Environmental Protection Authority
Te Mana Rauhī Taiao

# Code of Practice for Outdoor Pyrotechnic Displays

## HSNOCOP 30

**UPDATED OCTOBER 2012**

## APPROVED CODE OF PRACTICE

UNDER THE HAZARDOUS SUBSTANCES AND NEW ORGANISMS (HSNO) ACT 1996

New Zealand Government

# Preface

This Code of Practice entitled Outdoor pyrotechnic displays is approved as a Code of Practice under Sections 78 and 79 of the Hazardous Substances and New Organisms (HSNO) Act. The Environmental Protection Authority (EPA) has delegated the power to approve Codes of Practice to the Chief Executive of the EPA, and this code is approved in accordance with that delegation. It is confirmed that the requirements of Sections 78 and 79 have been met.

This code is approved as a means of compliance with the requirements of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001 that relate to the operation and management of outdoor pyrotechnic displays.

Notice of Approval of this Code of Practice has been published in the Gazette dated 1 November 2012.

Pursuant to Section 80(1)(a) of the Act, a copy of this Code of Practice may be inspected at the Wellington office of the EPA.

Pursuant to Section 80(1)(b) of the Act, a copy of this Code of Practice can be downloaded free of charge from the EPA website.

The code was approved 29 July 2008. This revision of the code was approved the 23rd day of October 2012.


Rob Forlong
Chief Executive
**Environmental Protection Authority**

# Table of Contents

## Release History

| Version | Date | Description |
|---|---|---|
| v 1 | 29 July 2008 | Original |
| v 2 | 23 October 2012 | Current version.<br>Original version amended to remove section 5.2.4(d) in its entirety. The definition of indoor pyrotechnics was revised.<br>Organisational names were also updated where relevant (e.g. ERMA New Zealand to EPA) and minor editorial corrections made. |

# Chapter 1: Introduction

## 1.1. Background

A Working Group comprising of members of the pyrotechnics industry and enforcement agencies was established by ERMA New Zealand to facilitate the development of a New Zealand Code of Practice for outdoor pyrotechnic displays.

The Working Group first met in August 2007 to discuss the purpose and scope of the Code. As part of the meeting, the Queensland Code of Practice Control of Outdoor Pyrotechnic Displays (2003) was assessed as a potential basis on which to develop a New Zealand Code (hereafter called the Code).

In addition to the Queensland Code of Practice, the following source documents have been reviewed and referenced in the development of the Code:

- Minutes of ERMA New Zealand Pyrotechnic Display Code of Practice Working Group, Friday 3 August 2007
- Indicative Table of Contents developed by the Working Group
- Department of Labour Draft Code of Practice for Pyrotechnic Displays
- Australian Standard on Outdoor Pyrotechnic Displays AS2187.4-1998
- Report from ERMA New Zealand's 2007 audit of test certificates
- HSNO Act and Regulations
- Court Theatre Code of Practice, based on A Guide for Safe Working Practices in the New Zealand Theatre and Entertainment Industry
- Approved Handlers Training Manual for Outdoor Pyrotechnics (Firework Professionals Ltd).

## 1.2. Purpose

The purpose of the Code is to ensure the safe handling of pyrotechnics and the safe operation of outdoor pyrotechnic displays. It covers practical aspects of managing and firing pyrotechnic displays. It is designed to assist people involved in all aspects of outdoor pyrotechnic displays to understand their obligations under the HSNO regulations, and to provide guidance on the best and safest ways of complying with these regulations.

The Code is of relevance to:

- persons wishing to hold an outdoor pyrotechnic display
- persons in charge of an outdoor pyrotechnic display
- outdoor pyrotechnics approved handlers
- test certifiers involved in issuing test certificates for outdoor pyrotechnic displays and approved handler test certificates to outdoor pyrotechnic operators
- enforcement officers.

## 1.3. Scope and application

The Code applies to the control of outdoor pyrotechnics displays using class 1G substances and covers both:

- outdoor pyrotechnics
- indoor pyrotechnics used as part of outdoor displays.

The Code provides guidance on all stages of an outdoor pyrotechnic display as well as addressing various aspects of the pyrotechnics' life cycle. The Code identifies the roles and responsibilities of the persons involved in outdoor pyrotechnics displays. The Code applies minimum requirements for those persons engaged in certain activities associated with outdoor pyrotechnics displays and promotes the adoption of risk management principles to achieve an outcome of an acceptable level of risk from harm for people, property and the environment.

### 1.3.1. Stages of outdoor pyrotechnics display

The Code applies to all phases of an outdoor pyrotechnic display including:

- the supply of pyrotechnics and pyrotechnics equipment,
- the maintenance of pyrotechnics equipment,
- planning the display,
- setting up the display,
- managing the display and
- post-display activities.

### 1.3.2. Stages of pyrotechnics life cycle

The Code applies to the management of activities in the different phases of the life cycle of pyrotechnics and the equipment and associated activities for an outdoor pyrotechnic display, including:

- the safe performance of pyrotechnics and pyrotechnics equipment,
- the classification, packaging and labelling of pyrotechnics,
- the purchase, sale and supply of pyrotechnics,
- the storage of pyrotechnics,
- the transport of pyrotechnics,
- the use, handling, possession and disposal of pyrotechnics and
- the use of pyrotechnics equipment.
- The Code does not apply to:
- indoor pyrotechnic displays
- retail fireworks
- special effects for film, video and other purposes
- distress signals, flares.

## 1.4. Approach

The Code recognises that the field of pyrotechnics is a rapidly developing one. The size and sophistication of displays continues to grow, as do audience expectations. World circumstances affecting trade in, and transport of, pyrotechnics change frequently. New products and new adaptations of existing products become available all the time. The industry as a whole must be alert to such changes, must anticipate future requirements and must expand research and testing to gain more precise knowledge in all aspects of its operations.

The Code advocates the adoption of a risk management approach. Risk management is recognised as an integral part of good management practice. The emphasis is on taking all practicable steps to minimise risk, i.e. developing and implementing control measures which, wherever possible, eliminate the hazards associated with pyrotechnics or isolate people from those hazards. Where the elimination or isolation of the hazards is not possible, work activities should be planned and controlled through administrative means (such as documented work procedures and rules) to prevent harm to a person's safety, health or property.

While the Code strives to reflect best practice throughout, it acknowledges that many aspects of pyrotechnics operation are not precise science, including the very important area of risk management. Observation, judgement, experience and training all form legitimate parts of decision-making by pyrotechnics handlers, alongside compliance with the regulations. The Code is not meant to replace other, equally safe work practices which also comply with the regulations.

## 1.5. Structure

As recommended by the Working Group, much material has been incorporated and adapted from the Queensland Code. The overall structure of the Code, however, is based on the New Zealand HSNO regulations applying to outdoor pyrotechnic displays.

These are:

- The Hazardous Substance (Fireworks, Safety Ammunition, and other Explosive Transfer) Regulations 2003
- Classification
- (Classes 1 – 5) Controls
- Packaging
- Disposal
- Tracking
- Personnel Qualifications
- Emergency Management
- Identification.

Material has also been added relating to other New Zealand legislation and government agencies. Practical advice from experienced industry members is included at every stage, above and beyond what is specifically mentioned in the regulations.

Appendix 1 contains an extensive list of definitions. A number of other appendices consisting of material too detailed or specialised to be included in the main body of the Code are also provided. These include topics such as design, construction & manufacture of pyrotechnic products and equipment, health and safety, forms and templates and risk and safety management.

# Chapter 2: Legislation and responsibilities

## 2.1. Overview

Pyrotechnics are classified as a Hazardous Substance (Explosive), Class 1, Category G.

This classification means that pyrotechnics are subject to specific laws and regulations. The most important of these are:

1. The Hazardous Substances and New Organisms (HSNO) Act 1996.
2. The HSNO Regulations on:
   a. The Hazardous Substance (Fireworks, Safety Ammunition, and other Explosive Transfer) Regulations 2003
   b. Classification
   c. (Classes 1 – 5) Controls
   d. Packaging
   e. Disposal
   f. Tracking
   g. Personnel Qualifications
   h. Emergency Management
   i. Identification.
3. The relevant sections of the Land Transport Rule DG 45001/1.
4. The Health and Safety in Employment (HSE) Act 1992.

Depending on the circumstances in which outdoor pyrotechnics are used, it may be necessary for those involved in the display to also notify or comply with the requirements of:

- the Labour Group of the Ministry of Business, Innovation and Employment (MBIE)
- the New Zealand Fire Service (NZFS)
- the relevant Rural Fire Authority (RFA)
- the Department of Conservation (DoC)
- the Civil Aviation Authority (CAA)
- the Maritime New Zealand
- the New Zealand Police
- local Government organisations such as Regional Councils and Local Territorial Authorities (under the Resource Management Act), and
- local iwi authorities.

## 2.2. The HSNO Act

> *"The purpose of this act is to protect the environment, and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms."*
>
> *"All persons exercising functions, powers and duties under this Act shall, to achieve the purpose of this Act, recognise and provide for the following principles:*
>
> *(a) The safeguarding of the life-supporting capacity of air, water, soil and ecosystems:*
>
> *(b) The maintenance and enhancement of the capacity of people and communities to provide for their own economic, social and cultural wellbeing and for the reasonably foreseeable needs of future generations."*

Under the HSNO Regulations, all outdoor pyrotechnic displays must be issued with a test certificate from a qualified test certifier. All outdoor pyrotechnic displays require written agreement from either the NZ Fire Service (urban areas) or the relevant Rural Fire Authority (rural areas). All outdoor pyrotechnic displays must be conducted by an approved handler certified to undertake all the activities and handle the products involved in the display.

Approved handlers for pyrotechnics have a legal responsibility to:

- Know and understand the purpose & principles of the HSNO Act,
- Understand the classification of the pyrotechnics they are handling and the hazards the pyrotechnics may pose to people or the environment,
- Be familiar with the regulations applying to the pyrotechnics designed to protect against those hazards,
- Comply with these regulations in the safe handling of pyrotechnics and
- Be aware of possible consequences of and penalties for not complying with the regulations (see Part VI of the Act).

More details of these requirements and procedures is given in Chapter 6, where the process of planning and setting up displays is described.

## 2.3. Obligations under the HSE Act

The following are key points to remember in relation to the HSE Act:

- All employers have a responsibility to provide a safe working environment.
- All employees have responsibilities for the safety of themselves and others in the work place.
- All hazards must be regularly and systematically identified. This requires an inventory of hazards, accident reporting systems and a review system to determine whether or not the hazard is significant. All should be documented.
- All significant hazards must be eliminated wherever possible.
- Where it is impracticable to eliminate a significant hazard it should be isolated.

- Where it is not possible to either eliminate or isolate a hazard then it should be minimised. Employees should receive information and training on how to work safely with the hazards, be issued with and ensure that they wear personal protective equipment; and where necessary, monitor the environment and their health for exposure to hazardous substances.

## 2.4. Key roles and responsibilities

The requirements governing these are discussed in more detail in Chapter 5.

The key roles associated with the various phases of an outdoor pyrotechnics display may include:

- The client
- The event organiser
- The pyrotechnics supplier
- The person in charge of the display
- Approved handler(s) working on the display
- Other staff working under the direct supervision of approved handlers
- The test certifier who issues a test certificate approving the display plan
- Security staff.

Any person or group of persons may perform more than one of these roles.

### 2.4.1. The client

- Engages a suitably experienced person to be in charge of the display,
- Has dialogue with the person in charge of the display regarding the hazards presented by the display,
- Obtains landowner permission where this is more direct or convenient than the person in charge of the display doing it.

### 2.4.2. The event organiser

- Arranges for security and audience control as necessary, in conjunction with the person in charge of the display.

### 2.4.3. The person in charge of the display

- Obtains landowner permission for the display (logical, though not required by current Regulations),
- Obtains a test certificate for the display from a test certifier no less than three days before the display,
- Obtains NZ Fire Service or RFA agreement for the display and accepts any requirements of the NZ Fire Service or RFA regarding fire-prevention or fire-fighting measures at the display,
- Notifies the Labour Group of the MBIE of the display, and
- Notifies other authorities (e.g. CAA, NZ Police, DoC) depending on the location of the display.

### 2.4.4. The supplier

- Ensures that the pyrotechnics are being supplied only to an approved handler,

- Ensures that the pyrotechnics are packed and labelled according to the requirements of the HSNO Regulations,
- Completes DG paperwork for the transportation of the Pyrotechnics according to the requirements of the Land Transport Rule DG 45001/1,
- Ensures that technical data sheets are supplied with the pyrotechnics, and
- Ensures that all pyrotechnics equipment supplied is in working order and comes with appropriate instructions.

### 2.4.5. The approved handler in charge of the display

- Supplies or purchases the pyrotechnics,
- Sets up the discharge areas and exclusion zones,
- Has the responsibility of deciding whether a display should be cancelled or postponed according to weather and security issues (in some cases fired ahead of schedule, if it is safer because rain is threatening but has not yet arrived),
- Has overall responsibility for the safe rigging, firing and cleanup of the display, and
- Supervises any other approved handlers working on the display.

### 2.4.6. Other approved handlers operating the display

- Rig, fire and clean up the pyrotechnics according to the plan and the instructions of the person in charge of the display, and
- Supervise directly any other staff who are not approved handlers.

### 2.4.7. Other staff

- Follow the instructions of approved handlers.

### 2.4.8. The test certifier

- Checks the display plan and the necessary consents,
- May refer to this Code as necessary in checking the safety of the plan,
- Negotiates with the person in charge of the display if necessary over modifications for safety reasons, and
- Issues (or declines to issue) a certificate stating that the plan is approved and the information supplied complies with the HSNO regulations.

### 2.4.9. Security staff (if required)

- Keep the audience and all other unauthorised personnel out of the exclusion zone, set up area and any other area required by person in charge of the display to be kept clear.

## 2.5. Government departments and agencies

Refer to section 97 of the HSNO Act for a list of HSNO enforcement agencies.

### 2.5.1. The MBIE and the EPA

The Labour Group of the MBIE enforces the HSNO Act in places of work. The person in charge of a display is required by law to notify the MBIE at least three working days (where possible, five is recommended) in advance of any outdoor pyrotechnic display. This notification must include:

- The date and time,
- Postponement date,
- Location,
- The number of firings,
- The name and registration number of the person in charge of the display and contact details for that person.

The display plan must be made available to a MBIE inspector, should they wish to see it.

If they see something that conflicts with the regulations, they may express their concerns.

Refer to Appendix 4 for contact details for the MBIE.

### 2.5.2. New Zealand Fire Service

For any outdoor pyrotechnic display within an urban fire district, the person in charge of the display must gain written agreement from the NZ Fire Service (NZFS).

The NZFS requires a written application form to enable them to make a reasoned decision about the display. A Chief Fire Officer can require additional fire-fighting and fire safety precautions. Refer to section 5.2.6 and Appendix 5.7 for information on what to include in the application. The MBIE and the NZFS share a joint form to reduce the duplication of paperwork.

An application form must be submitted at least five days before the date of firing. At the discretion of the Fire Service, this may be reduced to three working days in exceptional circumstances. No application will be processed with less than three days notice in any circumstance.

### 2.5.3. Rural Fire Authorities

Similar conditions to that of the NZFS requiring written approval for any outdoor pyrotechnic display also apply within a rural fire area (e.g. Rural Fire Authority (RFA), Department of Conservation, or Defence area). A Principal Rural Fire Officer, or his/her representative (Deputy Principal Rural Fire Officer or Rural Fire Officer), can also require additional fire-fighting and fire safety precautions (refer section 5.2.6).

However, many RFAs also require that the application form (shown in Appendix 5.1) be submitted at least ten (10) working days prior to the date of firing. In exceptional circumstances this may be reduced to five (5) working days at the discretion of the RFA. No application will be processed with less than five days prior notice in any circumstance.

### 2.5.4. Civil Aviation Authority

Pyrotechnics can be a hazard to air navigation. As such, most pyrotechnic displays held in the vicinity of either a controlled or uncontrolled aerodrome will need to be notified to the CAA and/or the relevant air traffic control unit. Refer to section 5.2.7 for details on when it is necessary to notify the relevant aviation authority.

Appendix 4 contains a list of controlled aerodromes and the contact details of the relevant air traffic control unit. CAA contact details are also provided in Appendix 4.

Also refer to Civil Aviation Rule part 77.11 for further information.

### 2.5.5. Maritime New Zealand

For pyrotechnic displays on or over water, permission for the display must be obtained from the local or regional Harbour Master. In addition, the following should be notified by fax or email (five days notice is recommended):

- The National Rescue Coordination Centre
- The local Maritime Safety Authority
- The local Coast Guard

### 2.5.6. New Zealand Police and Fire

It is recommended that the Police and Fire Communications Centres be notified by fax a few days before any outdoor pyrotechnic display, and that Police Communications be telephoned shortly before firing.

### 2.5.7. Local authorities

Local authorities may have bylaws, including fire bylaws, which limit the conduct of a pyrotechnics display. Permits may be required from the local authority for any road closures or a display to be held in a park or on a beach. Local authorities may also be charged with administering environmental requirements associated with pyrotechnics displays in urban areas. Pyrotechnics companies and operators should check with the relevant local authority during the planning of the display, if it is going to affect local body-controlled areas.

### 2.5.8. Local iwi authorities

When landowner permission is being obtained for a pyrotechnic display involving public land and bodies of water, it may be necessary or courteous to notify or obtain permission from the local iwi.

While on most occasions this does not apply, there are areas of land with traditional connections such as the land outside Auckland War Memorial Museum, and Lake Wakatipu near Queenstown.

Early investigation of site permission will ensure the correct parties are notified.

Maori iwi authorities may be contacted through www.mdrc.co.nz, Maori

Development Research Community. Te Puni Kokiri (Ministry of Maori Development) also provides a list of the relevant contacts.

# Chapter 3: Risk and safety management

The main elements of risk management are described in the Standard AS/NZS 4360:2004 Risk Management. This Standard defines risk management as a series of well-defined steps which, taken in sequence, support better decision-making by contributing insight into risks and their impacts.

An overview of risk management and guidelines to following a risk management approach are given in Appendix 3.

The following is a checklist of items that should be carefully considered in planning and operating an outdoor pyrotechnic display. For each of the items (a) to (x) listed below, the person in charge of the display should check:

1. That the HSNO Regulations and the procedures recommended by this Code have been followed, and
2. Any foreseeable hazards have been identified, evaluated and controlled to an acceptable level of risk.
    a. Documentation (notifications, agreements, certificates, data sheets, contact numbers etc.)
    b. Discharge areas
    c. Exclusion zones
    d. Security of exclusion zones and setting-up areas
    e. Security of pyrotechnic storage and vehicles
    f. Crowd control measures, including evacuation plan (if necessary) in case of emergency
    g. Access and egress of emergency personnel in case of emergency
    h. Terrain
    i. Weather conditions
    j. Nearby buildings, vehicles and other craft, animals, DG stores
    k. Nearby road, rail, air or water transport routes
    l. Nearby vegetation or structures
    m. Construction and vulnerability of surfaces from which firing takes place (e.g. roof, ground, barge)
    n. Fire-fighting equipment and fire prevention measures
    o. Qualification and experience of staff working on the display
    p. Safety equipment
    q. Emergency response plans
    r. Crew comfort facilities
    s. First aid equipment

t. Rigging and firing plans, methods and equipment

u. Pack-out procedures including disposal of debris and misfires

v. On site observation and communication (including communication on the day with event organiser, fire and police communications, air traffic control etc.)

w. Static electricity

x. Alternate firing plans in case of wind change.

