



NorthStar Fireworks Entertainment inc.

Safety Guidelines, 2015

These Guidelines apply to the handling, temporary storage, and discharge of all legal fireworks and pyrotechnic or explosive devices during any official North Star fireworks display. These Guidelines apply, without exception, to anyone on-site for the entire duration of a North Star fireworks display.

For further information on safely handling a fireworks display in Canada, please refer to the latest edition of *Display Fireworks Manual*, published by Natural Resources Canada.

1. Lead Supervisor In Charge

1. The need for safe conduct before, during, and after the discharge of fireworks cannot be over-emphasised. In order to ensure that the fundamental requirements for safe conduct during the handling and discharge of fireworks are being observed, the Lead Supervisor In Charge (“LSC”) shall have complete authority over all safety concerns. The LSC may, at their discretion, appoint other members of the crew as safety officers for the duration of the show, especially those crew members having first response training.
2. The LSC MUST be present before, during, and after the discharge of all fireworks. This includes being on-site before any equipment is set-up for a site inspection, and until the last equipment is put away upon completion of the show.
3. If LSC is unable to attend their show, it is their responsibility to contact Jeff Clarmo (705-446-8590) or Geoff Worthington (519-731-2660) as soon as possible so that a new LSC may be appointed.
4. The discharge of fireworks shall not begin until the LSC has surveyed the overall situation and is satisfied that it is safe to proceed. Whenever adverse conditions arise that significantly affect safety, such as crowd control or weather, the LSC shall halt or postpone any or all pyrotechnic activities as they deem necessary. The resumption of those activities shall only take place upon approval of LSC.
5. At all important crowd control points, security shall be provided by members of the North Star crew, local law enforcement personnel, the client, or security personnel as contracted by North Star Fireworks Entertainment Inc.
6. The LSC or their designate shall investigate any instances of unsafe behaviour or conditions, whether observed directly or reported by others, and take appropriate action.
7. In the event of an accidental fire, explosion and/or similar emergency, the LSC shall coordinate the appropriate response. If the incident is able to be contained without the aid of emergency services, crew members may assist as long as they are able to and comfortable doing so. If necessary, the LSC shall contact emergency services to allow them to render emergency medical and fire suppression services. If emergency services response is required, all North Star crew members shall vacate the area and not return until the authority having any jurisdiction in this matter deems it safe to do so. Priority shall always be given to saving life and minimising hazardous risks to which the responding personnel are exposed.

2. General Requirements

1. All persons working on a North Star fireworks display must hold a valid display fireworks licence, issued by the Explosives Regulatory Division (“ERD”) of Natural Resources Canada. Absolutely NO exceptions shall be granted.
2. All North Star employees, prior to working on a North Star display, must complete the Ontario Ministry of Labour’s Health and Safety Awareness training module, and submit their “Proof of Completion” certificate to Geoff Worthington (geoff@northstar-fireworks.com).
3. No person who is acting in an irresponsible manner or appears to be under the influence of alcohol or other drugs shall be allowed to be present on a North Star show site. The LSC has the authority to halt all work, including postponing the show, until such persons leave the site. If such persons refuse to leave the site or become belligerent, the LSC, or those designated by the LSC, has the authority to prevent them from accessing any explosive devices on-site until such time as law enforcement or other security personnel can be contacted.
4. Only authorised people are allowed on a North Star display site. These people are limited to: North Star employees; the local Authority Having Jurisdiction (“AHJ”); ERD personnel; security monitors; and sponsors, clients and media if they are escorted by a North Star employee who has a valid Display Supervisor licence. Non-North Star employees holding a valid Display Fireworks licence may visit the site at the discretion of the LSC. Unlicensed members of the public (eg: friends and family) are allowed to visit the site briefly at the discretion of the LSC. A maximum of 3 visitors may visit the site at any one time.
5. Smoking or open flames, other than devices used to ignite fireworks, shall not be permitted within 10 metres downwind of any firing areas. Smoking may be allowed in areas specifically designated as such.
6. Only electric lights or non-sparking means of illumination (eg: “glow sticks”) may be used on-site. Ignition sources (flares, torches etc.) may be used for illumination only as they are being used to fire a hand-fired show.
7. A first aid kit AND means of contacting first responders (mobile telephone) shall be present at all times in areas where fireworks are present.
8. A portable water supply and/or fire extinguishers shall be available at firing sites, to be used for extinguishing fires, flooding mortars, etc.
9. All mortars shall be cleaned, and all debris removed, prior to loading.
10. After delivery to the firing sites, fireworks shall not be left unattended and shall not be allowed to become wet.

