



## Explosives Branch

### Bulletin # 48

June 2006

#### Display Fireworks Certification Program

##### 1. Recommendation for electrically firing display shells 102-155 mm

###### Preliminary testing completed

We have completed preliminary testing of the colour shells now widely available in the Canadian marketplace.

###### Test findings

- The break charges of some colour display shells can be extremely violent.
- In-mortar explosions can cause serious or life-threatening injuries (the Supervisor and assistants are often close by).

###### Recommendation

The Explosives Regulatory Division (ERD) **highly recommends** that all display shells from **102 mm to 155 mm** be fired ELECTRICALLY.

###### Obligation

It is **mandatory** that all sizes of salute shells and all sizes of display shells **above 155 mm** be fired ELECTRICALLY.

##### 2. Changes in criteria for Level 2 Fireworks Supervisor

###### Requirements

Requirements for upgrading to Fireworks Supervisor (Level 1 to Level 2):

- Certification as Fireworks Supervisor, Level 1.
- Experience as Supervisor in Charge at *three* Level 1 displays in the past *five* years.
- Assistance during the past *three* years at *three* displays in which shells over 155 mm were fired.
- Submit written application to ERD, with *photos* and *proof of experience*.

“Proof of experience”: how it is established

“Proof of experience” must include:

- A list of shows you have assisted in, using shells over 155 mm (include dates, locations, and name of the *Supervisor in Charge* [Fireworks Supervisor, Level 2]).
- A *letter of reference* from the *Supervisor in Charge* (Fireworks Supervisor, Level 2) for one of the *three* displays in which you have assisted.
- Proof that you have worked as *Supervisor in Charge* (Fireworks Supervisor, Level 1) for a minimum of *three* displays in the last *five* years. This proof is established by supplying copies, signed by you as the *Supervisor in Charge*, of completed:
  - Event Approval Application
  - or -
  - Event Permits.

Requests for Upgrade

When sending the application for upgrade, please complete the *Request for Upgrade* form available on ERD’s web site at:

[www.nrcan.gc.ca/mms/explosif/edu/edu\\_displayB\\_e.htm](http://www.nrcan.gc.ca/mms/explosif/edu/edu_displayB_e.htm)

**3. Future changes to the fireworks and pyrotechnics certification program**

With the introduction, in late 2006, of the Plain Language Regulations and the regulations on explosives fees, there will be changes in the Fireworks and Pyrotechnics certification program. All certificate holders will receive the information regarding the changes in their next renewal reminders.

**4. Revised display site distances**

Two-year review undertaken to make spectators safer

Since September 2003, we at ERD have been reviewing current display fireworks practices, including site configurations and distances between fireworks and the public. Thousands of displays are held across Canada every year, the majority on Canada Day. Making these displays safer for spectators has been the overriding purpose of our review.

Adjustments to present distance requirements found necessary

From observations by ERD representatives, the fireworks industry, and the public, we have determined that the present site-distance requirements (100 metres to the audience, 200 metres fall-out downrange) are not sufficient to protect spectators. Audiences were found to be vulnerable not only to falling debris, but also to dud or live shells, which, under certain conditions, could land among spectators or potentially function above them.

### Testing for wind conditions

Two significant variables had previously been left out in determining safe distances: wind speed and wind direction. It is essential to correct this omission. An aerial shell fired into a 40 km/hr wind does not behave anything like one fired into a wind of only 5 km/hr.

### New tables: designed to make the necessary adjustments quick and easy for all

In light of the information produced by our review, we developed the new distance tables that follow. They take into account wind speed and direction, mechanical shell drift (Magnus effect), and mortar angle. The new tables are designed to provide the Display Supervisor with the maximum number of options. The tables are based on two configurations: the conventional, Canadian oblong site; and a new circular layout to be used with vertically fired mortars. Note that the new tables contain minimum site distances for *all* sizes of shells (i.e., there is no longer a single table for 155-mm aerial shells and under).

We do not expect that the increased display site distances and attention to wind velocity (if under 40 km/hr, and in the unlikely situation that there are spectators downrange) will present any difficulties to the industry. Everyone will be operating on a level playing field.

### Flying saucers and nautical shells

The minimum safety distance to the spectators will be **200 metres** for flying saucers.

The minimum safety distance to the spectators for nautical shells will be the **manufacturer's specification plus 50 metres**. Also, whenever the nautical shells are fired in the direction of spectators and/or within 200 metres of the shore line, a test must be performed prior to the display for each type used.

### **Contact**

For further details regarding the display fireworks certification program, please contact:

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Chris Watson, Ph.D.

