inspector of Explosives, CERL evaluated 296 products in 2002 (Table 2).

CERL provides the full range of testing specified in the UN Recommendations for the Transport of Dangerous Goods and can also test to other national and international standards where needed.

Its facilities include:

- One indoor blast tank, capable of shooting charges of up to 5 kg TNT equivalent;
- Two outdoor blast tanks, capable of shooting charges up to 2 kg;
- Field site for UN Series 6 testing and fireworks testing;
- Access to Department of National Defence bases for large-scale outdoor testing;
- A chemical laboratory with analysis by ion chromatography, atomic absorption spectrometry, and X-ray fluorescence;
- BAM, U.S. Bureau of Explosives and Type 12 impact apparatus;
- BAM friction apparatus;
- A Bichel gauge for explosive fume testing; and
- Electrostatic discharge sensitivity apparatus.



**Phil Lightfoot, Laboratory Manager, CANMET Canadian Explosives Research Laboratory.**

**Table 2  
Distribution of Products Tested  
by CERL, 2002**

Products	No.
Blasting explosives and initiators	32
Ammunition and propellants	9
Fireworks and pyrotechnics	187
Perforating products	14
Miscellaneous	54



**Bursting of a fireworks mortar.**

### 3.2.2 Explosives Applications

CERL's Explosives Application Group assists industry in improving productivity and safety in the manufacture, transport and use of explosives. It also has a strong interest in mitigating blast effects.

Some examples of services offered include:

#### ***Blast Response***

- Testing on barriers that separate detonators from explosives;
- Researching ways of minimizing blast effects on windows and concrete resulting from explosions.

#### ***New Technologies/Applications***

- Assisting clients to develop technologies used in the field of energetic materials, such as filament-wound fireworks mortars, explosive bonding of dissimilar metals, and 1.4S shipping containers.

#### ***Process Safety/HAZOP Assessment***

- Performing Hazard and Operability (HAZOP) studies on various processes from mechanical fireworks launching systems to disposal of energetic materials.

#### ***Accident/Incident Investigation***

- Providing support in accident/incident investigations by assessing the actions leading to an event and/or testing the energetic material involved in an event.

### 3.2.3 Explosives Research

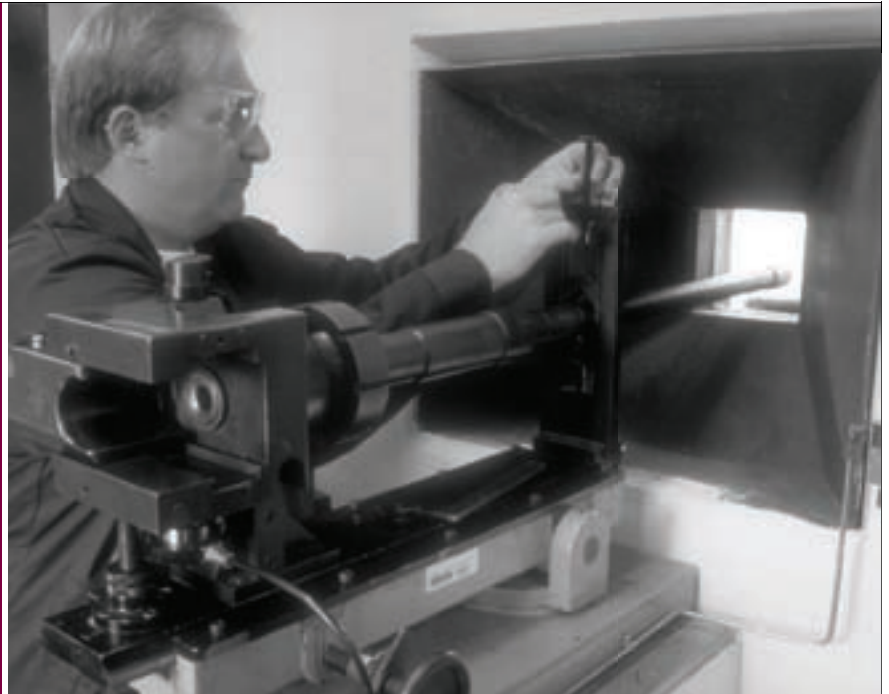
The primary goal of CERL's Explosives Research Group is to conduct research and development to improve the safe use of energetic materials in Canada, including:

- Thermal hazard evaluation;
- Thermal characterization;
- Literature reviews.