11. All items not directly related to firing a show (or related safety equipment) shall be removed from the firing areas prior to the start of the show.
12. All shells, cakes and other effects fired at a North Star show MUST be approved by the ERD (that is, legal for sale in Canada). Absolutely NO exceptions.
13. Only mortars constructed from the following materials may be used at a North Star show: Fibre-Reinforced Epoxy (“FRE”); High-Density Polyethylene (“HDPE”); schedule 40 steel; or specially-rolled cardboard for the sole purpose of pyrotechnics. Under NO circumstances shall ABS or PVC be used as mortar material due to the risk of shattering and shrapnel.
14. All mortars used shall be racked appropriately OR loose pipe must be buried 2/3 of their length in sand free of stones or other hazardous debris. Mortars less than 155 mm (6”) must be separated by at least 30 cm from any other effect, and the outside walls of the sandbox or drum. For mortars *larger than* 155 mm, the distance between them and any other effect increases to 1 metre.
15. Shells shall be of overall firm and adequate construction.
16. Finished outside dimensions of shells shall fit properly into the appropriate-sized mortar.
17. Leaders on shells to be hand fired shall have at least 15 cm (6") or more protruding from the mortar after the shell has been properly loaded. Leaders shall have a safety cap installed over the end of the leader, and at least 7.5 cm (3”) of bare match available for igniting the shell to allow sufficient time for the pyrotechnician to retreat to a safe position.
18. Additional lift charge shall not be added to the mortars prior to discharge of the shell or device
19. Dry grass or combustible materials located in the firing area shall be wet down or removed, if possible, prior to the display if they are a potential fire hazard.
20. Poles and other braces used for set-pieces, waterfalls etc. shall be firmly placed, guyed or otherwise secured to prevent accidental displacement prior to or during the functioning of the effect. If guy wires and/or stakes are used to support them, they shall be marked with coloured tape or ribbons.
21. All North Star employees are strongly encouraged to wear appropriate Personal Protective Equipment (“PPE”) (eyes, ear, and head coverings) during the firing of the show. Ultimately, it is the employee’s choice to forgo PPE; however, North Star will not be held liable for any injuries resulting from refusal to wear PPE. It is at the discretion of the LSC if they want to make PPE mandatory for their crew; in such cases, any employee refusing to use it shall be asked to leave the site during the show

22. At the shooting sites, crew members shall closely observe the firing in order to detect and maintain an accurate count and location of misfires and duds, if possible.
23. After the completion of shooting for the night, all firing areas and fallout areas shall be inspected in order to locate and retrieve hazardous materials.
24. After securing the grounds for the night, the LSC and/or designated crew members shall again inspect the firing areas and fallout areas early the following morning for any remaining materials.
25. All duds and hazardous materials shall be turned over to the LSC or their designate.
26. No shells over 6 inches in diameter shall be hand fired.
27. Every shell to be fired must have its own mortar. Absolutely NO reloading unless authorised by the LSC, and only if there are enough crew members to ensure that each mortar is free of debris prior to reloading.
28. If there are extra shells once the show has been loaded, they shall be stored inside their transportation boxes in a crew vehicle.
29. All crew vehicles must be parked AT LEAST 30 metres from the display before the start of the show, and must not be moved closer until the LSC or their designate has cleared the display after firing.
30. Qualified personnel shall have the right to inspect any and all pyrotechnic material brought onto a North Star site. Defective material, bad leaders, under-lifted shells and any items not consistent with ERD guidelines shall be disallowed.
31. Absolutely no unlicensed people allowed in the fallout zone (other than first responders, ERD personnel and AHJs) from 30 minutes prior to the show starting, and until the mortars are cleared.
32. ONLY the LSC or their designate shall handle all misfires, provided that the fuse is still completely intact. Otherwise, the shell shall be considered a "hangfire" and be doused with water and left to soak for at least 30 minutes.