Chief Inspector of Explosives

TABLE 1

<p align="center"><b>Oblong Site With Maximum 15° Angled Mortars</b></p> <p align="center">- OR -</p> <p align="center"><b>Circular Site With Vertical Mortars</b></p>						
<p align="center">Includes Any Projection-Type Article Such As:  <i>Aerial Shells, Roman Candles (Bombettes) &amp; Bombardo Boards</i>  <b>Winds to 40 km/hr</b></p>						
<p align="center"><b>Size (mm)</b></p>	<p align="center">OBLONG SITE                      15° Angled Mortars &amp; Articles</p> <p align="center">* See Table 2 for Adjustments for Wind                      Speed and Direction</p>			<p align="center">- OR -</p>	<p align="center">CIRCULAR SITE                      Vertical Mortars &amp; Articles</p> <p align="center">* See Table 3 for Adjustments                      for Wind Speed</p>	
	<p align="center"><b>Spectator                      Distance (m)</b></p>	<p align="center"><b>Fall-Out                      Zone (m)</b></p>	<p align="center"><b>Total (m)</b></p>		<p align="center"><b>Radius to                      Spectators (m)</b></p>	<p align="center"><b>Total (m)</b></p>
Up to 30	45	35	80		50	100
to 50	65	60	125		75	150
to 60	70	80	150		90	180
to 80	75	95	165		95	190
to 102	80	130	210		115	230
to 127	100	165	265		145	290
to 155	125	200	325		175	350
to 180	145	230	375		205	410
to 205	165	260	425		230	460
to 255	205	330	535		290	580
to 305	250	400	650		350	700

TABLE 2

<p style="text-align: center;">There are Spectators Downrange  <b>Adjustments For Wind Speed and Direction</b>  <b>Oblong Sites</b>                      15° Angled Mortars &amp; Articles</p>			
<p style="text-align: center;">All Shell Sizes                      Includes Any Projection-Type Article Such As:  <i>Aerial Shells, Roman Candles (Bombettes) &amp; Bombardo Boards</i></p>			
<p style="text-align: center;"><b>Conditions</b>                      (both must be present)</p>	<p style="text-align: center;"><b>Adjustment Options</b>                      (choose one)</p>		
	<p style="text-align: center;"><b>Increase Fall-Out                      Distance Downrange</b></p>	<p style="text-align: center;"><b>Decrease Mortar                      Angle</b></p>	<p style="text-align: center;"><b>Decrease Shell Size</b></p>
<p><u>Wind speed:</u>                      16 to 25 km/hr (occurs at 24% of displays); and  <u>Wind direction:</u>                      Towards the rear of the firing line, 4 to 8 o'clock</p>	<p style="text-align: center;">By 30 metres</p>	<p style="text-align: center;">5 to 10 degrees</p>	<p>Down one shell size (eliminate the 155-mm shells and fire a max. size of 127 mm).</p>
<p><u>Wind speed:</u>                      26 to 35 km/hr (occurs at 7% of displays); and  <u>Wind direction:</u>                      Towards the rear of the firing line, 4 to 8 o'clock</p>	<p style="text-align: center;">By 65 metres</p>	<p style="text-align: center;">0 to 5 degrees</p>	<p>Down two shells sizes (eliminate the 155 and 127-mm shells and fire a max. size of 102 mm).</p>
<p><u>Wind speed:</u>                      36 to 40 km/hr (occurs at 1% of displays); and  <u>Wind direction:</u>                      Towards the rear or either side of the firing line, 4 to 8 o'clock</p>	<p style="text-align: center;">By 80 metres</p>	<p style="text-align: center;">0 to 5 degrees</p>	<p>Down three shell sizes (eliminate 155, 127, 102-mm shells and fire a max. size of 76 mm).</p>

TABLE 3

<b>Adjustments For Wind Speed</b> <b>Circular Sites</b> <b>Vertical Mortars &amp; Articles</b>	
All Shell Sizes Includes Any Projection-Type Article Such As: <i>Aerial Shells, Roman Candles (Bombettes) &amp; Bombardo Boards</i>	
Wind Condition	Adjustments
<u>Wind Speed:</u> 21 to 30 km/hr (occurs at 10% of displays)	<u>Recommendation:</u> Angle mortars windward by up to 10°. This will further decrease the likelihood of dangerous debris falling into the audience.
<u>Wind Speed:</u> 31 to 40 km/hr (occurs at 3% of displays)	Angle mortars 10° to 15° into the wind. - OR - Reduce maximum shell size. At a typical display, eliminate the 155-mm shells and fire a maximum size of 127 mm.  <u>Recommendation:</u> Angle mortars windward by up to 10°.
<i>Note:</i> It is assumed that at circular sites spectators may be found at any point on the circumference.	