Thermal techniques used by this group include:

- Differential scanning calorimetry (DSC);
- Thermogravimetric analysis (TGA);
- Simultaneous thermogravimetric analysis — differential thermal analysis (SDT) with evolved gas analysis by mass spectrometry and Fourier transform infrared (FTIR) spectrometry;
- Accelerating rate calorimetry (ARC);
- Setaram C80 heat flux calorimetry (HFC) with pressure system up to 70 MPa;
- Adiabatic Dewar Calorimetry;
- Minimum Burning Pressure measurements;
- Isothermal nanocalorimetry.

*Providing services to manufacturers and distributors of various explosive products ...*



### 3.2.4 Hazardous Locations

CERL has one of the largest and best-equipped indoor facilities for hazardous locations explosion testing in North America. The lab provides testing and assessment services to clients in two main areas: certification services for underground coal mining equipment, and testing services on a contract basis to a broad range of industrial clients and to other testing and certification organizations.

Examples of services offered include:

#### ***Hazardous Locations Conformity Assessment Services***

- The indoor explosion test room can accommodate coal mining equipment weighing up to several tonnes.
- Work is carried out to many national and international standards and is accepted in support of product approvals by many overseas certification agencies. Twelve products were tested in 2002.

#### ***Certification of Equipment for Use in Underground Coal Mines***

- CERL issues the manufacturer a certificate, recognized nationally, that specifies the equipment assessed, the standard used to assess the equipment, and a schedule of technical details for the equipment. Three pieces of equipment were assessed in 2002.

**Determining the projectile impact sensitivity of explosives.**



**Packing a rock face with explosives.**



## 4. Statistics



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## 4. Statistics

### 4.1 Licensing

ERD provides licensing services to manufacturers, importers, distributors and users of explosives within Canada. These licences, certificates and permits cover a wide range of activities from the operation of complex explosive factory sites to the general public importing family fireworks for Canada Day celebrations. Applications for these various categories are submitted using the guidelines and forms developed for each application type. These forms and guidelines are available in .pdf format from ERD's web site ([www.nrcan.gc.ca/mms/explosif](http://www.nrcan.gc.ca/mms/explosif)) or by contacting one of its regional offices.

#### 4.1.1 New Requirements

Although the nature of explosives manufactured in and imported into Canada is controlled through the authorization process, importation permits and manufacturing licences, the volumes are not known. With the passage of Bill C-17, however, it will be mandatory for all companies to report their annual production of explosives to ERD. In addition, ERD will be collecting and reporting data on the importation, and eventually the exportation, of explosives.

These data will aid in trend monitoring (what industries are doing and where they are going) and what actions ERD must take to ensure that the Division looks ahead of the curve and evolves according to the needs of the industry and the safety requirements of the public. Take, for example, the rapid growth seen in the importation of fireworks. To effectively manage this rising demand for rapid product authorization and subsequent importation permits, ERD's partner, the Canadian Explosives Research Laboratory (CERL), expanded and dramatically improved its testing capabilities (see Section 3) while ERD provided the funding for an extra scientist to assist in product testing and authorization. Another trend is the continuing shift to using bulk explosives over packaged ones. In response to this change, ERD introduced new licence categories for explosives factories and is in the process of revising the *Bulk Explosives Standards*.

#### 4.1.2 Manufacturing

As mentioned above, it will soon be a requirement for all companies to submit their annual production volumes and quantities of explosives for sale. Tables 3 and 4 (see next page) serve as a guide to highlight the type of information that ERD will be collecting beginning in 2003.