3. The Display Site

1. Supervision

- (a) For each event in the public display area, a qualified LSC or their designate shall always be present while work is in progress.
- (b) If the show is completely loaded and ready to fire with significant time before firing, crew members (including the LSC) may temporarily leave the site so long as it is properly secured and overseen by at least one crew

member holding a Supervisor-level licence, or as many members as the size of the site requires.

- (c) All persons working on a North Star display MUST be licensed and approved by North Star Fireworks Entertainment inc. NO exceptions.

2. Controlled Access

- (a) In the interest of safety, access to the public display areas shall be controlled. Only those persons authorised in section 2.4 shall be permitted to visit the display site. However, provisions may be made for escorted or supervised tours upon request, as coordinated/permitted by the LSC, so long as they do not interfere with or delay the set-up of the display.

3. Spectator protection

- (a) The minimum distances to spectators and structures stated in the latest version of the *Display Fireworks Manual* (Natural Resources Canada) shall apply for all events in the display area. See **Appendix 2** for a quick reference.
- (b) All pyrotechnic items shall be vertical or directed away from the spectators. Angling or fanning of racks or mortars or other devices to create a performance effect may be permitted as determined by LSC. All reasonable care shall be taken to prevent items from inadvertently entering the spectator areas.

4. Precautions Against Fire

- (a) Adequate fire extinguishers shall be available in the display area during the setup and firing of any pyrotechnic items.
- (b) Smoking or open flames shall not be permitted closer than 10 metres from any pyrotechnic items and then only in designated smoking areas.

5. Firing

- (a) Provisions shall be made for a secure and safe position for those who must be present to fire the display.
- (b) All persons in the public display discharge area are strongly advised to wear eye, hearing and head protection.
- (c) In case of an emergency or accident, provisions shall have been made in advance for a signal or radio call to the personnel firing the show or that will result in immediate cessation of all firing. Personnel firing a display must be as vigilant as possible during the show with regards to any dangerous situations which might arise. Those personnel not actively engaged in firing the show will watch for fallout, debris, any outbreaks of fires, duds (shells

whose lift charges ignite, but do not break) and other situations requiring immediate attention.

6. Incidents

- (a) While all attempts shall be made to complete the show without interruption once it has begun, crew and spectator safety is of utmost importance. As such, postponing a show or calling a cease-fire during a show are acceptable approaches where safety has been compromised. In the event of show interruption, the LSC must immediately contact first responders if necessary, then the organiser/client to keep them apprised of the situation.
- (b) In the event of a fire, explosion, or other catastrophic event, all North Star employees shall establish a perimeter. Until an evaluation of the site is made by the LSC, the AHJ and/or first responders, no persons shall enter the site.

4. Mortars

1. Size definition

- (a) Mortar size shall be stated as the measurement of the inside diameter.

2. Materials

- (a) Only mortars constructed from the following materials may be used at a North Star show: Fibre-Reinforced Epoxy (“FRE”); High-Density Polyethylene (“HDPE”); schedule 40 steel; or specially-rolled cardboard for the sole purpose of pyrotechnics. Under NO circumstances shall ABS or PVC be used as mortar material due to the risk of shattering and shrapnel.
- (b) All mortar material shall be of sufficient thickness and strength to withstand the forces generated by the lift charges, and break charges in the event of a shell mining in the tube.
- (c) Paper mortars shall be inspected before each use to insure they have not been weakened by loose and unwinding inside layers.