# Chapter 4: Classification, packaging and labelling

Refer to the following HSNO Regulations:

- Classification
- Packaging
- Identification.

Everyone who has to deal with pyrotechnics, whether at display site, in storage facilities, assembling supplies for a display or moving freight needs to know the basic properties and hazards of the substances they are handling. For this reason, there are specific requirements for classification, packaging and labelling.

## 4.1. Classification of pyrotechnics

Classification specifies the type and degree of hazard presented by a substance. All pyrotechnics must be classified under the HSNO classification system which is consistent with the United Nations classification system (see Appendix 8). The default classifications as detailed in this Appendix must be used, unless the supplier can demonstrate that the pyrotechnics have a different classification. This alternative classification must be certified by a report detailing testing which has been undertaken in accordance with the requirements of the United Nations document Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria (2nd Revised Edition) and witnessed by an independent person acceptable to the EPA. This will normally be a test certifier.

The classification of mixed pyrotechnics, (i.e. when more than one type of pyrotechnic is packaged, stored or transported together), is based on the most hazardous pyrotechnic type. For example, if Class 1.2, 1.3 and 1.4 pyrotechnics are packaged, stored or transported together, the total combination of those pyrotechnics is classified as Class 1.2.

Appendix 8 has full details of the classification systems used in New Zealand and what they mean.

## 4.2. Packaging

To ensure that pyrotechnics are not crushed, mixed or subject to unnecessary impact as they are being stacked or moved around, there are regulations governing the standard of packaging of pyrotechnics.

As there are no ready means of certifying packaging in New Zealand, it is recommended that the original packaging from the overseas supplier or New Zealand manufacturer should be interfered with as little as possible except in the making up of selected orders for use at pyrotechnics displays. Combination packages of this nature should be:

- Fully taped closed,
- Marked and labelled for the contents in the package.

If the contents include items such as indoor pyrotechnics for use in an outdoor display, where the igniters are already fitted to the pyrotechnics, additional packaging and measures to avoid friction or static electricity may be recommended, such as wrapping contents in anti-static material. Igniters on their own may be wrapped in tin-foil inside outer packaging.

The outer package markings must be:

- Printed in English,
- Readily visible and legible,
- Able to withstand open weather exposure without a substantial reduction in effectiveness,
- Displayed on a background of contrasting colour on the external surface of the package and
- Located on the packaging so as to be normally visible when the package is stacked with other packages of the same kind.
- When packages are being transported, the outer package markings must include:
- Proper shipping name , authorised name and the UN number of the pyrotechnics in the package (when there is more than one type of pyrotechnic in the package, details for each type of pyrotechnics in the package must be marked on the outside surface of the package),
- Class label, e.g. Class 1.3G, appropriate to the pyrotechnics in the package (where there is more than one hazard division in the package, e.g. class 1.3 and class 1.4, the lowest number should be used) and
- The name and address in New Zealand of the pyrotechnics manufacturer or supplier or the agent of one of these.

Also refer to Chapter 7 (section 7.1.3) for information on placards.

## 4.3. Labelling

### 4.3.1. Labels – explosive substances

a. Priority identifiers:

Labels for explosive substances have to include the following information:

| |
|---|
| **EXPLOSIVE**<br>**Hazard classification**<br>**(e.g. 1.4G UN 0336)** |

Someone with average eyesight and in average light needs to be able to read this label within 2 seconds from 0.3 metres away, even if they are colour blind, for small amounts. For bigger amounts, see Table 4.1 below.

b. Secondary identifiers:

Labels for explosive substances also have to include the following information:

**Name (e.g. MAROON FLASH)**
**Contact phone number**
**What could make it explode accidentally**
**What would happen if it did**
**How to avoid that**
**(e.g. Avoid flame, sparks, static or impact. Violent explosion, hot flame.)**

Someone with average eyesight and in average light needs to be able to read this label within 10 seconds from 0.2 metres away, for small amounts. For bigger amounts, see Table 4.1 below.

Labels should be printed in plain English, without abbreviations or acronyms unless the whole word has already been used at least once on the same label.

Example of a label for a Maroon Flash, manufactured by Company X:

**EXPLOSIVE 1.4G UN 0336**
**Company X Ph ### ####**
**MAROON FLASH**
**Avoid flame, sparks, static or impact. Violent explosion, hot flame.**

Table 4.1 Distances for viewing labels and signs
(taken from Hazardous Substances (Identifications) Regulations 2001, Schedule 1)

| Quantity of hazardous substance | Distance for priority identifiers | Distance for secondary identifiers |
|---|---|---|
| <20 g or 20 mL | 0.3 m | 0.2 m |
| >20 g or 20 mL to <5 kg or 5 L | 0.3 m | 0.3 m |
| >5 kg or 5 L to <450 kg or 450 L | 1 m | 0.5 m |
| >450 kg or 450 L | 10 m | 10 m |

For details of what hazard and precautionary information labels should include, refer to Appendix 14.

Refer also to the HSNO Approved Code of Practice on Labelling developed by Responsible Care (formally the New Zealand Chemical Industry Council (NZCIC)). Contact Responsible Care through their website www.nzcic.org.nz.

# Chapter 5: Controls on displays

Refer Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001 (hereafter referred to as Controls Regulations).

## 5.1. General restrictions

Pyrotechnics, as class 1 substances, may not be carried on passenger service vehicles.

Pyrotechnics must always be under the control of an approved handler or a person directly supervised by an approved handler, unless they are secured at a hazardous substance location or designated use zone.

Pyrotechnics must be kept secured:

- at a hazardous substance location, or
- at a designated use zone, or
- at a discharge area, or
- at a designated transfer zone, or
- on or in a vehicle, ship, or aircraft under the direct control of its driver, master, or pilot that is under the jurisdiction of the Land Transport Rules, Maritime Rules, or Civil Aviation Rules, as the case may be.

Pyrotechnics must not be:

- at a transit depot, or
- at a designated transfer zone for more than:
- 24 hours, in the case of substances of hazard classifications 1.4G, or 1.4S, or
- 8 hours, in the case of all other class 1 pyrotechnic substances.

Except when they are being ignited, pyrotechnics should not be subject to impact, pressure shock, spark energy, static electricity or any ignition source which could result in an explosion or fire.

Pyrotechnics should be protected from stray electrical currents and electromagnetic radiation.

Schedule 2 of the Controls Regulations shows which class 1 substances may be stored or transported together and which may not.

## 5.2. Planning outdoor pyrotechnic displays

### 5.2.1. Event planning

Most of the following responsibilities are undertaken by the person in charge of the display, though in certain cases the client or event organiser may be involved in decision-making:

- Ensuring that the display plan complies with the regulations and that the clearance distances to be used are suitable,
- Ensuring that all relevant agencies are notified and that the necessary approvals have been obtained,

- Consulting as appropriate with the local community near the pyrotechnics display,
- Selecting suitable pyrotechnics for the site,
- Ensuring that the pyrotechnics display equipment is suitable and fully serviceable,
- Selecting appropriately trained and experienced approved handlers to operate the display,
- Ensuring that the approved handlers have been appropriately educated in the person in charge's safety management system,
- Identifying the approved handlers' assistants and ensuring that they are appropriately trained and instructed,
- Ensuring that pyrotechnics are only used in accordance with the manufacturers' recommendations (where these are available),
- Ensuring the provision and use of appropriate personal protective equipment (PPE),
- Determining the location for preparing the pyrotechnics and transit storage,
- Ensuring compliance with transport requirements for pyrotechnics to the display,
- Ensuring the provision of appropriate security measures for crowd control and control of access to the pyrotechnics display area,
- Ensuring the provision of first aid equipment and/or attendants,
- Emergency planning,
- Providing pyrotechnics display insurance,
- Ensuring that the site is properly cleared after the display, and
- Reporting to the supplier, the EPA and the Labour Group of the MBIE regarding any incidents, misfires, or accidents.

### 5.2.2. Selecting and purchasing the pyrotechnics

The pyrotechnics selected should be compatible with local conditions, taking into account:

- Noise,
- The features of adjacent areas such as nature reserves or community facilities, e.g. hospitals, rest homes, animals such as horses etc, and
- Prevalent environmental conditions (e.g. wind).

All pyrotechnics to be used at the display must be:

- Safe for use,
- In a category approved by the EPA, and
- Recorded and traceable right through to use and/or disposal.

### 5.2.3. Selecting the pyrotechnic display site

Selecting a suitable site involves assessing the risks to people and the environment posed by the site itself, the display planned and the conditions on the day.

The checklist given in Chapter 3 is a good starting point for making such a risk assessment.

In addition, the person in charge of the display should consider:

- The locality, size and area of the site, taking into consideration the type, nature and size of pyrotechnics to be used;
- The ability of the approved handler(s) and assistant(s) to have full sight of the pyrotechnics display site area and, in particular, the pyrotechnics firing zone;
- Overhead obstructions, with respect to the firing area. Any overhead object, e.g. trees, branches, wires, football posts, structures, buildings, should not be within 8 metres of the display site set-up area. The effects of wind and in particular branches of trees swaying in the wind must be taken into consideration to ensure that no part of any overhead object in a vertical plane is within 8 metres of any part of the firing area at any time. In the case of light trees, and where there is negligible fire risk, the person in charge of the display should work closely with the test certifier to come up with suitable provisions in the display plan, such as tying back branches with ropes;
- Wind - note that firing is not permitted in winds of over 30 kilometres an hour;
- The time period of the display;
- Ease with which the site may be secured and options for this; and
- The number of displays already held at that location (if any).

### 5.2.4. Discharge areas and exclusion zones

The person in charge of the display must comply with the regulations and make every effort to ensure that any pyrotechnics effect and hazardous debris (including for example any aerial shell which has not exploded in the air, as intended) falls within the exclusion zone.

The minimum distances for discharge areas and exclusion zones vary according to the size of any pyrotechnic shells being fired and the height of display.

Height of display means the height above the position at which firing takes place. There are three official heights of display:

- ground level,
- low-level (under 60 metres) and
- high-level (above 60 metres).

The discharge area is where the pyrotechnic effects are ignited. There are prescribed minimum clearance distances (that is, distances from the firing point to the edge of the discharge area) in the regulations for:

- vehicles, boats, aircraft and structures, other than those forming part of the display (30 m),
- places housing people who would require assistance in case of evacuation (200 m),
- livestock or other captive animals (200 m) and
- dangerous goods stores containing over certain quantities (250 m).

Exceptions: some fire resistant structures are allowed to be closer to the discharge area. For example, a show could be fired on the fire resistant roof of a building – see Regulation 37 (Controls Regulations) for a definition of an acceptable standard of fire resistance.

The exclusion zone is the clear space around and including the discharge area. It allows for the usual pyrotechnic debris, plus effects that don't fire, to fall to the ground without hitting anyone or setting fire to anything. The size of the exclusion zone varies according to the height of display.

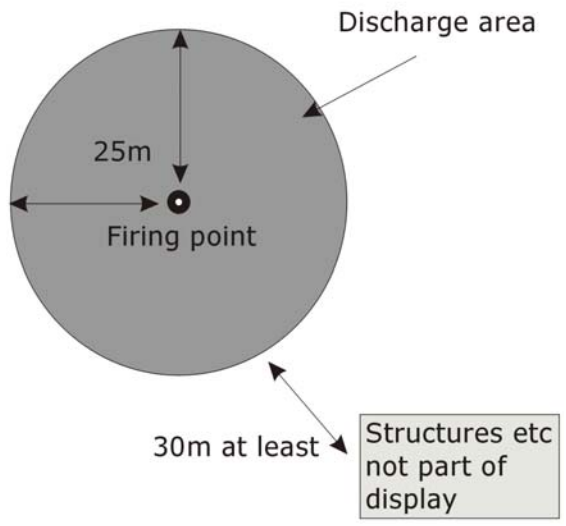
*a. Ground level displays*

Pyrotechnics that fire at ground level include fountains, falls, catherine wheels, fireballs and maroons.

For ground level displays, the exclusion zone may be the same as the discharge area.

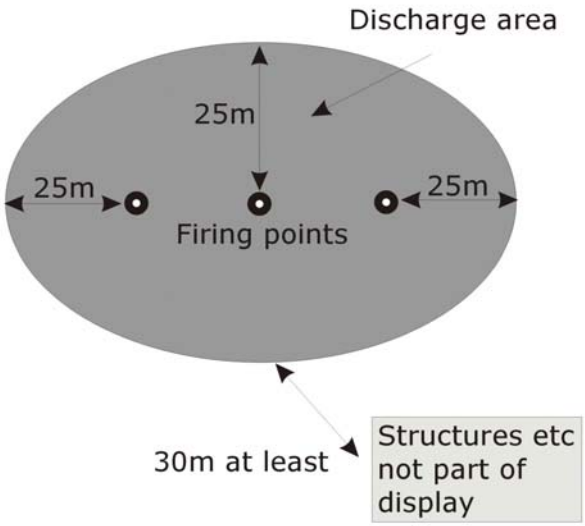
The absolute minimum discharge area would be for a display with only one firing point. This area would be a circle 25 metres in radius, with the firing point at its centre. See Figure 5.1 below.

Figure 5.1




If there is more than one firing point, then the discharge area will be bigger, as its edge must be at least 25 metres from the outermost firing point, as illustrated in Figure 5.2.

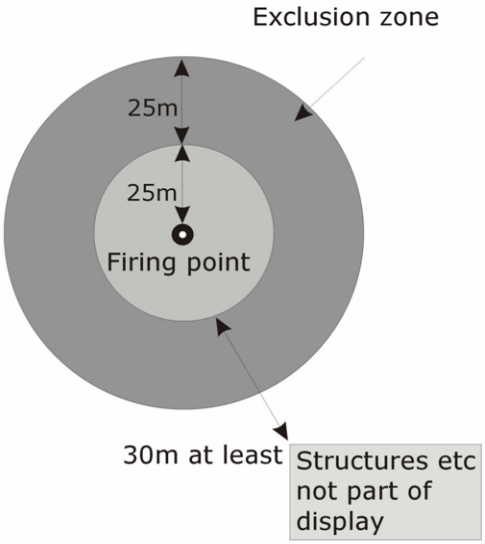
Figure 5.2



*b. Low level displays*

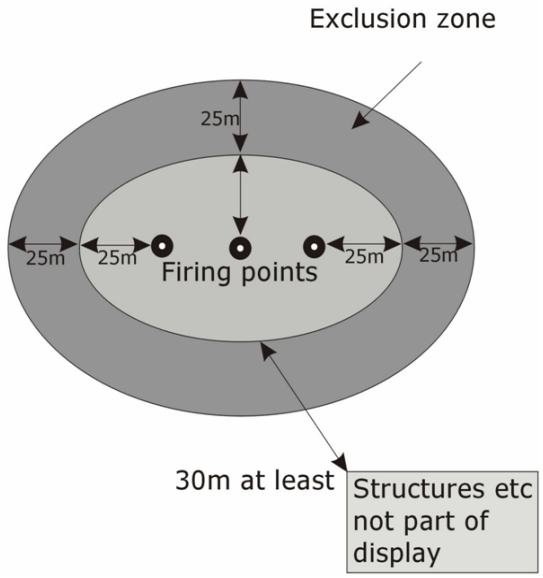
For low-level displays (under 60 metres) with a single firing point, the absolute minimum exclusion zone will be a circle 50 metres in radius, with the firing point at its centre. See Figure 5.3.

Figure 5.3




If there is more than one firing point, the exclusion zone will be bigger, as its edge must be 50 metres from the outermost firing point. See Figure 5.4.

Figure 5.4



*c. High level displays*

For high-level displays (above 60 metres), the size of the exclusion zone takes into account both the firing points and flight lines of the shells being used. See Table 5.1 below, and Tables 3 and 4 of Schedule 2 of the Controls Regulations.

Table 5.1 Minimum safety distances for starshells

| Shell size | Maximum wind velocity | Minimum safety distance either side of point of firing | Minimum safety distance in direction of flight |
|---|---|---|---|
| <75 mm (3 inch) | 30 kph | 50 m | 50 m |
| >75 mm (3 inch) | 30 kph | 50 m | 100 m |
| 100 mm (4 inch) | 30 kph | 50 m | 100 m |
| 125 mm (5 inch) | 30 kph | 50 m (75 m advisable where possible) | 125 m |
| 150 mm (6 inch) | 30 kph | 100 m | 150 m |
| 175 mm (7 inch) | 30 kph | 150 m | 150 m |
| 200 mm (8 inch) | 30 kph | 170 m | 170 m |
| 250 mm (10 inch) | 30 kph | 215 m | 215 m |
| 300 mm (12 inch) | 30 kph | 250 m | 250 m |
| >300mm (12 inch) | Approval of the EPA | | |

If mortars are placed vertically, the direction of flight distances will apply in all directions.

Basically, the bigger the shell being used, the more space must be allowed in the exclusion zone. See Figures 5.5, 5.6 and 5.7 as samples.

Figure 5.5

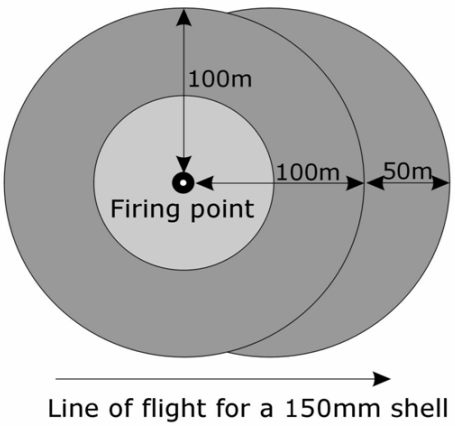
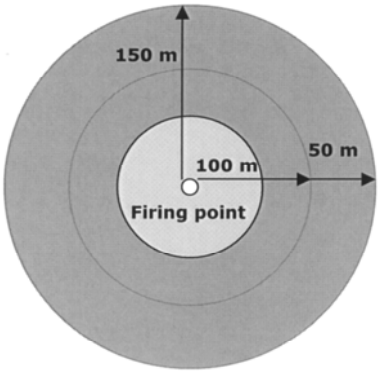
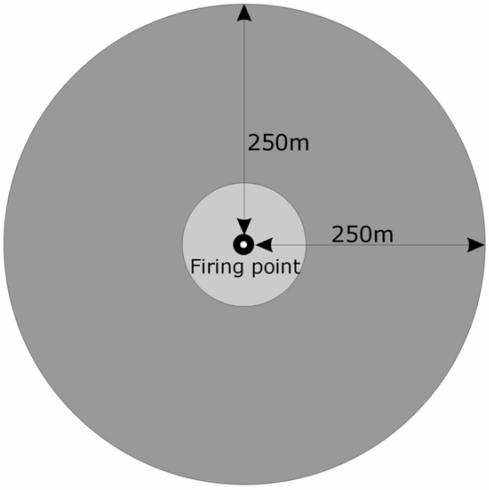


Figure 5.6




**Exclusion zone for 150 mm shell fired vertically**

Figure 5.7




Exclusion zone for a 300mm shell

*d. Indoor pyrotechnics used in outdoor displays*

Section 5.2.4 (d) was deleted on 23 October 2012 following an amendment to the Code.