**Table 3**  
**Sample Table for Annual Production of Explosives**

Description	Production (tonnes)
Packaged blasting explosives	
NG-based products	
Detonator-sensitive emulsions/watergels	
Booster-sensitive emulsions/watergels/dry blasting agents	
Bulk explosives	
Watergel/emulsions	
ANFO	
Initiator products (detonators, detonating cord)	
Ammunition propellants	
Small arms ammunition	
Fireworks	
Other (rockets, military ammunition)	

**Table 4**  
**Sample Table for Industrial Explosives and Blasting Agents Sold  
for Consumption by Class and Use**

Description	Coal Mining	Quarry and Nonmetal Mining	Metal Mining	Construction
Packaged blasting explosives				
Bulk explosives				
Watergel/emulsions				
ANFO				
Initiator products (detonators, detonating cord)				

### 4.1.3 Importation

With the exception of the explosives listed in Table 5 and those under the direct control of the military, an Importation Permit is required for the importation into Canada of any explosive. Some basic restrictions apply to the importation of explosives, the main one being that the explosive must appear on the *List of Authorized Explosives*, while other restrictions include licensing (for use or sale) and certification (for display fireworks or pyrotechnic) requirements. Special permits can be issued for testing and field trials.



**Consumer (family) fireworks displayed for retail sale.**

**Table 5  
Explosives for Personal Use and Not for Sale That May Be Imported  
Into Canada Without an Explosives Importation Permit**

Explosive Type	Quantity
Safety cartridges	5 000
Percussion caps (primers) for safety cartridges	5 000
Empty primed cartridge cases	5 000
Gunpowder (black powder) in canisters of 500 g or less and smokeless powder in canisters of 4000 g or less	8 kg
Model rocket engines	6
Pyrotechnic distress signals and lifesaving devices	Any quantity necessary for the safe operation of the aircraft, train, vessel or vehicle in which they are transported, or for the safety of the occupants

Table 6 shows the class and quantity of explosives imported into Canada from the world in 2002. The import statistics were classified and published according to the Harmonized Commodity Description and Coding System (Harmonized System or H.S.) as employed by Statistics Canada. The weights are based on estimates produced by Statistics Canada from factors applied to the value of goods; these weights should be used with caution. Additionally, in-transit data (i.e., goods originating in a foreign country but exiting through a Canadian port) are not included in these trade data.

**Table 6  
Canadian Imports of Explosives From Around the World, 2002**

	Total (kg)
<b>PROPELLANT POWDERS</b>	<b>147 851</b>
Propellant powders	92 375
Black powder (gunpowder)	55 476
<b>PREPARED EXPLOSIVES</b>	<b>14 418 976</b>
Prepared explosives, other than propellant powders	9 592 869
Prepared explosives, in cartridges, sticks or form, for blasting	2 107 050
Explosives, based on nitroglycerin, in cartridges, sticks or form, for blasting	2 689 087
Prepared explosives, other than propellant powders based on nitroglycerin	29 970
<b>FIREWORKS, SIGNALLING FLARES</b>	<b>1 536 961</b>
Fireworks	1 118 983 *
Rain rockets, fog signals and other pyrotechnic articles	69 274
Signaling flares	348 704
	<b>(\$ millions)</b>
<b>SAFETY FUSES, DETONATING CORD</b>	<b>36</b>
Detonating caps	15
Igniters and electric detonators	17
Safety fuses and detonating cord	4
Percussion caps	1

\* 713 225 kg imported from China alone.



## 4.2 Inspections and Compliance

To ensure compliance with the safety and security provisions of the *Explosives Act* and its Regulations, as well as the terms and conditions of licences and permits, etc., inspections are carried out throughout Canada by our inspectors and by those appointed as Deputy Inspectors of Explosives (RCMP, OPP, SQ).

When enforcing the *Explosives Act*, all inspectors follow a policy of Education Where Possible — Prosecution When Necessary. In most instances, unsafe conditions or other deficiencies found during an inspection are voluntarily corrected by the offender simply on request. In some cases, however, the inspector must issue a formal stop-work order or, in extreme situations, seize the explosives and prosecute.

### 4.2.1 How Are We Doing?

As expected, trend monitoring has shown that as the number of inspections increase, the rate of compliance also increases. Thus, ERD has continued to maintain a strong presence in the field, which in turn has resulted in greater safety in the explosives industry (see Table 7 as well as “Accidents and Incidents” on next page).