3. Plugs

- (a) All mortars shall be securely plugged at the bottom.
- (b) Steel mortars shall have a steel plate welded in/on the bottom, provided the weld is of good quality and forms a continuous water tight seal.
- (c) HDPE mortars up to and including 102 mm (4") in diameter may be of one-piece construction

4. Defects

- (a) Mortars with cracks, splits, bulges, excessive corrosion, excessively loose or split plugs, delaminated paper tubes, or large gaps between the plug and inside wall shall not be used.
- (b) Mortars with dents, bends or restrictions along their length or at the muzzle, or any other defect which might prevent the shell from properly lifting shall UNDER NO CIRCUMSTANCES be used.

5. Burial

- (a) Mortars not in racks shall have a minimum of 2/3 of their length buried in the ground or sand free of stones or other hazardous debris. Mortars less than 155 mm (6") must be separated by at least 30 cm from any other effect, and the outside walls of the sandbox or drum. For mortars *larger than* 155 mm, the distance between them and any other effect increases to 1 metre.
- (b) Drums may be used only if they are constructed of HDPE and have been inspected for possible tip-over hazards.

6. Racks

- (a) Racks for mortars shall hold the mortars securely and be well-constructed. The maximum size mortars to be used in racks shall be 152 mm (6") inside diameter.
- (b) Mortar racks shall be adequately braced to prevent tip-over and shall be placed perpendicularly to the spectators, whenever possible.
- (c) Plastic "Zip Ties" may not be used for securing or stabilising mortar racks, roman candles, or other large devices and may only be used to secure fuses, bundles of wires, etc.

7. Protecting loaded mortars

- (a) All loaded mortars shall be sealed with taped down foil, cap plugs or other equivalent means of protection when the following conditions occur:
 - i. Mortars will be left in the field overnight (also applies to empty mortars left overnight on multi-day setups).
 - ii. Other display material could drop sparks into the mortars and cause premature ignition.
 - iii. Rain or wet snow is forecast or present.

5. Shells

1. Size definition

- (a) The size of shells shall be stated as the inside diameter of the mortar from which they are to be fired.

2. Transportation and handling

- (a) All boxes of shells and other pyrotechnic materials entering the display area shall be organised and clearly labelled. Boxes shall be the original manufacturer's boxes.
- (b) Shells being transported in vehicles onsite shall be in containers or boxes, and shall be so secured as to prevent damage from movement.
- (c) To avoid possible hazards generated by friction or static, BOXES OR OTHER CONTAINERS OF SHELLS SHALL NOT BE PUSHED OR PULLED AROUND ON THE FLOOR OF MAGAZINES OR TRANSPORTING VEHICLES. They shall be lifted and carried.
- (d) The lids of all boxes and shell containers shall remain closed except when removing contents.
- (e) Apart from loading a rack or walking short distances, individual shells shall be carried by their bodies, not by their leaders. Preferably, they shall be carried in their boxes whenever possible.
- (f) Shells 152 mm (6") in diameter or larger shall be carried either in unopened factory packages or one at a time.
- (g) Shells shall never be allowed to be dropped.

3. Repair

- (a) Shells found to be damaged, or that have been damaged in handling, shall not be used unless repaired by a person trained and competent in that type of repair.
- (b) Shells requiring more than minor repairs shall be inspected by the LSC or other qualified person after repairs have been made. If in doubt, leave questionable shells out of the show and return them to North Star Fireworks Entertainment Inc. Be sure to label them accordingly.

4. Loading

- (a) The LSC or their designate shall instruct inexperienced crewmembers on the correct method of handling and loading of shells.