TABLE 4

<b>Emission-Type Articles</b> <b>Vertical Orientation - see Notes</b> <b>Winds to 30 km/hr</b>	
Includes Emission-Type Articles Such As: <i>Roman Candles (Mines &amp; Comets), Mines, Fountains, Set Pieces &amp; Wheels</i>	
<b>Type &amp; Maximum Elevation of Effects</b>	<b>Distance (Radius)</b>
Ground - Level 0 to 15 metres	30 metres
Low - Level 16 to 40 metres	40 metres
High - Level Greater than 40 metres	1 metre per metre of elevation
<p><i>Note 1:</i> If articles are angled towards spectators, multiply the required distance by a factor of 1.5 (50% increase). The effects should never function over the audience.</p> <p><i>Note 2:</i> For winds between 31 and 40 km/hr, multiply the required distance indicated above (including adjusted distances from Note 1, if applicable) by a factor of 1.5 (50% increase).</p>	

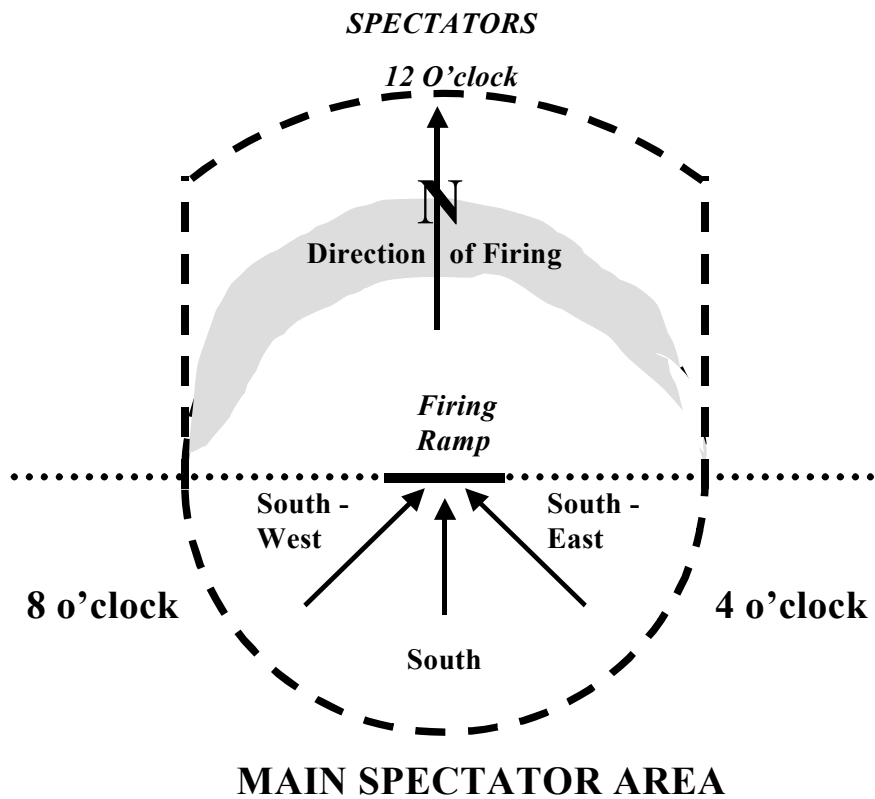
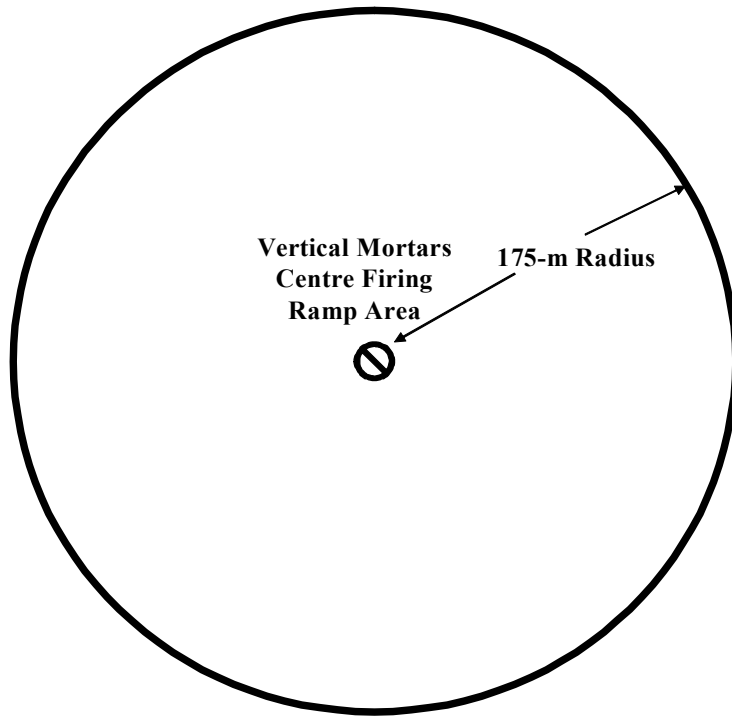


Figure 1. OBLONG SITE  
Mortars Maximum Angled 15°





**Figure 2. CIRCULAR SITE  
Vertical Mortars**