### 4.2.2 How Are You Doing?

As ERD expands its information-gathering network to include such things as the type of infraction seen during an inspection (minor, major, critical), a more complete picture of the relationship between compliance rates and safety and security of explosives will become available. It is envisioned that stakeholders will use this information as a guide to help ensure their own compliance (see “A Pro-Active Approach to Safety and Security? Your Choice!” on p. 24 and Table 10 on p. 27).

**Table 7**  
**Number of Federal Licences Issued and Number of Inspections Completed In 2002**

Category	Licences	Inspections	Percent Inspected
		(no.)	(%)
Factory Licence, Total	106	136	128.30
Mobile Process Unit Authorization	136	22	16.18
Mfr. Cert, Satellite Site	50	12	24.00
Mfr. Cert., ANFO Mech.	16	14	87.50
Mfr. Cert., ANFO Non-Mech.	11	2	18.18
Mfr. Cert., Re-Loading	12	7	58.33
Explosives Vendor Magazine	155	123	79.35
Explosives User, Regular	530	447	84.34
Explosives User, Zone	1 059	170	16.05
Explosives User, Special	50	9	18.00
Explosives User, Other	36	28	77.78
Propellant Magazine	74	39	52.70
Fireworks Vendor	131	112	85.50
Fireworks User	9	–	85.50
Unlicensed Premises	n.a.	90	n.a.
Port Survey	n.a.	1	n.a.
Trucks (Without Permits)	n.a.	14	n.a.
<b>Total</b>	<b>2 044</b>	<b>1 226</b>	<b>59.98</b>

– Nil; n.a. Not applicable.

... greater safety is the result of safer products and ever-improving management and technology.

Aerial view of a truck crash fire and detonation on Highway 17 near Sudbury, Ontario, in 1998.



## 4.3 Accidents and Incidents

Since promulgation of the *Explosives Act* in 1921, the production and importation of explosives have increased dramatically while the number of deaths and injuries has fallen from alarmingly high to encouragingly low numbers.

This greater safety record is the result of safer products and ever-improving management and technology. Enforcement of the law that regulates abandonment of explosives has reduced the number of incidents involving youth and children. Updated principles and constant enforcement of adequate quantity/distance relationships have minimized the risk of injury to persons or damage to property from an accidental explosion. Sufficient training of pyrotechnicians and display fireworks supervisors has allowed this rapidly expanding industry to develop with a minimal number of accidents and incidents while improved storage standards have dramatically reduced the risk of theft and subsequent misuse of explosives.

### 4.3.1 Serious Injuries

During 2002, there were 21 injuries in 17 separate instances involving explosives in Canada. Of these, five were classified as serious. Fortunately, none were fatal. To a large degree, the direct cause of these accidents can be explained and lessons can be learned from them. Please note that while the last three accidents involve the use of explosives for mining, which falls under provincial regulations, they were included here so they can be used as a learning tool.

**Homemade Explosive** — A pre-teen sustained severe damage to his hand, including the loss of three fingers, when the homemade explosive he was fabricating unexpectedly exploded.

**Fireworks** — A man was seriously injured when a box of fireworks he had been carrying accidentally exploded. His garage also incurred extensive damage (blown out concrete blocks, a bulging garage door, etc.).

**Critical Injury** — A blaster specializing in small blasting jobs was critically injured when a 10-kg slab of flyrock struck him in the chest. Although experienced, the victim had failed to take sufficient cover at an adequate distance.

**Blasting** — Two workers were injured (one lost an eye) while loading shallow holes with NG-based product. The individuals were attempting to push a primed stuck cartridge down a bore hole by hammering it with a brass pointer when the product deflagrated or detonated.

**Blasting** — Two workers were injured, one with serious facial injuries, when a missed hole detonated while they were washing down a blast site.

### 4.3.2 Canadian Accidents and Incidents

In addition to data on serious accidents, ERD collects information on accidents and incidents involving explosives in the areas of security, transportation, manufacturing, and fireworks/pyrotechnics. It is important to note, however, that while we make every attempt to obtain data on accidents and incidents, not every incident is reported and therefore the information may not come to the attention of ERD. Additionally, no statistics for the personal use of fireworks are available at this time.