- (b) NO PART OF THE BODY SHOULD BE PLACED OVER THE MOUTH OF THE MORTAR DURING LOADING, MATCHING OR HOOK-UP TO THE IGNITION SOURCE.
- (c) All shells, especially large calibres, shall be lowered gently to the bottom of the mortar during loading. Shells shall not be dropped into mortars during loading.
- (d) SHELLS LARGER THAN 152 MM (6") IN DIAMETER SHALL BE LOWERED INTO THEIR MORTAR WITH A LOWERING CORD OR ROPE AND NOT BY THE FUSE.
- (e) The LSC or another experienced supervisor shall be present when mortars larger than 152 mm (6") in diameter are being loaded.
- (f) ONCE THE SHOW HAS BEEN COMPLETELY LOADED, THE LSC OR THEIR DESIGNATE SHALL ENSURE THAT ALL SHELLS ARE SITTING ON THE BOTTOM OF THE MORTAR BY PRESSING DOWN ON THEM GENTLY WITH A NON-SPARKING IMPLEMENT. THEY SHALL ALSO ENSURE THAT ALL SHELLS ARE FACING UPWARDS, AND THAT EACH MORTAR HOLDS THE PROPER-SIZED SHELL.
- (g) Once shells have been loaded into mortars, all efforts will be made not to pull them up again in order to minimise the hazards generated by friction or static. If a shell must be raised for any reason, it shall be done slowly.

5. Firing

- (a) All shells 178 mm (7") in diameter or larger shall be fired electrically.
- (b) All salutes/reports shall be fired electrically.

6. Match and fuse

1. Quick match

- (a) Pyrotechnicians are cautioned that quick match may be ignited by the heat of friction generated by abrasion. They should use care and take their time when working with quick match.
 - i. Do not use scissors or other two-bladed cutters to cut quick match.
 - ii. Recommended tools for cutting quick match are knives, side/end cutters, or Teflon coated blade/anvil type pruners. They must be non-sparking whenever possible.

- (b) Quick match splices shall be secured against separation either from the weather or from handling.
- (c) Open ends on all quick match shall be covered with tape or safety caps.
- (d) With the exception of chained finales, individual shells shall be carried by their bodies, not by their leaders. Preferably, they shall be carried in their boxes whenever possible.
- (e) Due to the volatility of quick match, chained shells shall be handled with particular care.
- (f) All time fuses shall be secured against separation and sealed with tape against the weather and stray sparks.

2. Visco

- (a) Visco or green “safety fuse” may be used when factory-installed or where deemed necessary by the LSC. To the extent possible, visco shall be protected against accidental ignition.

7. Electric firing

1. Briefing

- (a) Persons handling any pyrotechnic items with the electric ignitors installed, or those installing electric ignitors, must be aware of the sensitivity of such devices to electrostatic discharge, impact and friction.

2. Precautions

- (a) The installation of electric ignitors and/or the storage and/or set-up of pyrotechnic items with their ignitors attached shall not take place within 75 metres of “high tension” power lines.
- (b) The LSC shall assess any such possible power line problems before set-up begins.
- (c) The installation of electric ignitors and/or the set-up of pyrotechnic items with electric ignitors shall not take place when electrical storms or lightning are present. In such cases all personnel shall evacuate the display to the perimeter of the danger zone and stow all shells and electric ignitors safely.
- (d) Portable communication devices such as radios and mobile telephones shall not be present within 4 metres of electric ignitors. For a complete list of safe-handling distances for personal communication devices, see Appendix 3 in *Display Fireworks Manual* (Natural Resources Canada, 2010)

3. Connections

- (a) THE FIRING SYSTEM SHALL NOT BE CONNECTED TO THE POWER SOURCE UNTIL ALL WORK ON THE DISPLAY IS COMPLETE AND ALL PERSONNEL HAVE VACATED THE AREA.
- (b) Before continuity checks are made, the immediate area shall be cleared of all personnel.
- (c) All electric ignitors shall remain shunted until connected to the firing system.

8. Low- and ground-level effects

1. Gerbs/fountains

- (a) Gerbs/fountains shall be securely anchored to prevent their breaking loose when fired.

2. Lancework/set-pieces

- (a) Lancework items shall be secured against falling over and/or burning through their braces.

3. Candles

- (a) Roman candles shall be secured against toppling and displayed in a manner approved by the LSC or their designate so as to minimise errant projectiles from flying towards the crowd.

4. Wheels

- (a) Stands or supports for wheels shall be secured against toppling. Wheels shall be displayed in a manner approved by the LSC or their designate so as to minimise the risks of malfunction.
- (b) Drivers, gerbs, and other components on wheels shall be securely fastened to minimize the risk of breaking away and becoming projectiles.
- (c) Petards, salutes, ground bombs or other explosive devices used on wheels shall be suspended or mounted securely and in such a manner as to prevent the production of splinters and/or shrapnel.