*e. Effects of wind*

The Controls Regulations specify that firing of an outdoor pyrotechnic display may take place in a wind of no more than 30 kilometres per hour, which is very close to 15 knots. This is specified as being measured within the discharge area. The Controls Regulations do not specify a height above ground level for taking wind measurements.

Wind speed measurement taken at ground level should be interpreted carefully. As measurements are taken higher and higher above ground, the wind speed generally increases. In addition, buildings, hills and trees create turbulence in which the wind direction can vary by as much as 180°.

Wind direction is just as important as wind speed in evaluating risk and adjusting clearance distances accordingly.

In a show with the audience at the minimum distance allowable and a wind of less than 30 kilometres an hour blowing towards them, there may be a risk of ash, paper debris and shell casings landing on the audience. A wind of greater strength blowing away over open water would not present such a risk.

It is sometimes advisable to adjust the position of pyrotechnics firing points to take account of wind conditions.

Another factor to consider is whether the wind is blowing in the direction of fire risks, particularly if they cannot be easily reached because of fences, cliffs or hilly ground.

There is also a balance to be considered between the costs and risks of dismantling a live fully rigged pyrotechnic show because of wind, and the actual risk presented by the wind.

In addition to complying with the Controls Regulations, and following the recommendations of this Code, the person in charge of a display must expect to use his or her own judgement in assessing and managing such risks.

*f. Effects of angled pyrotechnics*

Pyrotechnics are sometimes angled for cross-over effects, or to direct large shells away from the audience, or even to counter the effects of wind. While it is not possible to precisely calculate the changes in possible fallout zone from small mortar angles, there are some basic safety principles:

- When a display includes crossover effects, e.g. with Roman candles, where mortars may be set at considerable angles, very generous exclusion zones should be used, such as for example a large body of water able to be secured.
- When mortars are set at slight angles to counter wind or decrease the exclusion zone requirements, angles between 2° and 5° from the vertical are recommended.
- Exclusion zones are increased in the direction of flight of the shell for certain sizes of shell – see Table 5.1 above.
- Mortars should never be angled towards the audience, even to counter the effects of wind.

*g. Engineering solutions*

The use of barriers and shields to mitigate the possible effects of malfunctioning pyrotechnics should be discussed with a qualified test certifier as part of a display plan.

### 5.2.5. Insurance

Adequate and appropriate insurance for any display, including public liability insurance, should be held by the person in charge of the display. There may be rare exceptions when the person/organisation in charge of the event (e.g. a school, for a small annual display with a volunteer operator) is able and willing to arrange insurance for the event or does not wish to have insurance if the site is very safe.

Rural fire insurance, which can cover such things as helicopter hire, is not part of public liability insurance and needs, where relevant, to be obtained separately.

### 5.2.6. Permissions and approvals

Written permission for a display must be sought from:

a. Property owner/local iwi/person with delegated authority e.g. property manager

b. Relevant Fire Authority

c. Regional harbourmaster (if display is on water or port land)

d. Agency responsible for air safety in the vicinity of the display (if display is within certain distances of airports or low-flying areas)

e. Test Certifier.

*a. Property owner*

The Controls Regulations do not require permission to be sought from property owners, but obtaining it is a matter of logic and courtesy, and may also be required for public liability insurance to apply.

*b. Relevant Fire Authority*

Written agreement must be obtained from:

- The NZ Fire Service (urban fire district) or
- A Rural Fire Authority (rural area, Department of Conservation, or Defence area).

*c. Regional Harbourmaster*

For pyrotechnic displays on or over water, permission for the display must be obtained from the regional Harbourmaster. If the display is on port land, permission will also be needed from the port authority.

*d. Civil Aviation Authority*

The Controls Regulations require that prior written agreement for the holding of a display must be obtained from the agency responsible for air safety in the vicinity of the display, if the display involves firing of pyrotechnics to heights over 60 m. CAA, however, has advised the EPA that notification of displays is sufficient and this will be acknowledged, and that this acknowledgement in effect will provide the required 'written agreement'. CAA has specific requirements for when they, or other air traffic control authorities, should be notified and these are detailed in 5.2.7(b).

*e. Test certifier*

The person in charge of a display must apply to a test certifier for a test certificate to conduct an outdoor pyrotechnic display at least three days before the display.

Standard application forms are available on the EPA website at www.epa.govt.nz.

A copy of this application form is also attached as Appendix A.5.1.

Applicants must attach a display plan, showing:

- That the approved handler in charge of the display has a certificate indicating competence for the height of display planned,

- The name of the manufacturer, and the size, type, and number of pyrotechnic articles to be used in the display,
- Details of positioning of firing points and mortar tubes, and the methods of firing,
- That the discharge area and exclusion zone boundaries are the right size (a site plan must be included, showing the lines of flight of aerial shells),
- That the person in charge of the display has organised the safety and security of personnel, site and materials, and
- That the safety requirements of the Controls Regulations, e.g. regulation 42 and 43, have been met
- The names and responsibilities of all authorised persons operating the display.

Evidence must also be provided with the test certificate application that all the correct people have been notified, and the written approvals have been collected.

A model display plan is attached as Appendix A5.5.

A test certificate template for a pyrotechnic display is attached as Appendix A5.2.

### 5.2.7. Notifications

Notification of an outdoor pyrotechnic display must be sent to:

a. The relevant enforcement authority (e.g. Labour Group of the MBIE), and

b. The relevant air traffic control unit or CAA

#### *a. Labour Group of the MBIE*

The person in charge of a display is required by law to notify the MBIE at least three working days (where possible, five is recommended) in advance of any outdoor pyrotechnic display. This must include:

- The date and time of the display,
- Postponement date (if any),
- Location,
- The number of firings (which is the number of times a portfire is applied to a fuse, or an electrical ignition is initiated by pressing the button on an electric firing system or by a computer firing system),
- The name and registration number of the person in charge of the display and
- Contact details for the person in charge of the display.

The display plan must be made available to a MBIE inspector, should they wish to see it. It is recommended that a copy of the test certificate also be submitted to the Labour Group of the MBIE prior to the display.

*b. The relevant air traffic control unit or CAA*

Controlled Aerodromes

- All outdoor pyrotechnic displays held within 15 km of a controlled aerodrome must be notified to the relevant air traffic control unit not less than 5 days prior to the display,
- If the display is more than 15 km from a controlled aerodrome and the projectile height is to be higher than 120m above surface level, the CAA must be notified not less than 5 days prior to the display.

Uncontrolled Aerodromes

The CAA must be notified within 5 working days prior to an outdoor pyrotechnic display if the display is:

- within 4 km of an uncontrolled aerodrome and the projectile height is to be higher than 45m, or
- more than 4 km from an uncontrolled aerodrome and the projectile height is to be higher than 120m above surface level.

Appendix 4 contains a list of controlled aerodromes and the contact details of the relevant air traffic control unit. CAA contact details are also provided in Appendix 4.

### 5.2.8. Recommended notifications

In addition, the following should be notified by fax or email (five days notice is recommended):

- The National Rescue Coordination Centre (for displays on water),
- The local Maritime Safety Authority (for displays on water),
- The local Coast Guard (for displays on water),
- New Zealand Police and Fire Communications Centres,
- Local community groups if community likely to be affected and
- Local authorities or iwi authorities (if relevant, refer sections 2.5.7 and 2.5.8).

Police and Fire Communications should be telephoned shortly before firing.

## 5.3. Setting up the pyrotechnic display

### 5.3.1. Location

The location of a pyrotechnics display influences any special requirements that apply. Special requirements apply for pyrotechnics fired:

- from elevated positions (e.g. the tops of buildings)
- from floating vessels and floating platforms,
- from moving platforms,
- from aircraft and
- in stadiums.

The test certifier should be consulted during the planning stages for all such displays. The test certifier needs to understand and approve the product selection, in view of the planned location.

*a. Elevated positions*

The exclusion zone for a pyrotechnic display fired from an elevated position must be calculated in a horizontal direction, on the plane of firing.

Then allowance must be made for debris falling the extra distance from the roof to the ground which will have a wider fallout zone than that of a display fired from the ground and the exclusion zone should make allowance for this. Wind speeds will be higher on an elevated platform than at ground level and due allowance must be made for increased drift distances of debris.

The only situation where extra allowance need not be made is when the pyrotechnic products selected for such a display are all of the type that are consumed in flight, such as mines, comets and some Roman candles.

Large Roman candles may expel large plugs (sometimes burning) from between the stacked shots, and are therefore not recommended.

Inspection of the product by disassembling in a manufacturing facility and test firing may be required to establish that the product does not expel anything other than burning pyrotechnics and light cardboard debris.

Multishot mines in particular may have different products in the finale tube which could include hard plastic and heavy cardboard debris.

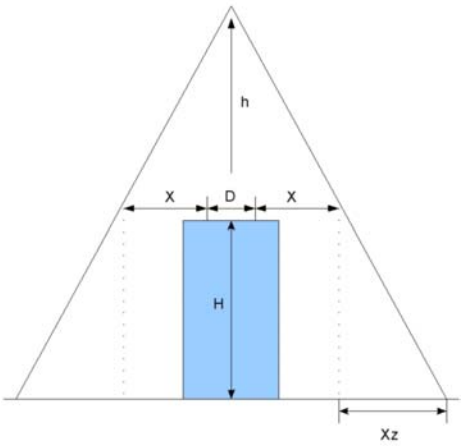
If the product is not consumed in flight, clearance must be available for debris to drop. This should extend out in a cone based on the height of the product fired, and the radius of the exclusion zone.

For example, a product fired on an elevated platform, rising to 50 metres and needing a 50 metre exclusion zone if fired on the ground, would have a cone of 45 degrees semi angle extending down to the ground to define the ground exclusion zone radius.

See Figures 5.8 and 5.9. In these diagrams, the conventional discharge area (D) is surrounded by an exclusion zone (X), on top of an elevated platform height H, firing pyrotechnics to a height of (h). It is clear that an additional exclusion zone (Xz) is required.

In Figure 5.8, there may be buildings in the total exclusion zone which require inspection and preventative measures as for the firing site building.

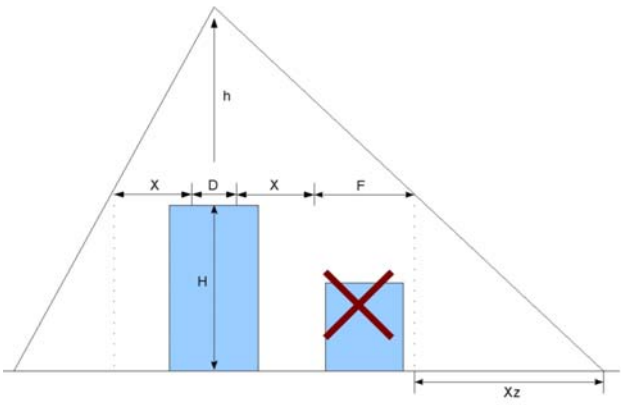
Figure 5.8




In Figure 5.9 where starshells might be used on a hill or an isolated building of substantial solid construction, an additional distance is allowed in the line of flight of the shells (in which direction the mortars will be inclined).

Here there could be no buildings or vulnerable structures in the total exclusion zone, as falling starshells could burst alongside buildings.

Figure 5.9




Aerial shells and other pyrotechnics must not be fired from buildings, unless the area is large enough to accommodate the entire calculated exclusion zone based on the above Figure 5.8.

Other factors to consider are:

- The composition of the roof or other surface from which the display is being fired,
- Fire escapes and fire exits not blocked by pyrotechnics,
- The possibility of smoke entering a building's air conditioning system and
- Unpredictable, strong and erratic winds around buildings.

*b. Floating vessels and floating platforms*

Many pyrotechnics displays on rivers and near the coast are fired from floating vessels (such as barges) or floating platforms. These vessels or platforms must be able to maintain relative position by their own power or a tug or anchor. The minimum calculated clearance distances must be maintained at all times. There must be a dedicated craft available for the emergency use of the crew on the barge or platform even if there is a secure refuge available for them which is safe for the sizes of shells being fired.

*c. Moving platforms*

The firing of pyrotechnics from a moving vehicle or platform (including any land-based or water-based vehicle, regardless of its form of propulsion) requires careful risk-assessment.

*d. Aircraft*

The Civil Aviation Authority and local authorities may require approval to be granted and should be approached early in the planning stages.

*e. Stadiums*

Pyrotechnic shows in stadiums are characterised by specific additional risk factors.

The generally rectangular or oval nature of the ground limits the allowances which can be made for wind direction. A wind across the ground would mean only small pyrotechnics could be used.

If the stadium is enclosed, or has high stands, turbulent wind rotors can carry debris up into the roof structures.

Moving the firing points to windward is not necessarily a good idea as there may be counter wind rotors carrying debris in the opposite direction.

The audience surrounds the area 360° and frequently seating is raked as in sports stadiums. This means the audience presents a large potential target for mishaps, in no matter which direction debris might fly.

Old wooden stands accumulate debris underneath them and can be a potentially very serious fire risk.

The show almost inevitably will include sports fixtures or entertainment of some sort, such as car races, which are tightly scheduled. This places additional pressures on the person in charge of the display to maintain safety distances, secure pyrotechnics and control other officials and workers in the area. It also places extreme pressure on the team to remove pyrotechnics after the firing before time has elapsed to allow debris to cool down and misfires to be checked for.

While a misfire with a directly electrically operated pyrotechnic item (no fuse) is almost always immediately safe, the schedule pressure can preclude rational judgements as to what is safe and what is not.

Ground areas will need protection against burning debris, and also against infrared radiation from the pyrotechnics which can kill or brown the grass. Unburnt stars, which can be dropped from starshells and some types of mines, will damage grass, killing areas of the turf.

While a stadium may have the clearance distances to fire 125 mm shells, according to the regulations, considering the greatly increased audience density and coverage, it would be unwise not to make extra allowance in calculating exclusion zones.

The following should be carefully checked for stadium shows:

- Stadium dimensions,
- Exclusion zones,
- Allowance for wind directions and changes,
- Calibration of the pyrotechnics to precisely establish their operation,
- Schedule of acts,
- Liaison with the stadium manager to ensure the pyrotechnic needs are fully considered and met,
- Analysis of the schedule and provision of staff to operate the display within the time constraints and
- Overall control person with no duties other than directing the operators with radio communication.

### 5.3.2. Documentation

The person in charge of the display must ensure that all the documentation required by the Regulations and the safety management system is present. This may include:

- Completed notification forms,
- Test certificates for the display and the approved handlers working on it,
- Checklists (refer to Appendix A5.4 for a model Pyrotechnics Display Worksheet),
- Safety information (including Technical Data Sheets where available),
- Work instructions and procedures from the safety management system and
- Plans including emergency plans.

### 5.3.3. Safety equipment, personal protective equipment and other equipment

All safety equipment, personal protective equipment and other equipment must be maintained in accordance with the relevant standard and manufacturer's recommendations e.g. testing and tagging of fire extinguishers by persons trained to do so.

The person in charge of the display must check all equipment, including safety equipment, to verify that it is present, fully serviceable and suitable for the display.

Fire-fighting equipment suitable for the size and location of the display must be present, taking account of weather conditions on the day.

Personal protective equipment must be available for all approved handlers and assistants, adequate to the tasks in which they will be engaged. For example, personnel exposed to flash and flame, unacceptable noise levels and smoke from the pyrotechnics during the display must wear suitable and appropriately rated safety equipment such as:

- Face protection,
- Respiratory protection equipment (e.g. respirator) and
- Ear protection.

Body, head and eye protection must withstand a 100g burning object for 2 seconds, while hearing protection must ensure that personnel are subject to no more than 120 dB during the display.

Pyrotechnics handlers who hand-light pyrotechnics are at greatest risk. Handlers who electrically ignite the pyrotechnics from outside the defined clearance distances of the display site do not necessarily require PPE during the firing of the display.

If the approved handler in charge of a display considers that various items of PPE are not necessary to protect personnel within the defined clearance distances of the display site from harm, the handler should undertake a documented risk assessment to confirm that such equipment is not required. The person in charge of the display should make this risk assessment available to all personnel involved as appropriate.

The person in charge of the display must make sure that that a fully serviceable, operational and appropriate first aid kit is provided at the pyrotechnics display site.

### 5.3.4. Control of public access to pyrotechnics and the exclusion zone

The person in charge of the display must liaise with the event organiser regarding the security requirements for the exclusion zone, including appropriate measures to prevent access to the pyrotechnics, pyrotechnics equipment and the pyrotechnics display site by spectators and other unauthorised persons. These access control measures must apply from the time the pyrotechnics arrive at the site to when cleanup has been completed and all equipment remove. If the person in charge of the display considers that appropriate measures to safeguard the pyrotechnics display site are not in place, the operator may refuse to set up the display or start the display, or may halt it at any time.

Once the pyrotechnics have been delivered to the pyrotechnics display site, they must not be left unattended or unprotected.

The event organiser and the person in charge of the display must provide effective crowd control at the perimeter of the exclusion zone. This may include a combination of trained people with security duties, barriers for the pyrotechnics display exclusion zones for setting up, conducting the display and post display activities, public address announcements and signs.

Prominent warning signs should be posted around the perimeter of the pyrotechnics display site area prior to setting up the display to communicate the hazards associated with the display.

Advance planning must allow for emergency vehicles and personnel to gain access to the site if people are exiting after an incident.

### 5.3.5. Preparing the pyrotechnics

The pyrotechnics must be prepared using safe work practices in accordance with the company's safety management system.

Before preparing pyrotechnics for a display, the person in charge of the display should have incorporated any supplier's operating and safety instructions into the safety management system. If the method of

operation of any pyrotechnic item is unclear, the person in charge of the display must contact the supplier and obtain further advice and instructions.

The pyrotechnics must be unpacked, inspected and prepared in accordance with the person in charge of the display's instructions prior to setting up the display. The pyrotechnics must be set aside when the inspection reveals the pyrotechnics to be of dubious performance or quality (e.g. pyrotechnics with tears, leaks, broken fuses or showing signs of having been wet). After the display, any such pyrotechnics must be either returned to the supplier or destroyed according to the instructions in the safety management system.

When approved handlers and assistants are working with pyrotechnics, risk is minimised by having only those pyrotechnics exposed which need to be exposed. Sealed cartons, self-closing boxes and ready boxes provide an effective method of isolating pyrotechnics from each other, minimise the exposure to other hazards and minimise the consequences should an incident occur.

The person in charge of the display must take measures to protect all pyrotechnics to be used in the display from adverse weather conditions. When pyrotechnics (such as cakes) are set up on damp surfaces, barrier materials (such as plastic sheeting and plastic bags) must be set up under the pyrotechnic. Moisture damaged materials must not be used.