In 2002, six reports of theft were received (Figure 1). In almost half of these cases, the explosives were not properly stored in federally licensed magazines but, rather, in trailers that were not secure. Additionally, only two recoveries directly related to these thefts were reported, which unfortunately leaves a considerable quantity of explosives unrecovered. Figure 1 also shows that there were five attempted break-and-enters — each one was successfully thwarted, in part because of good storage magazine standards. There were also two reported cases of abandonment. This is of particular concern because, almost without exception, misuse of discovered explosives involves children or youth.

Also in 2002, there were 20 accidents or incidents involving the manufacture of explosives resulting in four minor injuries (Figure 2). Although this number seems high, many of the incidents were classified as minor (11) and are probably the result of diligent accident-reporting rather than unsafe manufacturing practices.

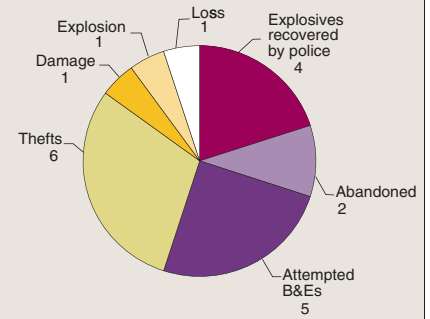
With respect to the transportation of explosives, 2002 was also a very good year with very few reports of incidents and no reports of injuries being received (Figure 3). In all cases (breakdowns, accidents and environmental spills), the proper authorities were contacted and, in all but one case, the proper procedures following the incident to ensure low levels of risk to worker and public safety were taken. Please note that Section 64 of the Explosives Regulations requires that operators or drivers report to the Chief Inspector of Explosives any accident, fire or damage to the vehicle or any other occurrence that causes a significant delay in the delivery of the explosives. Again, this is to ensure that procedures following the incident do not compromise the safety of the workers or the public.

Likewise, the number of accidents and incidents associated with the use of display fireworks and pyrotechnics is encouragingly low. Through the numerous Canada-wide display fireworks and pyrotechnician certification courses offered, which emphasize safety and knowledge of the regulations, ERD and users of display fireworks and pyrotechnic devices continue to show their dedication to maintaining and improving Canada's high level of pyrotechnic and fireworks safety by exercising due diligence and care (Table 8 and Figure 4). The low number of accidents and incidents (13) reported in 2002 highlights this fact (Figure 4). Approximately half of the reported incidents occurred around or on Canada Day.

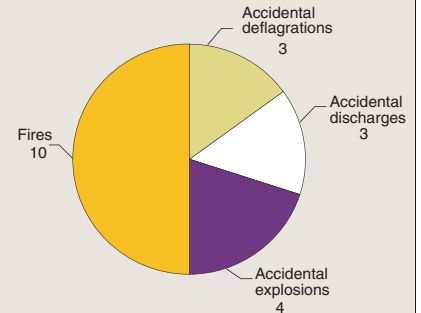
**Table 8**  
Total Number of Certification Courses and Attendees for 2002

Course	Sessions	Attendees
		(no.)
Pyrotechnic special effects	22	771
Display fireworks	25	711
<b>Total</b>	<b>45</b>	<b>1 482</b>

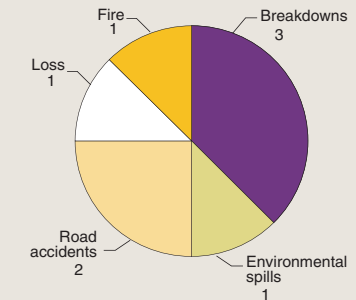
**Figure 1**  
Incidents Related to Explosives Security



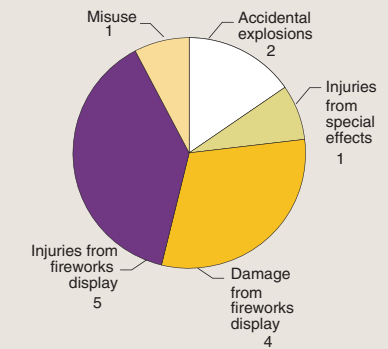
**Figure 2**  
Accidents and Incidents Occurring During the Manufacture of Explosives