9. Duds and misfires

1. Notification

- (a) Never assume all effects have fired properly before dismantling a display. There is always a chance that every show may have a dud or misfire, regardless of firing method and experience of crew members.
- (b) The LSC shall be notified immediately of all duds and misfires at the completion of the show UNLESS there is immediate danger to the crew or spectators. In such cases, the show must be stopped and emergency response initiated as outlined in section 3.6.

2. Deliberate action

- (a) No recovery of duds or misfires shall be attempted until after inspection by a the LSC.
- (b) In all cases, the LSC and experienced crew members shall agree on the method of recovery before recovery is attempted.

3. Misfires

- (a) If the item is a shell in a mortar with or without an electric ignitor, where the fuse has ignited but the shell has failed to lift, the mortar shall be doused with water and left standing for a minimum of 30 minutes unless alternate means are approved by LSC. Electric ignitors shall also be shunted as soon as possible, and not removed until the shell has soaked for 30 minutes.
- (b) In lieu of dousing the shell with water, an additional waiting period of 45 minutes (total time 75 minutes) prior to shell retrieval will be allowed.
- (c) If the item is a shell in a mortar with an electric ignitor:
 - i. Isolate and shunt the wires.
 - ii. If there is enough leader outside of the mortar to permit safe removal of the ignitor without placing any part of the body over the mouth of the mortar, the shell shall remain in the mortar. The ignitor may be removed either by withdrawing it slowly and carefully by the fuse, or, after the location of the ignitor's head is positively identified, by cutting off the leader match below it. The shell may then be removed from the mortar in a manner agreed upon by the LSC.
 - iii. If removal of the ignitor is not possible without exposing body parts over the mouth of the mortar, the shell shall be removed from the mortar in a manner agreed to by the LSC. When the shell has been moved to a safe distance and has been placed on the ground with the

lift charge at right angles to the pyrotechnician, the igniter shall be removed as described above.

4. Duds

- (a) If the item is a shell, it shall be isolated (surrounded by a barrier or otherwise restricted from public access) and left undisturbed for a minimum of 30 minutes. Then it shall be disposed of in a manner agreed upon by the LSC.
- (b) Roman candles, gerbs, lance work or ground salute misfires with quick match attached should be doused with water and left undisturbed a minimum of 30 minutes OR not doused with water and left undisturbed for the following times: 30 minutes (lancework); 45 minutes (candles, gerbs); or 60 minutes (ground salutes).
- (c) If any of the above dud items has an electric igniter installed, the item may be recovered for later use after the wires have been isolated, shunted and the igniter removed as described above.

Appendix 1: Useful Conversions

**Inches to
millimetres
(approximate)**

<u>Inch</u>	<u>mm</u>
1	25
2	50
3	80
4	102
5	127
6	155
7	178
8	205
10	255
12	305

Appendix 2: Minimum distances from projection-type effects to the public

Below is the ERD's basic requirements for crowd separation from the firing site. It is meant as a reference only; for more details, consult the latest edition of *Display Fireworks Manual* (Natural Resources Canada).

Mortar size inside diameter
(mm)
up to 30
to 50
to 60
to 80
to 102
to 127
to 155
to 180
to 205
to 255
to 305

Oblong site		
<i>15° angled mortars and articles</i>		
Distance to spectators (m)	Fallout zone (m)	Total (m)
45	35	80
65	60	125
70	80	150
75	95	170
80	130	210
100	165	265
125	200	325
145	230	375
165	260	425
205	330	535
250	400	650

OR

Mortar size inside diameter
(mm)
up to 30
to 50
to 60
to 80
to 102
to 127
to 155
to 180
to 205
to 255
to 305

Circular site	
<i>vertical mortars and articles</i>	
Radius to spectators (m)	Total (m)
50	100
75	150
90	180
95	190
115	230
145	290
175	350
205	410
230	460
290	580
350	700