Covers may need to be vented to allow condensation to evaporate to avoid wetting fuses.

### 5.3.6. Loading mortars

Immediately before an aerial shell is loaded into a mortar, the mortar must be examined to confirm that no water, foreign bodies or debris have entered during the setting-up operations. The shell assembly must be loaded into the mortar so that the lifting charge is beneath the shell, with the arrow pointing upwards when the shell is gently lowered into the mortar.

While being lowered into the mortar, the aerial shell must be held by its fuse or by lowering a cord (where provided), so that the shell comes gently to rest at the bottom of the mortar, resting on its lifting charge. The correct seating of the shell may be confirmed by slightly raising and lowering the shell or by measuring the depth of the shell using a pre-marked loading rod. Once the aerial shell is loaded in the mortar, no person (including approved handlers) must pass any part of his or her body directly over the mouth of the mortar. A mirror may be used to inspect the interior of the mortar.

Loaded mortars may have protection (such as foil caps) for the aerial shells from rain, burning debris, flash-over etc.

Barges used as a launch site should be stable and resistant to wave action due to wind or movement of vessels. The positioning of mortars on barges should take account of any wave action and proximity to any metal siding. The mortars and racks must be properly secured.

## 5.4. Securing pyrotechnics and equipment

### 5.4.1. Confinement of pyrotechnics

Extra confinement of pyrotechnics can increase their explosive force. Pyrotechnics should not be unnecessarily confined (for example, fountains should not be placed in tight-fitting mortars). However, the use of light, frangible materials to help secure some items, such as conveyor belting, may make them safer than if they are left free to throw themselves around. Only tested methods carried out by trained personnel should be used.

### 5.4.2. Securing of pyrotechnics

All pyrotechnics and associated equipment must be properly secured so that the pyrotechnics and equipment do not fall over during a display, through either normal or abnormal functioning of the pyrotechnics. Inadequately secured pyrotechnics may shoot burning material towards the crowd, causing serious injuries.

The methods of securing pyrotechnics should take into account:

- Weather conditions, such as rain (when water-proofing must be used to prevent cardboard, fastenings or adhesives weakening) and
- The surface on which the pyrotechnics are being secured (such as a barge, dirt, clay, sand and hard surfaces, e.g. rock and roof tops, etc.).

The person in charge of the display must develop methods to properly secure pyrotechnics. The safety management system must document these, and during a display, handlers and assistants should only be securing pyrotechnics in accordance with the safety management system.

The use of gravity only as a method of securing any pyrotechnics is not an acceptable method of securing pyrotechnics under most circumstances. An exception would be a low, flat unit of multishot mines, significantly wider than it is high. Such units have never, even when the pyrotechnics have blown out the bottom, shown a tendency to turn over.

Suggested methods of securing pyrotechnics are shown in Appendix 13 of this Code.

### 5.4.3. Mortars

Mortars must be used only in accordance with the manufacturer's recommendations and stated design, testing and performance criteria. The use of metal or PVC mortars is prohibited in New Zealand.

*a. Inspection*

To ensure that mortars used to launch aerial shells are maintained in safe functional condition, each mortar must be carefully inspected, before a display, for:

- Visible defects (such as dents, bent ends, damaged interior surfaces, splits, damaged plugs, attachment of plug to mortar and water damage),
- The presence of foreign materials and
- Unexploded aerial shells and components of aerial shells.

Damaged or defective mortars must be disposed of or destroyed as soon as practicable.

*b. Size*

The size of mortars is measured by their internal diameter. To assist in their ready identification during setting up and at the display site, mortars should be marked with their different sizes.

*c. Support, protection and securing*

The systems used to support, protect and secure the mortars and pyrotechnics must perform satisfactorily during normal or abnormal functioning of the pyrotechnics. These systems may include:

- Securing of the mortar to stakes, posts, or racks (or racks on trailers),
- Partial burial of the mortar in the ground or sand/earth filled bin to an appropriate depth (with some form of moisture protection, such as a plastic bag) or
- Partial burial of the mortar in the ground or sand/earth filled bin with additional sandbag protection to achieve protection of the required total height.

Mortars must be supported, braced, or secured regardless of the location (including securing to the ground or surface beneath the mortar) in such a way as to:

- Remain in position when fired during the display,
- Be protected or separated from one another to ensure approved handlers, assistants and the public are protected and
- Ensure that neighbouring mortars are not damaged or realigned due to a malfunctioning shell exploding in the mortar.

The misalignment or dislodgement of a mortar may render the subsequent firing of the shell unsafe or cause the shell in an adjacent mortar to sympathetically explode or otherwise perform unsafely.

*d. Rack systems*

The fragments of a rack system become dangerous debris with the potential to cause injury or to reposition other mortars and racks in the area. Therefore, the size and number of mortars permitted on a rack system may be restricted to reduce the possibility of damage to the rack system. The racks should be secured to prevent their tipping over by attaching stakes or spikes driven into the ground, banding, using A-frames, or other equivalent means.

For chain-fused shells, handlers should be aware of the potential impact of larger shells and use racks of suitable size and sufficient strength to withstand a failure that might cause the mortars to reposition.

Mortars for aerial shells greater than 150 mm must not be placed in racks. The explosive forces produced by aerial shells increase with increasing shell size. An explosive malfunction of larger shells within a mortar increases the likelihood of a mortar explosion and subsequent damage to the rack system.

*e. Trailer-mounted rack stems*

Trailers have an advantage in reducing heavy labour, and providing prompt adjustment to the mortars should wind conditions change. However the decking of standard trailers is of insufficient strength to safely handle the considerable impulse from a mortar when it is fired.

The trailer for a racked mortar system must be engineered and tested to achieve the following:

- Trailer of sufficient strength and with adequate support to provide a stable adjustable platform to fire from,
- Mortars of sufficient strength to retain integrity should an adjacent mortar rupture due to a shell explosion in the mortar,
- System tested so that the premature explosion of starshells in the mortar tube does not damage the rack system, or dislodge the adjacent mortars,
- Racking secured to the trailer,
- Mortars secured to prevent them bouncing out of the rack,
- Trailer designed to be locked into position with adequate fixed jacks,
- Trailer fitted with chocks should it be designed to sit on the wheels while in use,
- If trailer is operated by being jacked off the wheels, supported by sufficient chocking to reduce the bending moment on the structure to safe levels and
- Designed to be loaded so that the approved handler loading starshells does not need to place him- or herself over already loaded mortars.

Salutes up to 50 mm may be fired from adequately spaced mortars fitted in a tested rack on the trailer, but mortars for salutes above 50 mm should be located outside the trailer on individually staked or supported mortars with individual electric firing.

*f. Securing/supporting mortars for starshells*

Mortars for starshells may be secured to stakes or posts. There must be a minimum 10 mm clearance between the stake or post and the mouth of the mortar tube or alternatively the stake or post must not extend beyond the mouth of the mortar so that there is minimal risk that the projected starshell may strike the stake or post on firing. Mortars for starshells may also be supported by the placement of sandbags around the mortar to an appropriate height above the position of the starshell in the mortar.

(Appendix 13 outlines other methods of support for mortars firing starshells.)

*g. Securing chain-fused aerial pyrotechnics*

All chain-fused aerial pyrotechnics devices, including those not in mortar racks (such as Roman candle batteries and multi-tube aerial items), must be positioned securely (by the use of stakes, racks, sandbags, earth or equivalent means) to prevent hazardous movement (such as their tipping over) during operations.

*h. Supporting bundles of mortars*

All mortars in a bundle must be of the same diameter and no larger than 150 mm inside diameter.

Each bundle must have an appropriate means of support (e.g. stakes, group bundling).

*i. Separation and positioning of mortars*

Where practical, greater separation distances than those specified below should be used to provide more space for the handlers and assistants to work and to reduce the chances of crew injury particularly where hand firing is to be employed.

Table 5.2 Minimum recommended separation of mortars

| Internal diameter size of mortar | Minimum separation (see Note 1) |
|---|---|
| 100 mm or less | No separation required |
| More than 100 mm to 150 mm | 0.2 x D (see Note 2) |
| More than 150 mm to 225 mm | 0.5 x D (see Note 2) |
| More than 225 mm to 300 mm | 2.0 x D |
| More than 300 mm | Protection and separation are required |

1. These separation distances are a guide only. Separation is one way of lessening risk of one mortar damaging the next. So is choice of mortar material. All mortar systems and constructions should be tested, whether these recommended distances are followed or not.
2. D = diameter of largest mortar. For example, a mortar with an internal diameter of 150 mm would require a minimum separation from the adjacent mortar by 37.5 mm i.e. 0.25 x 150 mm = 37.5 mm.

*j. Mortars for aerial salute shells*

The mortars for aerial salute shells must be individually supported and separated from other mortars by at least two times the inside diameter of the mortar. Only one salute and no other aerial should be used per rack, unless in a special wide-spaced rack.

*k. Bundles of mortars for aerial shells*

All bundles of mortars for aerial shells must be appropriately separated so that a malfunctioning aerial shell exploding in a mortar will not damage or realign a neighbouring bundle of loaded mortars. Only one salute and no other aerial shells are permitted per bundle.

*l. Delay chain-fusing of aerial shells*

Additional protection measures are necessary when aerial shells are fired delay chain-fused (such as for sequential firing in barrages and finales). These may include:

- Increasing the separation distance between the mortars,
- Constructing suitable racks or
- Both of the above.

Such measures are necessary to prevent adjacent mortars from damage or repositioning or loaded aerial shells in adjacent mortars from sympathetic initiation, should a shell explode in a mortar, causing it to burst.

Unless witnessed test firings demonstrate that a malfunctioning aerial shell will not damage or realign a neighbouring loaded mortar, the protection provided must be equivalent to burial of the mortars with a separation of at least three diameters.

To prevent the repositioning of buried mortars, mortars must be separated from each other by at least four times their diameter. If the strength of the racks holding mortars for delay chain-fused aerial shells is uncertain, the clearance distances from the racks to spectators must be twice those prescribed in the Regulations for the largest mortar in the sequence. Racks for mortars of chain-fused aerial shells must be positioned perpendicular to spectator viewing areas.

*m. Securing multiple racks together in a single system*

More than two individual racks may be joined together into a single system and secured, provided that certain control measures have been adopted. This practice is sometimes referred to as cubing or a dense pack. This design has particular benefits as follow:

- Creates a more stable cubic arrangement of mortars and
- Allows for easier and quicker set-up, particularly on barges or other sites where access can be difficult, because a large number of racks and mortars are carried as a single item. (Securing such a device also saves time for the person in charge of the display.)

The control measures for adoption for securing multiple racks together into a single system include:

- The use of racks of certified design and performance,
- The application of the requirements applying to individual racks in the sections above e.g. stand-off distances,
- The permitting of electric firing of shells only,
- The permitting of chain-fusing where rack construction is robust and tested to show sufficient strength to restrain the mortars in the event of a shell exploding in a mortar,
- The securing of racks together e.g. by cross braces. (Methods of securing the system must meet the general requirements for securing.),
- Loading and checking of mortars carried out methodically according to the design of the rack,
- A minimum spacing between the mortars in all directions sufficient to ensure the integrity of the pack should a shell explode in the mortar,
- A maximum permitted shell size of 150 mm diameter.

*n. Pre-packaged multi cake mortar pyrotechnics*

These need to be approved by the EPA, tested by the manufacturer and suitably barricaded when used. They have been known to split apart on occasion. Pre-packaged mortars and shells are now classified as 1.2G and are currently difficult to import due to shipping companies' reluctance to handle 1.2G.

### 5.4.4. Securing strings of crackers

A string of crackers must be suspended in such a manner that it does not risk causing, or contributing to, injury to persons or damage to property.

Any stand used must be strong enough for the weight and explosive blast of the crackers and adequately secured to prevent it from falling over or toppling.

When crackers are being used as an outdoor ground effect, an exclusion zone with a radius of 25 metres must be maintained.

Gunpowder crackers rather than flash crackers may be preferable for some purposes. They are lower powered and can be used outdoors without a shroud.

Strings of crackers should not contain clay plugs.

### 5.4.5. Loading of aerial shells

Aerial shell pyrotechnics must be prepared for use at the display site or at a location at a safe distance from protected works and the public. The reloading of aerial shells into mortars during an outdoors pyrotechnics display is a high risk activity and should not be carried out.

An aerial shell must be carried by its body and not its fuse, unless the manufacturer and supplier have explicitly recommended carriage by the fuse in the safety and performance information provided. Aerial shells must be checked to ensure a proper fit into the mortar, varying from a close sliding fit to 10% diametrical clearance. Shells that do not fit into their appropriate mortars must not be used. They must be labelled “reject”, put aside and the supplier notified. Unless they can be safely returned to the supplier, they should be disposed of or destroyed according to the person in charge of the display’s safety management system.

## 5.5. Electric firing of pyrotechnic displays

Electric firing involves the use of electric fuseheads and an electric firing unit (or controller). The electric firing unit can range from a very simple device to a computer-driven unit synchronised to music. With proper training, experience and equipment, the electric firing of pyrotechnics increases safety approved handlers and assistants who are isolated from the pyrotechnics as they are fired.

### 5.5.1. Electric firing hazards

There is a very low probability that electric fuseheads may inadvertently ignite because of their sensitivity to the following:

- Friction (such as the rough attachment or removal of fuseheads or quickmatch),
- Impact (such as dropping the electrically fused pyrotechnic),
- Radio transmissions and radio frequency energy,
- Stray electricity (such as electrostatic discharges and electrical storms, inadvertent contact with other ignition sources).

Therefore appropriate precautions and good work practices must be adopted such as:

- Maintaining appropriate distances from the sources of electromagnetic radiation,
- Not coiling wires,

- Not using staple guns to secure quickmatch that is connected to aerial shells, mines, or comets, and
- Covering (and securing the cover) all pyrotechnics against rain, move all personnel to the perimeter of the exclusion zone and maintain security, at the approach of an electrical storm, until the storm has passed.

The wiring for electrically fired pyrotechnic displays is not normally earthed. However inadvertent earthing could occur if wire joins were not insulated, and were touching wet ground or metal support structures.

This would not normally be a safety problem, unless the display were being fired close to a power station or substation, or a large radio frequency transmitter, which generated large ground currents.

Near a power station, if it is necessary to use an earth for static electricity protection, no more than one earth should be used. This will avoid earth differential currents flowing in the system.

For recommended distances from radio frequency transmitters, see Appendix 15.

Location dependent static electricity is normally only encountered in wind driven snow. If the crew have just left a vehicle, wear synthetic clothing, use synthetic seating or work at synthetic tables for set up, static charges may be produced.

Precautions are:

- Not using synthetic clothing and underwear,
- Using a high resistance foot earthing strap,
- Not using synthetic tables for set up or using earthing mats on the tables and
- Keeping covers on igniter wire bare ends until the pyrotechnic product is in a safe place.

### 5.5.2. Location of electric firing point

When only electrical ignition is to be used, the handlers and assistants should be positioned at least the required safety distances from any mortar, preferably behind a suitable protective barrier. For pyrotechnics displays on barges or rooftops, a suitable protective barrier may be required unless the separation distances can be met. These protection measures are not required for the electrical ignition of lance work and other small ground level pyrotechnics of similar low hazard. The electric firing point must be positioned so that there is a clear line of sight to the set-up area and all the pyrotechnics ignited by electric firing.

If both hand firing and electrical ignition are to be used during a display, the mortars to be used for hand firing must be separated from the mortars to be used for electrical ignition by a distance of at least:

- 10 metres, if the hand firing and electric firing do not occur together, or
- 25 metres if the two do occur together,
- Electric firing only permitted.

There are certain applications where electric firing provides an acceptable level of risk and hand firing does not. The applications where electric firing only of pyrotechnics is permitted are:

- Multiple racks of salute shells,
- All starshells 125 mm in diameter and greater, and

- All pyrotechnics on floating vessels and barges.

### 5.5.3. Setting up an electric firing display

*a. General steps involved*

In setting up an electric firing display, an approved handler or assistant will:

- Ensure that potential ignition sources are isolated, e.g. cigarette lighters and smoking paraphernalia and high-powered radio transmitters over 10 W,
- Ensure that workers are not distracted by mobile phones or pagers,
- Reduce the chance of access by unauthorised persons to unexploded pyrotechnics and
- Assist cleaning up after the display.

*b. Set-up of electric firing units*

Prior to the pyrotechnics display, an approved handler must inspect the electric firing unit, cables, junction boxes, testing equipment, power supply and electric fuseheads for serviceability and compatibility. The firing unit must not be in test status or armed status during this inspection. It must be provided with at least a two-step positive interlock (with one positive interlock keyed) to prevent accidental firing.

The power sources must have sufficient power to fire all the pyrotechnics ignited by electric fuseheads.

Repairs to cables (but not to firing units, except by handlers fully trained in their maintenance) may be permitted, provided that the system can be returned to full, safe operating condition prior to the display.

The electric firing unit must be set up to permit a clear line of sight from the handler to the pyrotechnics and other parts of the discharge site. However, this is not necessary when an assistant (acting as a spotter) is in direct communication with the handler controlling the operation of the electric firing unit.

To prevent inadvertent ignition of pyrotechnics while they are being set up for firing at the display site (including positioning of the pyrotechnics in the mortars), the following steps may be undertaken:

- Disconnecting the cables from the electric firing unit,
- Disconnecting the batteries,
- If a computer firing system is used, programming a protection system into the computer system.

*c. Testing of firing unit electrical circuits*

Once the pyrotechnics have been set up, the electrical circuits must be tested for continuity, using a blaster's galvanometer or the integral tester from the firing unit. (The firing unit test circuit must be current limited 20 milliamp maximum or 20 per cent of no fire current). During this test, no persons are permitted in the immediate vicinity of any pyrotechnics that have been attached to the electric firing unit or in the set-up area.

If the circuit testing indicates a problem, an approved handler must initially inspect visually any cables, connections, splices or electric fuseheads that appear defective and make the necessary repairs. This inspection must be performed only after the electric firing unit has been switched off or disconnected from the power source and the key removed and kept by the person in charge of the display.

Electrical faults can be detected by testing isolated sections of the electrical circuit and by testing individual wires or the electric fusehead until the fault is detected. This must be done via a meter approved for use with electrical igniters, using no more than 20 milliamps.

Where the test indicates a fault of discontinuity, joins, defective fuseheads or wires must be replaced or repaired as necessary.

### 5.5.4. Electric igniting operations

Pyrotechnics are initiated by inserting the electric fusehead into the quickmatch leader and securing it in this position with tape, twine or some other secure method.

With the exception of indoor pyrotechnics being prepared for use in an outdoor display, any operation involving the attachment, removal or repair of an electric igniter (electric fusehead, etc.) must be carried out:

- In a dedicated area (either at the pyrotechnics display site or off-site in the person in charge of the display's work area) and
- Remote from people, protected works, storages of pyrotechnics (including magazines) and other features which represent an unacceptable risk, should the pyrotechnics accidentally ignite.

It is strongly recommended that rigging not be carried out indoors. If rigging is carried out indoors, then workers should have free and quick access to exits, such as roller doors. There should be no pyrotechnics placed between the workers and the exits.