**Figure 3**  
Incidents Occurring During the Transportation of Explosives



**Figure 4**  
Accidents and Incidents Occurring During the Use of Fireworks or Pyrotechnic Devices



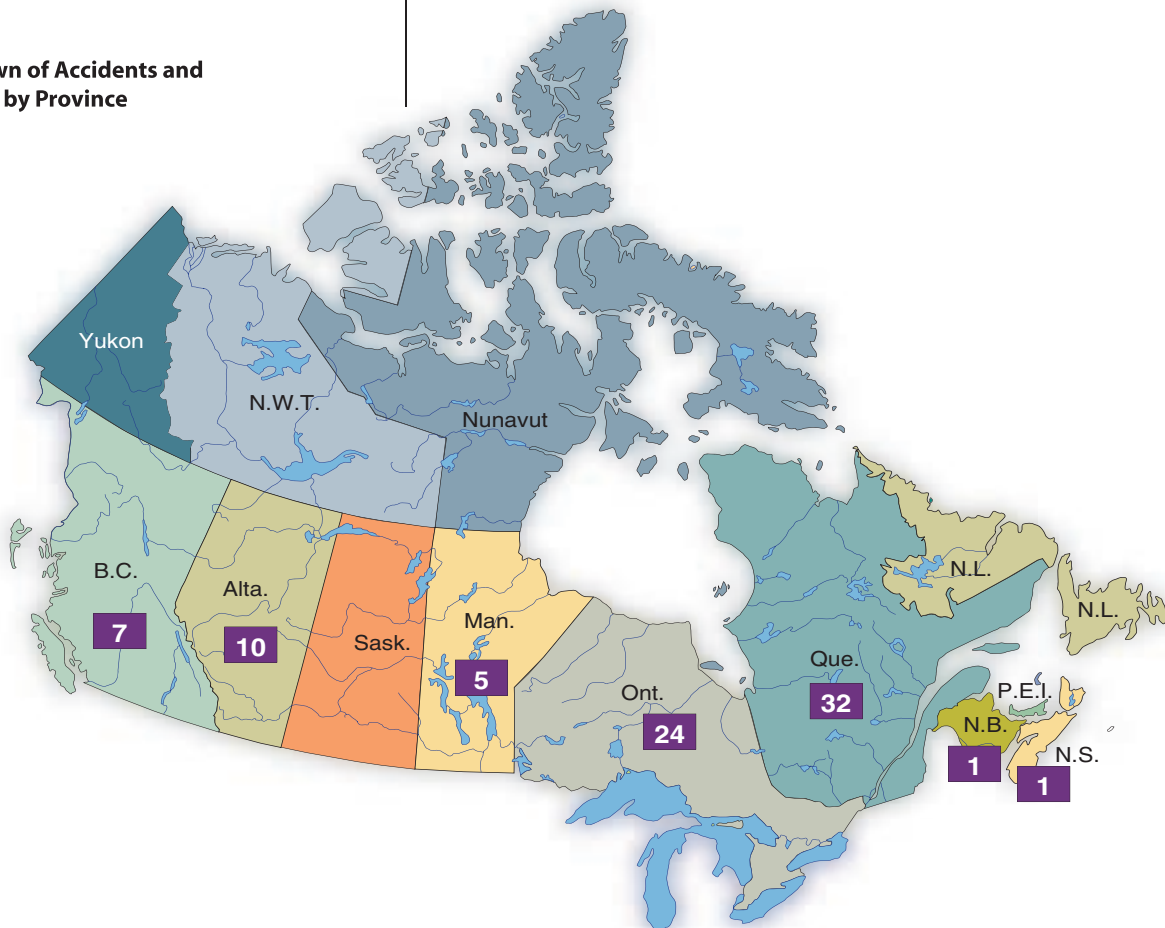
Source: Natural Resources Canada.

*ERD — improving Canada's high level of pyrotechnic and fireworks safety by exercising due diligence and care ...*



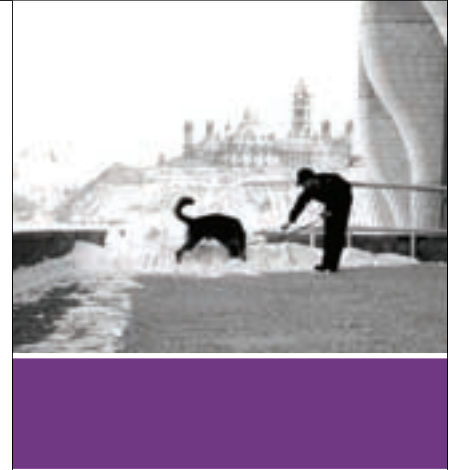
**Figure 5** below shows a breakdown of accidents and incidents reported to ERD by province. Quebec and Ontario, with two thirds of Canada's population and seven eighths of the manufacturing factories, not surprisingly reported the highest number of accidents and incidents.

**Breakdown of Accidents and Incidents by Province**



### 4.3.3 RCMP Bombing Incidents

Although incidents pertaining to bombing fall under the *Criminal Code of Canada*, ERD has always maintained an active interest in this aspect of the illegal use of explosives. This interest is fostered by concern over the security of explosives that, when stolen, abandoned or carelessly lost, often end up in the hands of criminals. The data in Table 9 are extracted from the Bomb Incident Summary 2001, published by the Canadian Bomb Data Centre (CBDC), an agency of the RCMP. Also presented are statistics regarding hoax devices and the recovery of explosives and improvised explosive devices (IED). This summary provides an overview of bombings and related incidents in Canada in 2001. It is not an exhaustive report and not all incidents have been reported to the CBDC.



**Table 9**  
**Bomb Incident Summary, 2001**

	Bombings	Attempted	Accidental	Hoax	Theft	Recov. IED	Recov. Exp.	Total
Alberta	2	–	–	1	2	2	1	8
British Columbia	29	3	1	11	3	31	34	112
Manitoba	–	–	–	1	–	2	1	4
New Brunswick	2	–	2	–	–	–	9	13
Newfoundland and Labrador	–	–	–	–	–	–	–	–
Northwest Territories	–	–	–	–	–	–	–	–
Nova Scotia	–	–	–	3	–	2	–	5
Ontario	5	1	–	13	1	8	5	33
Quebec	2	4	2	16	1	5	8	38
Saskatchewan	–	–	–	–	–	2	2	4
Yukon	1	–	–	–	–	–	–	1
<b>Total</b>	<b>41</b>	<b>8</b>	<b>5</b>	<b>45</b>	<b>7</b>	<b>52</b>	<b>60</b>	<b>218</b>

– Nil.

*Good safety and security practices involve monitoring systems on a constant basis ...*



#### **4.3.4 A Pro-Active Approach to Safety and Security? Your Choice!**

What causes or initiates change? Typically, the impetus for change begins with an incident — new employees, regulations or discoveries that alter our routine and thus, change begins. The extent and degree to which individuals and organizations sense and monitor incidents affect the manner in which they cope — proactive or reactive — with the change.

Take, for example, the driver who leaves explosives unattended and unlocked, but suffers no loss. Or the operator whose pump runs dry while transferring emulsions from one tank to another, but does not cause an explosion. Because there was no harm or damage, these incidents are typically dismissed, but what about the next time when the operator isn't so lucky? This reactionary approach to safety and security may prove to be costly.

But what about the individual who, after monitoring the tragic events of September 11th, adds extra security measures to magazines or the individual who only sells ammonium nitrate to known customers? Proactive individuals and organizations will scan for, monitor and value early warning systems, and try to learn from others' experiences before a crisis occurs. Of course, organizations will encounter surprises, but good safety and security practices result from monitoring systems (inspections, incident reports, near-miss incidents, safety violations, changes in operations or training), anticipating needs, and constantly reviewing, critiquing and changing procedures — not because new regulations require one to do so.

The proactive process looks at regulatory requirements as the foundation on which to build. But many would argue that this approach is costly to the individual or organization — perhaps, but it also results in minimized down time, enhanced public and employee safety and, most importantly, it can break the chain leading to a potentially disastrous event.