Fuseheads are easily ignited and are sensitive to many stimuli such as friction. Great care must be taken when fitting and removing fuseheads from pyrotechnics. Fuseheads must not be crushed when cutting the fuse to remove them. Protective shrouds on fuseheads should be left in place whenever similar.

The quantity of pyrotechnics being worked on at any one time must be kept to a minimum. Cartons of pyrotechnics must be kept outside the work area and fused pyrotechnics must be removed frequently from the area.

#### *a. Fusing of aerial shells*

Direct fusing into the lift charge of aerial shells should only be carried out with care and by approved handlers trained to do so.

#### *b. Repairing quickmatch leaders*

An approved handler certified for electric firing may perform minor repairs to quickmatch leaders (e.g. repairing torn paper and fitting replacement fuseheads) provided that the pyrotechnics composition has not been lost and the performance and safety of the pyrotechnic will not be compromised.

Any other repairs should be carried out only by an approved handler whose certificate shows he or she has been trained to carry out repairs.

#### *c. Cutting quickmatch*

Quickmatch may be safely cut by using:

- A sharp knife on a wooden or other non-sparking surface or
- Garden cutters of the blade and anvil type similar to those recommended for high explosives (where the blade cuts against a flat surface or anvil made from plastic, brass or other non-sparking material).

## 5.6. Managing the pyrotechnic display

### 5.6.1. Commencing the pyrotechnics display

*a. General conditions*

The person in charge of the display may commence the pyrotechnics display only when:

- The requirements of the Regulations have been observed and the practices of this Code, or other equally safe practices, have been followed,
- The risk of harm to people and property is at an acceptable level,
- It is safe to commence the display,
- All notifications, test certificates and written agreements from all agencies have been undertaken and are in order, and
- All personnel with duties for the display are ready and in position.

The person in charge of the display must record the relevant information including the set-up, people, features, conditions etc. for the display. Such information should be recorded in a document such as a worksheet, logbook or equivalent. This will permit the handler to assess whether the following are in place:

- An appropriate calculated minimum clearance distance and exclusion zone for the actual conditions,
- The security of the exclusion zone,
- The proper set-up and securing of the pyrotechnics and pyrotechnics equipment,
- All PPE required, present and correctly worn,
- Readiness/preparedness of all personnel and
- Documentation of the time of commencement.

*b. Weather conditions*

On the day of the outdoor pyrotechnics display, the person in charge of the display must determine the anticipated weather conditions at the time of the display from a weather forecast source. The display set-up must take into account the anticipated weather conditions.

The person in charge of the display must respond to conditions prior to commencement of the pyrotechnics display and changing hazards during the conduct of the pyrotechnics display.

For rooftop displays, an anemometer should be used to measure wind speed at the roof level, as this may differ from wind speed at ground level.

The possibility of wind drift of gas plumes from the display to vulnerable persons (such as, for example, rest home residents) should be taken into consideration.

If conditions are unfavourable, the person in charge of the display must either:

- Modify the pyrotechnics display (e.g. firing the smaller calibre pyrotechnics only to ensure that the exclusion zone is appropriate for the actual conditions),
- Modify the exclusion zone to take account of the conditions, or
- Delay, postpone or cancel the pyrotechnics display.

If adverse conditions or a change in conditions (such as a significant change in wind speed or wind direction) significantly affect compliance with the Regulations or present a risk to safety, the approved handler must stop the pyrotechnics display. He or she may recommence the display when satisfied that the Regulations have been complied with and it is safe to resume the pyrotechnics display. He or she must advise the event organiser accordingly.

### 5.6.2. Access by spectator crowd to the exclusion zone

If the spectator crowd enters the exclusion zone during the pyrotechnics display through ineffective security or barriers in controlling the crowd, the approved handler in charge must stop the display. The display may resume only when he or she is satisfied that the exclusion zone will not be entered and the spectator crowd is under control and the Regulations will be observed.

### 5.6.3. Malfunctioning pyrotechnics

If, during the pyrotechnics display, malfunctioning pyrotechnics cause, or are suspected to cause, harm to people or damage to property (including pyrotechnics in the display), the approved handler in charge must stop the display. The display may only resume when he or she has confirmed that it is safe and appropriate to do so.

### 5.6.4. Incident during pyrotechnics display

If a pyrotechnic incident (for definition, see post-display notification form in Appendix 5) occurs during the pyrotechnics display, the emergency plan should be implemented. The pyrotechnics display must be immediately stopped until the approved handler in charge has confirmed that it is safe and appropriate to resume the display.

### 5.6.5. Personnel

*a. Authorised personnel*

The person in charge of the display must authorise and control all personnel permitted within the exclusion zone during the display. The number of such authorised personnel must be kept to a minimum. Tabards, uniforms or identification tags may be used as a means of identification.

The person in charge of the display must ensure that no person is allowed in the exclusion zone while apparently under the influence of alcohol, narcotics, banned substances, medication, fatigue or other condition that could adversely affect judgment, mobility, or stability.

Personnel with responsibilities for crowd control must be properly identified and instructed in their duties.

*b. Spotters*

Unless using electric firing only, and in a position to observe all pyrotechnics and shell flight trajectories, the person in charge of the display must appoint one or more spotters to observe that all pyrotechnics are functioning as intended. If an unsafe condition is detected, such as hazardous debris falling into the audience, the spotter must immediately notify the approved handler to cease firing until the unsafe condition is corrected. The spotter must be in direct communication with the approved handler during the conduct of the display, with an effective means of informing the approved handler of any hazardous condition or situation.

In particular, the trajectory of the first pyrotechnic including aerial shells fired must be observed carefully to confirm that the pyrotechnics function within the exclusion zone and that any hazardous debris or unexploded aerial shells will fall in the exclusion zone. If the initial trajectory is incorrect or there is a change in the environmental conditions, changes with the set-up or exclusion zone may be necessary.

*c. Emergency services personnel*

When present, emergency services personnel (such as the ambulance service and fire protection personnel) and their vehicles must remain at or beyond the perimeter of the exclusion zone during the actual firing of the display. If a situation requires the entry of emergency services personnel into the exclusion zone, the approved handler in charge must halt the display until the situation is resolved and the exclusion zone is once again clear.

At least two qualified first aiders should be present at any display with an audience of more than 5000 people. A dedicated first aider other than the approved handler, should be on duty at the display outside the exclusion zone (though not on any barge or isolated firing site area) and must be dedicated to that duty and not otherwise involved in the display. A person who is a registered nurse, ambulance officer or medical practitioner is an acceptable alternative to a qualified first aider.

### 5.6.6. Firing of Pyrotechnics

Individual display pyrotechnics must be set off strictly in accordance with the person in charge of the display's documented procedures in the safety management system and the approved handler's instructions.

*a. Hand firing*

The quickmatch fuse used for aerial shells to ignite the lifting charge must be long enough to protrude a minimum of 150 mm of fuse from the mortar after the aerial shell has been properly inserted. To allow for the person igniting the aerial shells to safely retreat, the time delay between igniting the tip of the aerial shells fuse and the firing of the aerial shell must not be less than three (3) seconds. A safety cap must be installed over the exposed end of the fuse in such a manner that the fuse is not damaged. The safety cap must be of a different colour from that of the fuse.

Aerial shells, not electrically initiated, must be ignited by lighting the tip of the fuse. The safety cap protecting the fuse must not be removed until immediately before the aerial shell is to be fired. As soon as the fuse is ignited, the firer must withdraw from the mortar area.

Personnel located within the exclusion zone during the display may take refuge in a shelter as extra protection.

*b. Electric firing*

Electrically fired displays do not require safety caps except that the pyrotechnics composition must not be exposed and fuses must be protected against accidental ignition. Furthermore, electrically fired displays do not require a delay period when aerial shells are fired.

Only personnel necessary for the proper and safe firing of the display are permitted in the vicinity of the electric firing unit during the display.

### 5.6.7. Ignition sources

Ignition and light sources not approved by the person in charge of the display's safety management system are not permitted in the exclusion zone. Permitted ignition and light sources may include port fires, flashlights, electric lighting, or other non-incendiary illumination, such as chemilluminescent devices, for illuminating the firing area.

5.6.8 Malfunctioning aerial pyrotechnics

*a. Hand fired shells*

The mortar of a hand fired aerial shell which has failed to leave the mortar must be marked as soon as practicable to indicate the presence of an unfired aerial shell. When an approved handler or assistant detects such a failure, he or she must warn other persons in the area. The misfired aerial shell should be isolated and left for at least 30 minutes before it is returned to storage or destroyed according to the safety management system procedures.

*b. Electrically fired shells*

Personnel entering the area after the pyrotechnics display must be warned if an unfired aerial shell remains. At the end of the display, the mortar must be marked to identify the presence of a malfunctioning shell. The misfired aerial shell should be isolated and left for at least 30 minutes before it is disposed of or destroyed according to the safety management system procedures.

## 5.7. Cleanup and post-display activities

This section includes all activities that should be undertaken after the pyrotechnics display has concluded to establish that the exclusion zone and surrounding areas are safe before the person in charge of the display returns control of the display site to the event organiser.

Personnel must not enter the set up area and post-display activities must not commence on the display site until the person in charge of the display has deemed that it is safe to enter the site and surrounding areas.

### 5.7.1. Use of personal protective equipment

Personnel involved in post-display activities must wear PPE as instructed by the person in charge of the display. Personnel handling pyrotechnics equipment must wear covered footwear. Those people at risk, should a pyrotechnic function during cleaning-up activities, must wear safety footwear and protective clothing (full length cotton overalls or long sleeved cotton shirts and long cotton pants are an acceptable alternative) when handling live pyrotechnics. See Appendix 14 on types and grades of PPE.

### 5.7.2. Inspecting pyrotechnics and equipment

The person in charge of the display should not return control of the exclusion zone to the event organiser until:

- An effective search of the exclusion zone and, if appropriate, surrounding areas has been conducted and
- The person in charge of the display has declared that the zone has been properly cleaned and presents no hazards arising from the pyrotechnics display.

### 5.7.3. Inspecting electric firing equipment

Following displays using electrical ignition, the person in charge of the display must ensure that the electric firing equipment has been turned off and isolated from all power sources before proceeding with other post-display activities. All cables connecting the electric firing unit to the electric fuseheads must be disconnected.

### 5.7.4. Searching for and inspecting unexploded pyrotechnics and pyrotechnics components

The person in charge of the display and assistants must inspect the exclusion zone to locate any unexploded pyrotechnics and pyrotechnics components, such as the insert from a cake and unburnt stars.

While debris fallout and erratic or malfunctioning pyrotechnics are normally contained within the exclusion zone, they may extend to surrounding areas, on occasions.

Pyrotechnics remnants should be checked for any malfunction, including blinds, duds and explosions. Hang-fires which can last for up to 30 minutes (though an hour is a safer time to wait) must be identified and accounted for.

### 5.7.5. Inspecting pyrotechnics equipment

The person in charge of the display, or the approved handler receiving the goods after the display, should inspect all equipment (including methods of securing the pyrotechnics and equipment) for damage and failure. Any damaged equipment should be identified with a damaged or reject tag. The equipment should not be reused until it has been deemed fully serviceable. It should be disposed of at a later date or repaired before reuse.

### 5.7.6. Dealing with unfired or misfired pyrotechnics

Misfires must be dealt with in accordance with the operating procedures of the person in charge of the display.

A shell may misfire because:

- The delay fuse has not connected,
- The delay fuse has stopped burning outside the mortar,
- The electric match has not fired or
- The pipe match leader has a break in the gunpowder core.

It is extremely rare to find a shell without lift charge and this would be normally quite visible by inspection while loading the mortar.

In clearing up after a display it is critical to know which mortars have live shells in them, and consequently which shells might have a smouldering pipe match leader, and could fire at any time.

It will be obvious if the external delay fuse has stopped burning. However it is not necessarily clear whether the electric igniter has fired. The igniter could have been inserted between the paper of the pipe match yet not connected to the fuse. Alternatively, the igniter may have fired, but the pipe match may have a break. Its external paper may still be smouldering in the mortar, and may ignite the remaining live piece of pipe match.

Various techniques can be used to establish if the shell has fired. Pieces of tape placed across each mortar, caps over each mortar or some variation of these can be used.

However, energetic pipe match may blow these “witness devices” off, making it appear as though the shell has fired. They cannot be relied on absolutely.

Alternative techniques can be used to inspect the mortars directly. These include:

- A mirror on an extension arm with a torch attached so the mortar can be viewed indirectly and safely.
- A fishing weight on a length-marked piece of string attached to a short extension pole. This may be dipped into every mortar to establish whether there is a shell in it or not.

Once the presence of misfires has been established, the following procedures or others at least equally safe should be used. Where practicable, the area surrounding an unfired or misfired pyrotechnic (including an aerial shell found during the search) must be isolated to an area at least equivalent to its bursting diameter. The pyrotechnic must not be handled until at least 30 minutes and preferably one hour after the pyrotechnic was fired.

Dousing pyrotechnics with water carries a small risk as it has been known to initiate pyrotechnics. This method of dealing with misfired or unfired shells should only be used if waiting the recommended length of time is not possible.

In circumstances when pyrotechnics are required to be cleared away quickly for the next event (leaving no time to deal with a misfire properly) only pyrotechnics which do not present problems in this matter should be selected and used.

### 5.7.7. Salvaging pyrotechnics

When electrical ignition is used and the firing failure is electrical in nature, the pyrotechnics (including aerial shells) may be appropriately marked and may be salvaged by the person in charge of the display. Where the cause of the misfire is identified and it is safe to recover the aerial shell, the aerial shell may be salvaged by the operator.

Pyrotechnics which are fully serviceable and have not been fired for various reasons (e.g. unsuitable clearance distances because of changing weather conditions) must be properly packaged for transport away from the site. The pyrotechnics may be returned to the person in charge of the display for return to the supplier or stored at an authorised store in the interim. Records of any unused pyrotechnics at any display must be kept by the person in charge of the display and the person in charge of the display indicating the actions taken with those pyrotechnics. The storage and transport of these pyrotechnics must be undertaken in accordance with Chapters 6 and 7 on Storage and Transport, respectively, in this Code.

### 5.7.8. Disposing of pyrotechnics containing residual pyrotechnics composition

See Disposal Regulations, section 5.

Pyrotechnics containing residual pyrotechnics composition may not be deposited in a landfill or sewage facility. The supplier of the pyrotechnics is responsible for providing disposal instructions with the supply of the pyrotechnics. This information will be provided in the Technical Data Sheet and other safety information and incorporated into the person in charge of the display's safety management system.

All pyrotechnics used in the display, which contain residual pyrotechnics composition, must be rendered safe and destroyed. They should be disposed of on site – partially fired pyrotechnics are not approved for transport. The person in charge of the display is permitted to fire safely any partially fired and unfired pyrotechnics or components after the display, provided that:

- The handler has undertaken a risk assessment to confirm that it is safe to do so,
- Conditions permit and
- The clearance distances are suitable.

Misfired pyrotechnics must not be disposed of by burning in an open fire unless the destruction takes place at an authorised and approved destruction facility.

Any pyrotechnics and components of pyrotechnics containing explosive composition which cannot be disposed of in this way must be rendered safe for transport away from the display site. They should be placed in water to ensure that the pyrotechnics composition cannot be ignited, and then transported away from the display site in a superior package.

Used pyrotechnics not containing residual composition (i.e. free from explosives) must not be disposed of before removing or defacing the markings identifying the used pyrotechnics as explosives.

The person in charge of the display should dispose of/destroy pyrotechnics and other materials associated with disposal activities (such as water used to douse pyrotechnics) while bearing in mind the degrees of hazard of the procedures involved, and any likely environmental consequences, e.g. from water run-off.

### 5.7.9. Cleaning up the pyrotechnics display site

The person in charge of the display and assistants must clear the exclusion zone and surrounding areas of all live pyrotechnic debris. Plant, equipment and rubbish associated with the pyrotechnics display may be cleared later by other personnel.

### 5.7.10. Documentation and records

The person in charge of the display must keep documentation and records associated with each display, including:

- The pyrotechnics display plans, notifications and approvals and
- Conditions, circumstances and details of the display e.g. a pyrotechnics industry worksheet or equivalent (refer to Appendix A5.4 for a model Pyrotechnics Display Worksheet).

The person in charge of the display or the person in charge of the display must retain these records and documents for a minimum of 12 months.

### 5.7.11. Notifications

Following the pyrotechnics display, if there have been any explosive incidents or malfunctioning pyrotechnics or equipment, the person in charge of the display should as soon as possible notify:

- The Labour Group of the MBIE and the EPA using a “Post-Display Notification of Incidents” form (refer to Appendix 5.6),
- The supplier of any malfunctioning pyrotechnics and
- The test certifier for the display.

In addition, it is a requirement of the Health and Safety in Employment (HSE) Act 1992 that any incident resulting in a serious harm accident or death must be notified to the Labour Group as soon as possible by phone or fax (0800 20 90 20). Written notice must also be provided within 7 days, on a specified form available on the Labour Group website (http://www.osh.govt.nz/services/notification/accident.shtml).

# Chapter 6: Storage

Refer Hazardous Substances (Classes 1 – 5 Controls) Regulations 2001 (regs 22 – 31) and Hazardous Substances (Identification) Regulations 2001 (regs 51 and 52).

Pyrotechnics must be secured to certain standards or be under the personal control of an approved handler at all stages of their life cycle.

## 6.1. Secure storage

### 6.1.1. Location

Pyrotechnics must always be in one of the following:

- A hazardous substance location (such as a magazine),
- A designated use zone (such as a work area),
- A discharge area (in a display site),
- A designated transfer zone or
- A means of transportation.

Storage areas must be dry, weatherproof, clean and tidy. Test certificates will specify the amount of any type of pyrotechnic that may be stored at a particular hazardous substance location.

Unless under the personal control of an approved handler, pyrotechnics must be correctly packaged and labelled and either under lock and key, or otherwise securely packaged (e.g. during freight transport).

The requirements for storage and hazardous substance locations (including strength, locking arrangements, materials and the need for test certificates) change according to the quantity of pyrotechnics involved. The following tables are given in Schedule 2 in the Controls Regulations.