So how does one get buy-in to this type of approach? One way might be by explaining the rationale to and obtaining commitment from employees. If employees feel that they have the necessary information and tools to make a difference, they are more likely to be committed to a proactive approach and, in turn, will feel empowered to ensure its success.



## 5. Additional Information



5.1 ERD Contact List

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5.2 CERL Contact List

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## 5. Additional Information

### 5.1 ERD Contact List

**Explosives Regulatory  
Division Headquarters**  
CANMET Mineral Technology Branch  
Minerals and Metals Sector  
Natural Resources Canada  
1431 Merivale Road  
Ottawa, Ontario K1A 0G1  
General Inquiries  
Tel.: (613) 948-5200  
Fax: (613) 948-5195  
E-mail: canmet-erd@nrcan.gc.ca

**Pacific Region  
(British Columbia and Yukon)**  
605 Robson Street, Suite 101  
Vancouver, British Columbia V6B 5J3  
Tel.: (604) 666-0366  
Fax: (604) 666-0399

**Western Region  
(Alberta, Manitoba, Saskatchewan, N.W.T.)**  
755 Lake Bonavista Drive S.E., Unit 214  
Calgary, Alberta T2J 0N3  
Tel.: (403) 292-4766  
Fax: (403) 292-4689

**Ontario Region and National Capital Area**  
1431 Merivale Road  
Ottawa, Ontario K1A 0G1  
Tel.: (613) 948-5202  
Fax: (613) 948-5195

**Quebec Region  
(Quebec, Nunavut, Labrador - immediate  
area around Labrador City and Wabush)**  
1615 Lionel-Boulet Boulevard  
P.O.Box 4800  
Varenes, Quebec J3X 1S6  
Tel.: (450) 652-3999  
Fax: (450) 652-5672

**Atlantic Region  
(Newfoundland and Labrador,  
Nova Scotia, New Brunswick, P.E.I.)**  
1505 Barrington Street, Suite 1505 North  
Halifax, Nova Scotia B3J 3K5  
Tel.: (902) 426-3599  
Fax: (902) 426-7332

### 5.2 CERL Contact List

**Canadian Explosives Research Laboratory**  
Minerals and Metals Sector  
Natural Resources Canada  
555 Booth Street  
Ottawa, Ontario K1A 0G1  
Tel.: (613) 947-7534  
Fax: (613) 995-1230



**Table 10**  
**Blank Sample Magazine Inspection Report**

Inspection Date	Licence No.	File No.						
Location								
Name and Title of Escort					Name and Title of Escort			
Any Particularities of the Site or Conditions Imposed by the Inspector (NEW)								
Magazine Number	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8
Unique Magazine Number (NEW)								
Type of Magazine								
<b>Items in bold caps are further described on the back and can include critical, major and minor characteristics. (NEW)</b>								
Construction vs. Standards "C"								
<b>SECURITY</b>								
<b>HOUSEKEEPING</b>								
Explosives in Approved Packaging "M"								
<b>CONDITION OF STOCK</b>								
Explosive Present vs. Licence Limits "C"								
Quantity Distances "C"								
<b>CONDITION OF THE GROUNDS</b>								
Signs Posted "M"								
Special Instruction Posted "M"								
Licence Available "M"								
Inventory Control "M"								
Records "M"								
Ownership and Identification "M"								
<b>LOCATION (NEW)</b>								
<b>CONDITION OF THE STRUCTURE (NEW)</b>								
<b>ELECTRICALS</b> (where applicable) (NEW)								
<b>OTHER</b> (as applicable) (specify)								
<b>Total of Deficiencies (NEW)</b>	Critical _____		Major _____			Minor _____		
Comments								
Inspector of Explosives	Print Name			Signature				
<b>ACTION</b>								
Written notification that corrections have been completed is to be forwarded no later than _____ Date				Regional Inspector of Explosives			Rating	
<b>ACKNOWLEDGEMENT</b>								
The undersigned acknowledges receipt of this order comprising _____ pages								
Name Print	Signature			Date				