Table 6.1 Quantities of class 1 substances that activate requirements for establishing a hazardous substance location, and for establishing a controlled zone to limit effects

| Hazard Classification | Quantities |
|---|---|
| 1.1B, 1.2B, and 1.4B | 1 kg |
| 1.1 (other than 1.1B or 1.1C and gunpowder of 1.1D), 1.2, and 1.5 | 5 kg |
| 1.1C and 1.3 (other than 1.3G) and gunpowder of 1.1D | 15 kg |
| 1.3G and 1.4 (other than 1.4S) | 100 kg |
| 1.4S | 200 kg |
| Fireworks 1.3G, 1.4G, and 1.4S controlled under the Hazardous Substances (Fireworks) Regs 2001 | 1 000 kg (gross weight) |

Table 6.2 Quantities of class 1 substances that activate requirements for a test certificate at a hazardous substance location, for a designated use zone, for a designated transfer zone, and for notification of transport

| Hazard Classification | Quantities |
|---|---|
| 1.1B, 1.2B, and 1.4B | 5 kg |
| 1.1 (other than 1.1B or 1.1C), 1.2, and 1.5 | 50 kg |
| 1.1C and 1.3 (other than 1.3G) | 100 kg |
| 1.3G and 1.4 (other than 1.4S) | 200 kg |
| 1.4S | 1 000 kg |
| Fireworks 1.3G, 1.4G, and 1.4S controlled under the Hazardous Substances (Fireworks) Regs 2001 | 10 000 kg (gross weight) |

Table 6.3 Quantities of class 1 substances that activate requirements for securing the substance

| Hazard classification | Lock and key only, when not for sale | Readily move-able containers, when held for sale | Magazines, when not for sale | Magazines, when held for sale |
|---|---|---|---|---|
| 1.1B, 1.2B, and 1.4B | <0.2 kg | <1 kg | >0.2 kg | >1 kg |
| 1.1 (other than 1.1B or 1.1C and gun-powder of 1.1D), 1.2, and 1.5 | <2.5 kg | <25 kg | >2.5 kg | >25 kg |
| 1.1C and 1.3 (other than 1.3G) and gun-powder of 1.1D | <15 kg | <50 kg | >15 kg | >50 kg |
| 1.3G and 1.4 (other than 1.4S) | <15 kg | <100 kg | >15 kg | >100 kg |
| 1.4S | <25 kg | <200 kg | >50 kg | >200 kg |

### 6.1.2. Reducing risk

Segregation requirements for class 1 substances.

In all locations, pyrotechnics must be segregated from incompatible hazardous substances (see Table 6.4 below and Schedule 2 of the Controls Regulations).

The unmarked cells in the following table identify the categories of class 1 substances (shown by the letters at top and left of the table) that must be segregated as required in regulation 21. The marked cells relax the requirement to the extent specified in the keys below.

Table 6.4 Segregation requirements for class 1 substances

| | A | B | C | D | E | F | G | H | J | K | L | N | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | ✔ | | | | | | | | | | | | |
| B | | ✔ | 1 | 1 | 1 | 1 | 1 | | | | | | ✔ |
| C | | 1 | ✔ | ✔ | ✔ | 2 | 3 | | | | | ✔ | ✔ |
| D | | 1 | ✔ | ✔ | ✔ | 2 | 3 | | | | | ✔ | ✔ |
| E | | 1 | ✔ | ✔ | ✔ | 2 | 3 | | | | | ✔ | ✔ |
| F | | 1 | 2 | 2 | 2 | ✔ | 2 | | | | | | ✔ |
| G | | 2 | 3 | 3 | 3 | 2 | ✔ | 4 | | | | | ✔ |
| H | | | | | | | 4 | ✔ | | | | | ✔ |
| J | | | | | | | | | ✔ | | | | ✔ |
| K | | | | | | | | | | | | | |
| L | | | | | | | | | | | | | |
| N | | | ✔ | ✔ | ✔ | | | | | | | ✔ | ✔ |
| S | | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | | | ✔ | ✔ |

Key

✔ The 2 categories indicated by a cell so marked may be stored and transported together without the segregation required by Regulation 21.

1 The 2 categories indicated by a cell so marked may be stored and transported together without the segregation required by regulation 21, provided the category B explosive articles are held in a manner (achieved through containment, internal barricading, or separation distance, or any combination of them) that will prevent their accidental initiation propagating to explosive substances of the other category.

2. The 2 categories indicated by a cell so marked may be stored and transported together without the segregation required by regulation 21, provided the category F explosive substances are held in such a manner (achieved through a combination of containment, internal barricading, and separation distance) that will substantially reduce the risk of their accidental initiation propagating to explosive substances of the other category.

3. The 2 categories indicated by a cell so marked may be stored and transported together without the segregation required by regulation 21, provided the category G pyrotechnic articles are held in a manner (achieved through meeting the packaging requirements) that will prevent their release of loose pyrotechnic substances.

4. The 2 categories indicated by a cell so marked may be stored and transported together without the segregation required by regulation 21, provided they are separated from each other by a wall with a fire resistance rating of 120/120/120 minutes.

### *Separation distances*

At hazardous substance locations, pyrotechnic materials of various kinds must be located at suitable minimum distances apart and under various protections to reduce the level of risk to acceptable levels (see Table 6.5, taken from Schedule 2 of the (Controls) Regulations).

Table 6.5 Quantities of substances above which 250 metre separation required from boundary of discharge area for firing of class 1 category G substances at outdoor pyrotechnic display

| Property of substance | Hazard classification | Quantity (NEQ) for each separate classification |
|---|---|---|
| Explosive | 1.1 | 5 kg |
| | 1.2 | 50 kg |
| | 1.3 | 100 kg |
| | 1.4 | 1000 kg |
| Flammable liquids where held above ground | 3.1A | 50 L |
| | 3.1B | 250 L |
| | 3.1C | 1000 L |
| Flammable solids and oxidising substances | 4.1.3A, 4.2A, 4.3A and 5.1.1A | 50 kg |
| | 4.1.1A, 4.1.3B, 4.2B, 4.3B and 5.1.1B | 500 kg |
| | 4.1.1B, 4.1.3C, 4.2C, 4.3C and 5.1.1C | 5000 kg |
| Self-reactive flammables and organic peroxides | 4.1.2A, 4.1.2B, 5.2A and 5.2B | 10 kg |
| | 4.1.2C, 4.1.2D, 5.2C and 5.2D | 25 kg |
| | 4.1.2E, 4.1.2F, 5.2E and 5.2F | 100 kg |

Any spillage of pyrotechnic compositions must be immediately cleaned up and properly disposed of.

The person in charge of any location where pyrotechnics are stored must ensure that risk of static electricity, heat, accidental ignition of pyrotechnic material or nearby combustible material (e.g. vegetation, fuel stores, paper, cardboard, timber and hay) is of an acceptable level.

Fire protection equipment should be present at any location where pyrotechnics are stored, to the level required by the Regulations, and must be readily accessible to prevent a fire from reaching pyrotechnics.

Fire protection equipment must not be used to fight a fire involving pyrotechnics which are very likely to ignite or have ignited.

### 6.1.3. Lightning protection

Container-type magazines must be grounded in opposite corners against lightning strike and earthing systems approved in any hazardous substance location test certificates.

No person should handle pyrotechnics nor be in a pyrotechnics storage facility during an electrical storm.

### 6.1.4. Separation of activities

A magazine or storage area must not be used as a workshop to undertake any activity on the pyrotechnics such as preparing the pyrotechnic for a display. Pyrotechnics must not be repackaged in the storage area, but in dedicated work areas.

### 6.1.5. Signs

Where certain quantities of pyrotechnics are held, there must be big, clear signs at every entrance to the building and the storage area, and beside any outdoor packages. The signs must:

- warn of hazardous substances and
- describe the kind of hazard (e.g. EXPLOSIVE).

Signs next to or in the storage area must also:

- give safety instructions (e.g. NO SMOKING) and
- tell people simply and clearly what to do in an emergency (see regulation 42 of Hazardous Substances (Emergency Management) Regulations 2001.

Refer also to the HSNO Approved Code of Practice on Signage developed by Responsible Care (formally the New Zealand Chemical Industry Council (NZCIC)). Contact Responsible Care through their website www.nzcic.org.nz.

### 6.1.6. Temporary storage at display sites

Where pyrotechnics are stored temporarily at a display site, the following precautions should be taken:

- Placarding with pictorial signs indicating no smoking and no ignition sources adjacent to the storage,
- Appropriate physical or surveillance security,
- Vehicle placarding, DG documentation and separation distances that comply with the Land Transport Rule for an vehicle used as storage (see Chapter 7) and
- No pyrotechnics left unattended inside vehicles at the display site.

# Chapter 7: Transit, transport and tracking

Refer to regulations 46-52 of the Hazardous Substances (Classes 1 – 5 Controls) Regulations 2001, the Land Transport Rule, 45001/1, and Hazardous Substances (Tracking) Regulations 2001.

## 7.1. Transit

Transfer to or from a location or transfer zone for pyrotechnics must:

- Be under the control of an approved handler,
- Ensure that signage and safety precautions are preserved in each area,
- Have emergency plans in place for the locations and any reasonably foreseeable events.

## 7.2. Transportation

To transport pyrotechnic substances the following are generally needed.

### 7.2.1. A dangerous goods endorsement on the driver's licence or certified completion of an LTSA approved course in transporting Class 1 dangerous goods

However, without the above qualification, an approved handler can transport pyrotechnics of a gross weight of less than 50kg as "tools of trade", providing he or she can demonstrate a knowledge of the associated hazards and relevant safe practice and emergency procedures.

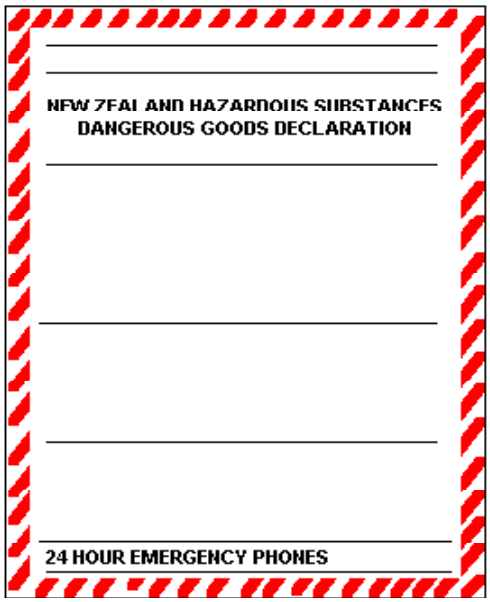
For amounts over 50kg an approved handler must be DG endorsed or have completed an approved LTSA course in transporting dangerous goods, unless his or her Approved Handler training includes transportation of Class 1 dangerous goods.

This system does not require a permit or licensing for the vehicle being used. However the vehicle does need to be safe, with no risk that the exhaust system could set the vehicle on fire, and should carry a fire extinguisher.

A diesel vehicle is recommended for the transport of pyrotechnics.

### 7.2.2. A dangerous goods declaration form

This form (with cross-hatched edges) must be filled out correctly and be visible and accessible when the driver's door is opened - usually in a marked pouch attached to the driver's door. It will include the emergency response information for the goods being carried and 24 hour emergency contact numbers.




### 7.2.3. Explosives placards and signs on the vehicle and packages

The correct Explosives placards must be displayed on the vehicle: front and rear orange diamond explosives symbols, 250 millimetres square, with the correct hazard classification: Class 1.2G, 1.3G or 1.4G.

The correct Explosives signs must be on the packages: the correct hazard class and UN code marked and two 100 millimetre orange diamond explosives symbols on each box of pyrotechnics. A mixed load must use the symbols for the higher risk.


### 7.2.4. Straps

Straps or load restraints should be used to hold the load against normal cornering and braking forces, if the load is not self-bracing due to packing.

## 7.3. Tracking

Refer Hazardous Substances (Tracking) Regulations 2001.

The location and movement of pyrotechnics must be tracked throughout their life cycle, from the time of import or manufacture, to the time of disposal.

Persons in charge of a location where pyrotechnics have been kept (apart from vehicles) must keep records for:

- 12 months after the pyrotechnics have been transferred to another location or
- 3 years after the pyrotechnics have been disposed of.

Records must include:

- The identity, work address and details of certification of the approved handler,
- The identification and quantity of the pyrotechnics,
- The location of the pyrotechnics,
- Details of any transfer to another location (including identification and amount, address of new location, identity and position of approved handler in charge at new location and date) and
- Details of any disposal (manner, date, amount and location).

# Chapter 8: Personnel qualifications

Refer Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001.

## 8.1. Approved handlers

An approved handler for pyrotechnics must hold a test certificate issued by a test certifier qualified to issue certificates in the field of pyrotechnics. The certificate must state:

a. Which hazardous substance(s) the person is approved to handle (e.g. display pyrotechnics, Class 1),

b. Which phases of the pyrotechnics' life cycle the person is approved for (e.g. manufacture, transport, storage, use, disposal) and to what extent,

c. Approved handler's identification, and contact details (work and residential) and

d. Date of issue (the certificate is valid for 5 years).

e. Type of pyrotechnics which the person is trained and competent to handle and therefore certified for. This should specify whichever of the following apply:
   - Indoor (Note – not covered by this Code)
   - Outdoor
     - Level 1: Ground level and low level displays less than 60 m in height. Pyrotechnics in this category should only be of hazard classification 1.3G or 1.4G. This category excludes all aerial shells but may include:
       - lances (of any size)
       - multi-shot cakes/mines (pre-loaded, chain-fused shells in non-reusable mortars) with an internal tube diameter not greater than 30 mm
       - fountains, mines, comets and other ground fireworks not greater than 75 mm internal diameter
       - roman candles with an internal diameter not greater than 50 mm
       - cracker chains
       - catherine wheels
       - falls.
     - Level 2: Level 1 + aerial shells up to 100 mm.
       Pyrotechnics in this category should only be of hazard classification 1.3G or 1.4G. This category may also include:
       - multi-shot cakes/mines greater than 30 mm internal tube diameter
       - roman candles with an internal diameter greater than 50 mm
       - other ground effect pyrotechnics
     - Level 3: Level 2 + aerial shells greater than 100 mm.
       Pyrotechnics in this category may be of hazard classification 1.1G, 1.2G, 1.3G or 1.4G.

f. Type of display the person is trained and competent to operate; this should specify whichever of the following apply:
   - Hand fired
   - Electrically fired
   - General outdoor
   - Elevated positions
   - Floating vessels and floating platforms
   - Moving platforms
   - Aircraft
   - Stadiums.

The test certifier must be satisfied that the person being certified as an approved handler knows and can describe:

- The hazard classifications and possible adverse effects of the pyrotechnics,
- The controls imposed under the HSNO Act on the pyrotechnics, and where to obtain the Regulations,
- His or her obligations and liabilities under the HSNO Act,
- Any conditions of the certificate,
- The precautions required to prevent injury to persons or damage to the environment by the pyrotechnics and
- Emergency procedures for an incident involving the pyrotechnics.

The approved handler must also be able to demonstrate a working knowledge of relevant operating equipment. A written record of training or work that describes the method used to assess a person's knowledge and practical skills, signed by a training provider or work supervisor, is one means of demonstrating to a test certifier that the person is qualified to be an approved handler.

It is recommended (though not required by the Regulations) that approved handlers should be at least 18 years of age.

It is recommended that approved handlers keep a field diary to assist in the recording and verification of the activities in which they gain experience over time.

A template for a pyrotechnic approved handler test certificate is included as Appendix A5.3.

# Chapter 9: Safety and emergency management

Refer Hazardous Substances (Emergency Management) Regulations 2001.

## 9.1. Safety management system

A safety management system ensures that:

a. the risk control measures developed by the person in charge of the display/ approved handler in charge of the display, and

b. all procedures developed to comply with the HSNO Regulations, are both:
   - applied consistently,
   - documented,
   - communicated to all relevant persons,
   - monitored for effectiveness and
   - reviewed at appropriate intervals.

The safety management system should document safe operating procedures covering a range of areas, including:

- Relevant phases of the life cycle of pyrotechnics and pyrotechnics equipment (supply, maintenance, transport, storage, preparation, rigging, cleanup and disposal),
- Control of the pyrotechnics display site (including control of ignition sources, hazards such as drugs and alcohol, security measures, adverse weather procedures, emergency plan, dealing with audience behaviour, etc.),
- Responsibilities and competencies of pyrotechnics personnel (including clear assignation of tasks, direct supervision of non-certified assistants, re-training and up-skilling as required) and
- Reporting, recording and auditing (of Safety and Technical Data sheets, display plans, test certificates, permits, incidents and defects).

## 9.2. Emergency planning

The safety management system may form part of a training manual, or the procedural handbook of a person in charge of the display.

It should always include clear and straightforward instructions for responding to emergencies such as:

- The outbreak of a fire (such as a bushfire or a fire in a building or pyrotechnics store),
- Hazardous malfunctions of pyrotechnics,
- The firing of a pyrotechnic into the audience and
- An injury or medical emergency involving an approved handler, another staff member or a spectator during the pyrotechnic display.

There are 3 levels of emergency management requirements for hazardous substances, depending on the quantity and classification of the substances involved. These levels are described in the Hazardous Substances (Emergency Management) Regulations 2001.

### 9.2.1. Level 1 (information)

A 24 hour emergency telephone number must be available with the pyrotechnics substance, and may be present for example, on the product label or packaging.

### 9.2.2. Level 2 (further documentation and fire extinguishers)

Information available to anyone handling the pyrotechnics should include how to respond in an emergency and how to reduce or eliminate the dangers arising from such an emergency. This information is typically provided on a safety data sheet.

Fire extinguishers must be present in a vehicle or location where the pyrotechnics are held above certain quantities. One fire extinguisher is required to be available if the aggregate quantity of pyrotechnics present is greater than:

- 25 kg, for any class 1.1G, 1.2G or 1.3G pyrotechnic, or
- 50 kg, for class 1.4G pyrotechnics.

Note that fire-fighting in a vehicle or location where pyrotechnics are held must be undertaken only if there is a chance of extinguishing the fire before pyrotechnic initiation. If there is no such chance, people should instantly retire to a safe distance, as fire extinguishers cannot extinguish burning pyrotechnics.

### 9.2.3. Level 3 (emergency response plans and signage)

There must be an emergency response plan available to anyone handling the pyrotechnics, telling the persons how to warn and look after people involved and how to manage the emergency to restrict its effects.

There must be signs giving this information, as well as identifying the pyrotechnics according to the Hazardous Substances (Identification) Regulations 2001 (refer to Chapter 5).

## 9.3. Additional fire-fighting methods

Regulations require that the person in charge must control the exclusion zone such that any fire which starts as a result of ignition by pyrotechnics must not spread more than five metres from the point of ignition.

Techniques to prevent any possible fire spreading include the following:

a. Relying on wet weather and wet vegetation. This is subject to numerous pitfalls such as the dried tops of grass still being a fire risk even though the vegetation underneath is sodden. Tops can burn and the flame travel very quickly if there is a wind blowing.

b. Cutting back grass. It is common for venues to comply with a need for grass to be cut back by cutting it on the day of the pyrotechnic display. This creates additional fire risk, especially if the grass is dry. Tractors and grass cutting equipment around the display area may present other dangers. The

pyrotechnic contractor should liaise with the event manager and/or venue manager to ensure that grass is cut well in advance and raked up if necessary.

c. Placing fire-fighting equipment such as water sprays at a number of crucial locations, so prompt and efficient fire-fighting can be done. Crew numbers must be sufficient to make use of the equipment, should the need arise.

d. Organising an appliance and trained people to operate this. Here it is essential to ensure that ready access is available to all points of the site and beyond. Farm fences, crowd barriers and other obstructions may need to be considered in advance, and any access issues addressed.

e. Arranging fire-fighting by means of helicopters. This may be required as part of the fire safety conditions, when nearby hillsides with poor or non-existent access due to steepness present an additional fire hazard.

The techniques of watering down the grass to reduce fire hazard is not considered effective unless it is over a very limited area (ie a few square metres) which can be thoroughly saturated. It gives a false sense of security and the grass very rapidly dries up by the time of the display. Tens of thousands of litres of water can go nowhere in the height of summer, when hot winds and high temperatures dry up the ground very quickly.

While the regulations state that the maximum wind speed for pyrotechnic displays is 30 km an hour, lower speeds may be still likely to enhance any fire hazard and it may be necessary to postpone a show if the wind conditions are blowing sparks on to sensitive areas with lots of fuel and easy ignition.

# Chapter 10: Purchase, sale and supply of pyrotechnics and pyrotechnics equipment

## 10.1. Pyrotechnics

### 10.1.1. Sale to authorised persons

Pyrotechnics must be supplied at a recognised safety performance level and supported with appropriate documentation.

Persons selling pyrotechnics must be approved handlers and may only sell and supply pyrotechnics to persons who are approved handlers.

The seller must ensure that any person employed in the sale of pyrotechnics is aware of and complies with the relevant procedures and Regulations.

Records and procedures relevant to the sale of pyrotechnics must be maintained, including legitimate validation of any approved handler's test certificate at the point of sale.

### 10.1.2. Reporting of defective or unsafe pyrotechnics

When a pyrotechnics supplier is advised of an incident at a display that has resulted from a defective or unsafe pyrotechnic article, details of this, and the article involved, should be reported to the Labour Group of the MBIE and the EPA as soon as practicable. These requirements apply to any staff or agents of the approved seller.

### 10.1.3. Quality management

All pyrotechnics, whether imported or manufactured in New Zealand, must be approved by the EPA for sale and use in New Zealand. Minor variants on existing products will not need separate approvals.

An import certificate from the EPA must be obtained for every batch of pyrotechnics imported into New Zealand.

All pyrotechnics manufactured in or imported into New Zealand should be supplied with a Technical Data Sheet, which specifies:

- Height of operation,
- Diameter of burst,
- Duration,
- Noise level,
- Nature of falling debris (wads, spacers etc.) and
- Whether items fall to ground level or are destroyed at altitude.

While testing of all pyrotechnics is not possible, as testing destroys the articles, any manufacturer in New Zealand is responsible for:

- Regularly testing products,
- Monitoring their performance and

- Control and disposal of non-conforming products and
- Informing approved handlers who use these products of up to date handling procedures.

## 10.2. Pyrotechnics equipment

No certification is required for the sale or supply of pyrotechnics equipment. However, the supplier has general duty of care obligations, including ensuring that:

- The equipment is safe for use with specified pyrotechnics,
- The purchaser of the equipment is provided, on supply, with suitable information on installation, testing and inspection, use, cleaning and repair, shelf life and service life, and
- The purchaser of the equipment is provided with any information that becomes available after supply if this may impact on the safety of the equipment.

# Appendix 1: Definitions

| | |
|---|---|
| **Act** | The Hazardous Substances and New Organisms Act 1996. |
| **Aerial display** | A pyrotechnic display using timed effects fired into the air. |
| **Aerial shell** | A pyrotechnic article of class 1.1G, 1.2G, 1.3G, or 1.4G that:<br>a. is fired or designed to be fired from a mortar tube; and<br>b. contains a lift charge capable of lifting the article above the firing point before any pyrotechnic display is produced. |
| **Approved handler** | A person who holds a current test certificate certifying that the person has met the requirements of the regulations (Personnel Qualifications) in relation to an approved handler for 1 or more hazard classifications or hazardous substances. |
| **Approved seller** | A person certified under the Act to sell pyrotechnics. |
| **Barrage** | A rapidly fired sequence of aerial pyrotechnics. Mortars are loaded prior to the display and the aerial shells are chain fused to fire in rapid sequence. May be a device preloaded by manufacturer. |
| **Black match** | A fuse made from string impregnated with black powder and used for igniting pyrotechnic devices. Used as the core of pipe match. |
| **Black powder** | Synonym gunpowder: a finely ground and incorporated mixture of potassium nitrate, sulphur and charcoal. Sometimes nitrocellulose rifle and shotgun powders are referred to as gunpowder, but this is not the meaning for pyrotechnics. |
| **Bombardos and barrages** | Small diameter (25–50mm) mortars fastened vertically on to a wooden base of the mortars. The fuses are interconnected and timed to fire in a predetermined sequence after the first fuse is lit. The barrage is the larger and more elaborate of the two. |
| **Break** | An individual burst from an aerial shell or timed air burst multi shot or roman candle effect, generally either producing a visual effect (stars) or noise (salute). Aerial shells can be either single-break (having only one burst) or multi-break (having two or more bursts). |
| **Chain fusing** | A series of two or more aerial shells fused so as to fire in sequence from a single ignition. Multishots, finales and barrages are typically chain fused. Once the initial fuse is lit, the operator no longer has control of the subsequent ignition of pyrotechnic items in the chain. |
| **Delay chain fused** | Pyrotechnic items which have their fuses linked by a length of slow burning fuse, such that they are ignited in series. Once the initial fuse is lit, the operator no longer has control of the subsequent ignition of pyrotechnic items in the chain. |
| **Designated transfer zone** | a. A place used (and required to be designated as such under regulation 46) for the movement of a class 1 substance from one type of transport to another where the movement requires handling of packages or containers; but<br>b. does not include:<br>i. roll-on roll-off operations in which a vehicle or trailer with its load drives or is driven on to or into another means of transport for the duration of a journey; or<br>ii. a hazardous substance location; or<br>iii. a designated use zone. |

| | |
|---|---|
| **Designated use zone** | a. A place used (and required to be designated as such under regulation 32) for the detonation or deflagration of class 1 substances or articles; but<br>b. Does not include a hazardous substance location, a designated transfer zone, or a discharge area. |
| **Discharge area** | A place from which class 1 category G substances are to be fired in an outdoor pyrotechnics display or indoor special effects display. |
| **Discharge into the environment** | a. Includes release from a treatment facility, incinerator, landfill, or sewage facility; but<br>b. does not include depositing or discharge into a treatment facility, incinerator, landfill, or sewage facility. |
| **Documentation** | Includes information recorded electronically. |
| **Double loading** | A technique where an extra shell or a number of smaller shells without lift charge are placed on top of the bottom shell. The lift from the bottom shell projects both starshells upwards to fire at normal operating altitude. The extra starshells may be the same size as or smaller than the bottom shell. |
| **Electric match** | Synonym electric igniter: a device consisting of wires terminating at an approximately 1 or 2 ohm element surrounded with a small quantity of heat sensitive pyrotechnic composition. When a sufficient electric current is passed through the wire circuit, the heat that is generated ignites the pyrotechnic composition producing a small burst of flame. This flame is used to ignite a fuse or a lift charge in a pyrotechnic device. |
| **Electric firing unit** | Synonym firing box: the source of electrical current used to ignite electric fuse heads. Generally the firing unit will have switches to control the routing of the current to various pyrotechnic items and will have test circuits and warning indicators. |
| **Electrical ignition** | A technique used to discharge pyrotechnics in which an electric match and source of electric current are used to ignite fuses or lift charges. The electric fuse heads are attached prior to the display generally with wires connected to an electric firing unit during the display. (The operator or an assistant ignites the pyrotechnics from the electric firing unit during the display.) |
| **End fuse** | A fuse inserted into any pyrotechnic device at the end as distinguished from the side of such item. |
| **Exclusion zone** | A place that receives debris from an outdoor pyrotechnics display or indoor special effects display, and that requires establishment as an exclusion zone under regulation 36 (Controls). |
| **Explosive substance** | A solid or liquid substance (or a mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even though they may not produce large volumes of gases. |
| **Falls** | Tubes suspended on a horizontal rope containing an aluminium rich mixture. This mixture burns pouring silver sparks down for up to two minutes. |
| **Finale** | A rapidly fired sequence (barrage) of aerial pyrotechnics typically fired at the end of a display. The mortars are loaded prior to the display and the aerial shells are chain fused to fire in rapid sequence. |
| **Firecracker** | Synonym cracker: a small cardboard or paper cylinder, 30 to 60 mm in length, |

| | |
|---|---|
| | containing small amounts of pyrotechnic material such as flash powder or gunpowder, designed to explode and make a noise. |
| **Flash powder** | Explosive composition intended for use in firecrackers and salutes. Flash powder produces an audible report and a flash of light when ignited. Typical flash powder composition contains potassium perchlorate, sulphur and powdered aluminium. |
| **Fountain** | Either a sealed cylinder or cone containing pyrotechnic composition designed to eject sparks under pressure which rise and then curve down to the ground. This is as distinct from a gerb where the sparks burn out during the upward flight. |
| **Fuse** | A generic name for a wide range of pyrotechnic materials designed to transport ignition flames either in a timed manner to a series of pyrotechnic items, or to transport the flame inside the pyrotechnic item to ensure ignition.<br>Visco, safety, thermalite, igniter cord, pipe match, tape match, sticky match are some fuse types. |
| **Fusee** | A highway distress flare sometimes used to ignite pyrotechnics at an outdoor display. Often this term is used interchangeably with the word portfire, though a portfire will not be as bright. |
| **Garnishing** | Synonym, parasitic loading. This is the addition of effects such as stars, small timed effects, comets and bees on top of a starshell. The additional weight is gauged as being 30% of a starshell's weight. It is ignited by the flame travelling around the starshell, and is projected out by this excess flame ahead of the starshell. The effect is as if a mine fired at the instant the lift charge was fired. A variation on this is double loading where smaller shells without a lift charge may be placed on top of a large shell. |
| **Girandola** | An array of rockets in a circle that point down at about 45 degrees. The device fires and spins on a central axis, acquiring stability by gyroscopic forces, and then rises vertically about 100 m to finally burst into stars. Other variants may rise, then fire downwards, and then rise again. |
| **Ground display piece** | A pyrotechnic device that functions on the ground (as opposed to an aerial shell which functions in the air). Typical ground display pieces include fountains, Roman candles, wheels and set pieces. Note that there are crossover devices, such as Roman candles that fire shells. |
| **Ground salute** | A salute generally using flash powder, to provide a very loud explosion and flash. A much larger version of a firecracker. |
| **Hazard** | A source of potential harm or a situation with a potential to cause loss. |
| **Hazard classification** | 1. The classification system for hazardous substances comprises:<br>a. numbered classes (for example, class 4) indicating the intrinsic hazardous property of a substance:<br>b. numbered subclasses (for example, subclass 4.2) indicating the type of hazard of a substance:<br>c. lettered categories (for example, category A) indicating the degree of hazard of a substance.<br>2. The combination of numbers and letters used in the classification system constitutes the hazard classification of a substance. |

| | |
|---|---|
| **Hazardous debris** | Any debris produced or expelled by the functioning of a pyrotechnic that is capable of causing personal injury or property damage, including, but not limited to, hot sparks, heavy casing fragments, component fragments, clay plugs and unignited components. |
| **Hazardous substance location** | In relation to a class 1 substance:<br>i. an area where an amount of the substance that is in excess of the relevant quantity specified in table 5 in Schedule 2 (Controls Regulations) is manufactured, or is located for more than 2 hours:<br>ii. does not include any designated use zone or designated transfer zone (as defined in regulation 11) or any means of transport within a transfer zone for the purposes of transfer:<br>iii. does not include a vehicle, ship, or aircraft while it remains under the direct control of its driver, master, or pilot and under the jurisdiction of the Land Transport Rules, the Maritime Rules, or the Civil Aviation Rules, as the case may be: |
| **Helicopter, aerial spinner** | A propeller or blade is attached which upon ignition, lifts the rapidly spinning device into the air. A visible or audible effect is produced at the height of flight. |
| **Indoor pyrotechnics** | Pyrotechnic items that are designed for indoor use and have the characteristics given in regulation 45(2)(a) of the Controls Regulations. Indoor pyrotechnics may be used indoors or outdoors. |
| **Instantaneous chain fused** | Pyrotechnic items which have their fuses linked by a length of quickmatch, so that once the quickmatch is lit, all pyrotechnic items are ignited within a few tens of milliseconds. |
| **Lance** | A thin cardboard tube packed with colour-producing pyrotechnic composition used to construct ground display pieces. Lances are mounted on a frame and fused with pipe match or tape match so that ignition of all tubes is nearly simultaneous. |
| **Lift charge** | That composition in an aerial shell which propels (lifts) the shell into the air when ignited. It usually consists of a black powder charge ignited by a quick match fuse. (A time-delay fuse then ignites the main part of the shell producing the desired effect.) |
| **Manual ignition** | Synonym hand firing: a technique used to ignite pyrotechnics using a hand held ignition source such as a fusee, gas torch or portfire. |
| **Manufacture** | In relation to a class 1 substance or article, includes the following processes:<br>a. making an explosive substance or article:<br>b. adapting an explosive substance or article to make any other explosive substance or article:<br>c. dividing up an explosive article into component parts:<br>d. breaking-up or unmaking an explosive article:<br>e. remaking or altering or repairing an explosive article:<br>f. separating or picking out defective or damaged portions of an explosive article:<br>g. assembling, inspecting, or packaging an explosive substance or article. |
| **Mine** | The effect is a sudden eruption of a multitude of one or many of the following: stars, comets, whistles, bees, streamers, confetti or timed salutes. |
| **Missile-type rocket** | A device similar to a sky rocket in size, composition and effect that uses fins and sometimes spin rather than a stick for guidance and stability. |
| **Mortar** | A tube from which aerial shells are fired into the air. This may be made of cardboard, fibreglass or polyethylene but not metal. |

| | |
|---|---|
| **Multi break shells** | Up to 14 separate starshells, assembled as a column and fired as one starshell. Particularly strong mortars and substantial clearance distances are needed for such shells. A peanut shell is the smallest variant of this. |
| **NEQ** | “Net explosive quantity” for an explosive article is the mass of the explosive components only and is exclusive of any non-explosive components. |
| **Outdoor display pyrotechnic** | Any pyrotechnic intended for use only in outdoor pyrotechnics displays. |
| **Outdoor pyrotechnic display** | Pyrotechnic display held outdoors for an audience of more than one person. |
| **Oxidiser or oxidising materials** | A substance such as a nitrate or perchlorate that readily yields oxygen. This oxygen oxidises the fuels such as carbon metal or organic compounds in the pyrotechnic device. |
| **Peanut shells** | Two starshells of identical calibre held together with a pasted paper link. Both are fired out of a mortar linked together, and burst about a second apart at altitude. |
| **Portfire** | Long tube containing slow-burning pyrotechnic composition which can be used to ignite pyrotechnics at outdoor displays. |
| **PPE** | Personal protection equipment. |
| **Prepare for use** | Operations preparing a pyrotechnic item for a display and involves the fitting of igniters and priming devices such as attaching fuses, quick match and electric fuseheads and repairs to broken leaders. |
| **Quick match** | Synonym pipe match: black match that is encased in a loose-fitting sheath. While exposed black match burns slowly, quick match propagates flame extremely rapidly, almost instantaneously. Quick match is used in leader fuses for aerial shells and for simultaneous ignition of a number of pyrotechnic devices such as lances in a ground display piece. May be plastic or foil wrapped to be water- and spark-proof. |
| **Radianna** | A very complicated Catherine wheel involving lots of mechanical linkages to create complex moving patterns. Numerous drivers and lances are used to create colours and power the wheel. |
| **Ready box** | A storage container for aerial shells at the site of a pyrotechnics display where hand firing is being carried out.□ |
| **Report** | A loud noise intended as the main effect from a pyrotechnic item. The effect from the report is usually achieved by confining flashpowder. Reports are effects from pyrotechnics such as multishot boxed items, aerial shells, crackers, and maroons. |
| **Risk** | The chance of something happening that will have an impact upon objectives. It is measured in terms of consequence and likelihood. |
| **Roman candle** | Heavy paper or cardboard tube containing pyrotechnic composition. Upon ignition, up to 10 stars (pellets of pressed pyrotechnic composition that burn with bright colour) are individually expelled at several second intervals. Also may eject fuse-timed effects like starshells. |
| **Safety cap** | A paper tube closed at one end that is placed over the end of the fuse of a pyrotechnics |

| | |
|---|---|
| | device to protect it from damage and accidental ignition. Extremely important for hand firing. |
| **Safety distance** | The minimum distance from a pyrotechnic firing point to the edge of its exclusion zone, as required by the regulations (Controls). |
| **Safety management system** | A system for managing safety which sets out:<br>• the safety objectives;<br>• the systems and procedures to achieve the safety objectives;<br>• the performance standards to be met; and<br>• the means to maintain these standards. |
| **Salute** | A special pyrotechnic that is designed to produce a loud report. Usually incorporates flash mixture involving aluminium and perchlorates. |
| **Salute powder** | Synonym, flash mix: a pyrotechnic composition which makes a loud report when ignited and constitutes the sole pyrotechnic mixture in a salute. |
| **Self-closing box** | A wooden box with hinged lid fitted with a strap so that the box cannot be left open and will close in normal use. The self-closing box will protect the contents of the box from ignition from flame and flash. |
| **Sky rocket** | Sky rockets contain a wooden stick for guidance and stability and rise into the air upon ignition. A burst of colour or noise or both is produced at the height of flight. |
| **Special effects** | Articles containing any pyrotechnic composition manufactured and assembled, designed or discharged in connection with television, theatre or motion picture productions, which may or may not be presented before live audiences and any other article containing any pyrotechnic composition used for commercial, industrial, educational, recreational or entertainment purposes when authorised by the authority having jurisdiction. |
| **Supplier** | A person who sells, provides, imports or exports explosives, including pyrotechnics. |
| **Test certifier** | A person who has a current approval as such under section 84 of the Act. |
| **Theatrical flash powder** | A pyrotechnic composition intended for use in theatrical shows. Theatrical flash powder produces a flash of light when ignited. Typical theatrical flash powder burns more slowly than salute powder and may also produce a shower of sparks. Theatrical flash powder is not intended to produce a loud report. |
| **Tourbillion** | Consists of a cardboard tube which is made to spin in the plane of its longitudinal axis by a jet projected through a hole at right angles to that axis. A curved piece of wood is secured to the casing forming a pivot on which to revolve when lying on a flat surface and providing the needed lift. |
| **Transit depot** | A permanent place (excluding a means of transport, and excluding any place where the substances are held for sale or supply) used as a transport depot that is designed to hold hazardous substances in containers that remain unopened during the time that they are present at the depot for periods that:<br>a. are more than:<br>i. 18 hours, in the case of a substance that is not subject to the tracking provisions of the Hazardous Substances (Tracking) Regulations 2001:<br>ii. 2 hours, in the case of a substance subject to the tracking provisions of those |

| | |
|---|---|
| | regulations; but<br>b. are in no case more than 3 days. |
| **Vulnerable facility** | Any of the following facilities:<br>a. buildings of 4 storeys or more, of curtain wall construction with panels greater than 1 500 mm square:<br>b. buildings of 4 storeys or more with more than 50% of the wall area glazed:<br>c. any hospital (as defined in the Hospitals Act 1957), early childhood centre (as defined in section 308 of the Education Act 1989), or school (as defined in section 145 of the Education Act 1989):<br>d. public buildings or structures of historic value:<br>e. major traffic terminals such as railway stations and air ports handling more than 1 800 people in 24 hours:<br>f. major public utilities whose service could be disrupted by a blast of 5 kPa:<br>g. any similar facilities. |
| **Waratah** | Y-section steel stake, approximately 40 mm x 3 mm. |
| **Wheel** | Synonym Catherine wheel: device which consists of several cylinders of pyrotechnic material (called drivers) placed almost tangentially but facing outwards in a circle on a frame and fused consecutively. When the drivers are ignited, the wheel spins around a central axis and ejects sparks or colours. Multiple drivers may be used to change colours. |
| **Whistle** | This self-propelled pyrotechnic device acts like a rocket, but at the same time produces a whistling noise. Often finishes with a report. Frequently the flight is quite unstable and erratic. |

# Appendix 2: Pyrotechnics: general principles

## A2.1 Pyrotechnics: general principles

Pyrotechnics are composed of a fuel mixed with an oxidiser along with binders, colouring agents, flow agents and other chemicals to enhance sound or colour production. Sometimes two or more functions may be combined in one chemical such as barium chlorate, where barium gives the green colour, chlorine assists the colour production and oxygen works to burn the fuel.

On other occasions atmospheric oxygen is a major contributor to the oxygen supply, such as for the sparks in fountains and for the stars of starshells in their trajectories. However it is essential to have an initial oxidiser to supply the oxygen to initiate the reaction.

The only obvious exception to pyrotechnics being such a mixture, is in the case of electric igniters which use a substance known as a pyrogen, such as lead styphnate, to create a flash initiated by the hot bridge wire of the igniter.

Pyrotechnics are unlike high explosives which universally, when they explode, cause a supersonic shockwave to travel through the composition.

An extremely wide range of effects may be achieved with pyrotechnic compositions. Depending on the technique of formulation, widely different results may be obtained from a single composition.

A composition may be designed to burn slowly for a fountain, or explode as gunpowder for bursting a starshell. This difference is achieved by relatively small changes in the formulation and method of production.

Although pyrotechnics are not high explosive and so do not send supersonic shock waves through the composition, nevertheless when confined they can produce extremely high pressures, with the power to tear metal apart.

The high variability possible with pyrotechnic compositions suggests the need for excellent quality control. A mixture of aluminium and potassium perchlorate with particle size about that of coarse sugar, 10 mesh, will scarcely burn. Used in the correct ratio, a very fine dust with particle sizes around 400 mesh is powerfully explosive and is used in maroons.

The original quality control is totally under the manufacturer’s care, and apart from observing that the pyrotechnic item is in good condition without leaking powder, damaged clay plugs, water damage or sizing issues there is nothing that an operator can do to check quality until the product is fired.

A number of identical products showing a similar failure obviously indicates a manufacturing defect. But in any group of products, until everyone has been fired one can never know if there is a defect in one of them. This is why generous safety distances are needed for supposedly modest products such as fountains which, if they explode, can throw casing material and support structures about.

It is important to observe that the conditions under which pyrotechnics are designed to work do not get changed. For example crushing the tube of a Roman candle with a wire lashing could break up the effect inside, causing an explosion in the tube, or firing out a dud effect.

Similarly, dropping fountains can damage the clay bungs and cause them to turn into fireballs.

## A2.2 Pyrotechnic chemicals

The chemicals used in pyrotechnics in general are not specifically made for the pyrotechnics industry. For instance aluminium powder is used extensively in high explosives, military flash grenades, military illuminations and paint production.

Ammonium perchlorate was not available to the pyrotechnics industry until it was extensively used in the production of solid fuel rockets.

Potassium nitrate still has military applications and is extensively used as a fertiliser.

So the types of chemicals used over the years will change as industry changes, offering new opportunities for pyrotechnic developments, but also needing thorough testing to ensure that they do not introduce new safety issues.

Recent sensitivity tests on potassium perchlorate compositions, which was hailed as a replacement for the very dangerous chlorate, have shown that they can be as sensitive as chlorate compositions. It seems that it was likely that it may have been impurities in the chlorates and double decomposition reactions that led to the formation of very sensitive compounds, and that pure potassium chlorate is not a major safety issue.

The extensive use of potassium chlorate in smoke compositions without any safety issues arising, argues for it being quite safe under the right conditions.

This again is another reason why maintaining safety distances is important, as the chemistry is always a little uncertain, especially when New Zealand operators have no input into overseas manufacturers' quality control.

## A2.3 Trajectories

A number of pyrotechnics are shot in the air from mortars: Roman candles, single shot mines, multishot mines and starshells.

The trajectory of these may be affected by a number of things:

- The profile and symmetry or lack of it of the object being fired,
- Any trailing string or fuse remaining attached as the object leaves the mortar,
- Balloting in the mortar (bouncing from side to side) partly determined by the clearance of the object in the mortar,
- Spin as the object leaves the mortar,

- Variation in the lift charge,
- Humidity, temperature and atmospheric pressure,
- Wind when the object has left the mortar.

Essentially the firing process is ballistically unstable, and the amount of drift that a dud (blind) shell may experience can be very large.

Dr Ken Kosanke, editor of the Journal of Pyrotechnics, has written up observations following experiments with dud shells. In Journal of Pyrotechnics, Issue 17 Summer2003, “Reasons for Fuse Failure and Drift Distance of Spherical Firework Shells” Kosanke notes:
*For spherical aerial shells, 7.6 cm to 25.4 cm (3 in. to 10 in.) it was found that, on average, duds fall 3.8 m per cm of shell size, from the point ballistically predicted.*
*Further the data suggests that drifts as great as 12 m per cm (100 ft per in.) of shell size may occur nearly 1 percent of the time.*

This means that a 4 inch shell statistically could land 38 m away on average and 1% of the time could land 120 m away. This seems not unreasonable considering the number of factors affecting the starshell ballistics.

Of course the probability of this happening in live displays is low.

Most shells explode in the sky, a few explode in or just above the mortar, and a very few come down as blind or dud shells. Of these that come down we can see that the 50 m isolation distance for the average 100 millimetre shell is just adequate, (38 m).

However 1% of these could come down 70 m into the audience safe area.

If we use some likely but arbitrary figures such as that one in 10,000 shells is blind, and of these blind shells, one in 100 drifts a large distance, there is a one in a million chance of this shell landing among the audience, assuming the audience is all around the pyrotechnics site.

If, however, one in 1000 shells is blind, then there is a one in 100,000 chance of this shell landing among the audience.

### A2.3.1 Control of trajectory

There are two methods of controlling the trajectory, though using the word “control” implies more than operators are realistically able to do.

Consider 100 mm shells, which statistical evidence shows can fall 38 m from the firing point when fired vertically with no wind.

Firstly the mortar can be inclined (angled), which will statistically move the landing zone in the direction of inclination. 1° inclination will move the landing zone 25 m and 6° inclination will move it just over 100 m.

Secondly the wind speed can be measured, and assuming this speed is consistent and has a standard profile of shear (variation with altitude), allowed for.

However it is extremely difficult to accurately position mortars to within 1°. In addition, the wind speed variation in the short term still varies over quite a wide range, approximately 2 to one (see An Introduction to Boundary Layer Meteorology By Roland B. Stull, page 30).

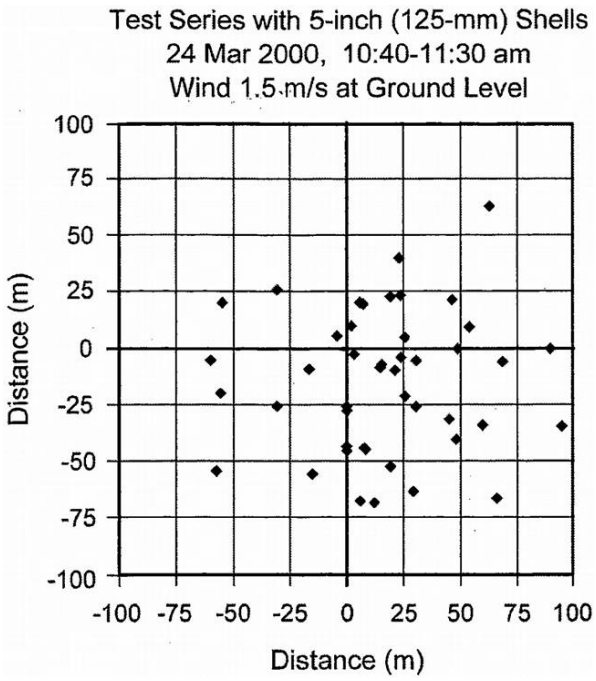
So again using the example of 100 mm shells, 3 metres per second wind speed will shift the averaged falling zone 6 metres, while 6 metres per second wind speed will shift it approximately 22 metres.

Figure A2.1 below shows the results of a test series of firings with 125 mm shells on March 24, 2000. 45 shells were fired in wind of 1.5 metres per second at ground level.

The average drift distance was 45.8 metres.

The maximum drift was 101 metres.

Figure A2.1




Paper by Marc Speer, Speer Pyrotechnik Germany. Courtesy of Journal of Pyrotechnics, Issue 17, Summer 2003. Publisher Bonnie Kosanke.

# Appendix 3: Risk and safety management

The management and measurement of risk involves considering

- The consequences of an event and
- The likelihood of such an event occurring.

Risk may be described qualitatively (or comparatively) as “low”, “medium”, “high” or “extreme”.

Risk is usually evaluated in terms of:

- “Acceptable” (or “tolerable”) or
- “Unacceptable” levels or standards.

Precise application of this approach is problematic for the pyrotechnics industry because so little serious research has been carried out into the actual risk levels of pyrotechnic activities and products. As noted in Chapter 1, observation, judgement, experience and training all form legitimate parts of decision-making by pyrotechnics handlers.

Legislation covering explosives has tended to focus on the potentially catastrophic consequences of an event involving explosives, rather than the low likelihood that it might occur.

The primary objective of such legislation is zero consequence, i.e. the prevention of fatalities and injuries. To achieve this objective, the HSNO legislation has traditionally been prescriptive, imposing strict controls (such as certification) on activities involving explosives.

## A3.1 Adoption of risk management approach

While recognising the need for more research in this area, the Code advocates the adoption of a structured risk management approach, in conjunction with the HSNO Regulations, to reduce the risk of harm to people, property or the environment as the result of activity associated with outdoor pyrotechnic displays.

Risk management involves three distinct steps:

- Recognition
- Evaluation
- Control.

To complete a risk assessment:

### Recognise:

Identify potential hazards in a given situation. This should be done in communication with those who must work in the situation, and should take any historical or research data available into account.

Then identify the at-risk population and any property or environmental elements that may be at risk.

Take into consideration the length and frequency of exposure to the hazard.

### Evaluate:

Here is one of many possible models for this process.

Identify the item (task/area/equipment/ product) that could present a hazard.

Specify the potential harm that could occur with no control measures in place to prevent the hazard.

Identify who or what is at risk from this hazard, i.e. people (staff or the general public), property or the environment.

Rate the likelihood of an accident if no control measures are put into place:

- Negligible
- Unlikely
- Possible
- Likely.

Rate the potentially worst consequences of an accident involving that hazard:

- Insignificant = no injuries, low financial loss
- Minor = first aid treatment, on-site release immediately contained, medium financial loss
- Moderate = medical treatment required, on-site release contained with outside assistance, high financial loss
- Major = extensive injuries, loss of production capability, off-site release with no detrimental effects, major financial loss
- Catastrophic = death, toxic release off-site with detrimental effect, huge financial loss.

Table A3.1 shows how correlating these two factors (likelihood and severity of consequence) give the Qualitative Levels of Risk:

- Low
- Moderate
- High
- Extreme

Table A3.1 Qualitative levels of risk

| Severity of consequence | Likelihood | | | |
|---|---|---|---|---|
| | Negligible | Unlikely | Possible | Likely |
| Insignificant | L | L | L | M |
| Minor | L | L | M | M |
| Moderate | L | M | H | H |
| Major | M | H | E | E |
| Catastrophic | M | H | E | E |

L = Low M = Moderate H = High E = Extreme

The qualitative levels of risk can indicate where to focus efforts for reducing risk to acceptable levels. The person undertaking the risk assessment and reduction should address all “E” (extreme risk) first, followed by “H” (high risk) and then “M” (moderate risk).

“L” (low risk) is an acceptable level of risk. Under certain circumstances, a moderate level of risk may be acceptable if the risk has been minimised as far as is reasonably practicable.

“E” and “H” are unacceptable levels of risk.

## Control

*Level One:*

Eliminate the hazard; for example by removing certain pyrotechnic products or types of equipment from displays altogether. Steel mortars are an example of items previously in use in New Zealand but now prohibited.

*Level Two:*

Reduce the impact of the hazard by:

- Substitution; for example using alternative materials for mortars, such as high density polyethylene, cardboard or fibre-reinforced plastic to replace steel mortars, or using higher quality pyrotechnics with lower risk levels in a display.
- Isolation; for example by following the regulations on minimum clearance distances between the pyrotechnics and the audience, buildings, animals, dangerous goods stores, aircraft etc. Using remote electric firing rather than hand firing where practicable also reduces risk.
- Management control; for example by establishing safe work procedures and ensuring there are sufficient staff, facilities and time allowed for the rigging, firing and clean up of a display, so that personnel do not become stressed or fatigued to the point where they are more likely to make mistakes.
- Engineering control; for example use of sandbags, pyrotechnic barricading, crowd control barriers, shelters, secure storage facilities etc.

*Level Three:*

Personal Protection Equipment (PPE)

This is the least favoured as it only reduces the handlers’ exposure to the risk without actually eliminating or reducing the hazard. However, outdoor displays frequently present noise and low-level debris hazards which make protective equipment essential:

- Hearing protection (The selection may provide for the firing of lift charges to be heard clearly.),
- Eye protection, e.g. safety glasses or full face shield,
- Covered footwear, including safety footwear when handling heavy equipment,
- Natural fibre clothing such as full length cotton overalls or long sleeved cotton shirt and long cotton pants (shortsleeved cotton shirts are permitted as a suitable alternative during setting-up activities), and
- Impact protection e.g. a safety helmet to protect against being hit by falling debris.

# Appendix 4: Contacts

## A4.1 Civil Aviation and other air authorities

A list of controlled aerodromes and their contact details are as follows:

| | |
|---|---|
| Auckland | 09 256 8074 |
| Christchurch | 03 358 1636 |
| Dunedin | 03 486 2628 |
| Gisborne | 06 867 1223 |
| Hamilton | 07 843 4340 |
| Invercargill | 03 218 8089 |
| Napier | 06 835 7584 |
| Nelson | 03 547 9799 |
| New Plymouth | 06 755 0714 |
| Ohakea | 06 351 5422 |
| Palmerston North | 06 357 5169 |
| Queenstown | 03 442 2092 |
| Rotorua | 07 345 5199 |
| Tauranga | 07 575 4144 |
| Wellington | 04 387 1980 |
| Whenuapai | 09 417 7421 |
| Woodbourne | 03 572 8014 |

Civil Aviation Authority contact details:

Phone: 04 560 9400

Email: fireworks@caa.govt.nz

Further information on the CAA requirements are available on their website at:

www.caa.govt.nz/airspace/airspace_hazards.htm#Part 77

## A4.2 Labour Group of the MBIE

General enquiries:

Labour Group

Ministry of Business, Innovation and Employment

P.O. Box 3705

Wellington, New Zealand

Freephone: 0800 20 90 20

Refer to the MBIE website for a list of regional fax numbers and site addresses (http://www.osh.dol.govt.nz/about/region-office/index.shtml).

Email

- HSNO@dol.govt.nz; or
- if you know the name of the relevant HSNO enforcement officer, you can email them at: firstname.lastname@dol.govt.nz

# Appendix 5: Forms and templates

This Appendix contains the following forms:

- A5.1 Model application for a test certificate for an outdoor pyrotechnic display
- A5.2 Test certificate template for an outdoor pyrotechnic display
- A5.3 Test certificate template for a pyrotechnic approved handler
- A5.4 Model pyrotechnics display worksheet
- A5.5 Model display plan
- A5.6 Model form for post-display notification of incidents
- A5.7 NZ Fire Service Agreement
- A5.8 Sample Pyrotechnic Testing Form

## A5.1 Model application for a test certificate for an outdoor pyrotechnic display

**Display name:** **Date:**

PURSUANT TO THE HAZARDOUS SUBSTANCES AND NEW ORGANISMS ACT 1996 and the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001:

I hereby make an application for a test certificate for an outdoor pyrotechnics display, and in support thereof, supply the following particulars:

| | | |
|---|---|---|
| 1. Person in charge of the display: | | |
| 2. Address of person in charge: | | |
| 3. Name of Client: | | |
| 4. Location of display: | | |
| 5. Consent of owner of property: | Name:<br>Contact:<br>Title:<br>Signature: | |
| 6. Name of pyrotechnics supplier: | | |
| 7. Date of display: | | |
| 8. Postponement date(s): | | |
| 9. Approved handler in charge: | | |
| 10. Address of approved handler in charge: | | |
| 11. Details of AH certification:<br>Test certificate No:<br>Expiry date:<br>Approved for level/height of display: | | |
| 12. Other Approved Handler(s): | Name | Test certificate number |
| | | |
| | | |
| 13. Display plan attached, which includes:<br>• A site plan of the discharge area and any exclusion zone<br>• Details of arrangements for identifying and securing discharge area and exclusion zone<br>• The name of the manufacturer, and the size, type and number of pyrotechnic articles to be used<br>• Details of positioning of firing points and mortar tubes and the methods of firing<br>• The names and responsibilities of all authorised persons operating the display<br>• An indication that the requirements of regulation 42 will be met<br>• In the case of aerial displays over 60m in height, an indication that the requirements of regulation 43 | | |

| |
|---|
| will be met |
| 14. Approval of the Principal Rural Fire Officer (if applicable).<br><br>Signature:<br><br>Stamp: |
| 15. Conditions of Rural Fire Authority (if applicable). |
| 16. Approval of the Chief Fire Officer (if applicable).<br><br>Signature:<br><br>Stamp: |
| 17. Conditions of NZ Fire Service (if applicable). |
| 18. Evidence of notification to Civil Aviation Authority/air traffic control unit attached (if required).<br>Controlled Aerodromes<br>• All outdoor pyrotechnic displays held within 15 km of a controlled aerodrome must be notified to the relevant air traffic control unit not less than 5 days prior to the display. (i.e Auckland, Christchurch, Dunedin, Gisborne, Hamilton, Invercargill, Napier, Nelson, New Plymouth, Ohakea, Palmerston North, Queenstown, Rotorua, Tauranga, Wellington, Whenuapai, Woodbourne);<br>• If the display is more than 15 km from a controlled aerodrome and the projectile height is to be higher than 120m above surface level, the CAA must be notified not less than 5 days prior to the display.<br>Uncontrolled Aerodromes<br>The CAA must be notified within 5 working days prior to an outdoor pyrotechnic display if the display is:<br>• within 4 km of an uncontrolled aerodrome and the projectile height is to be higher than 45m, or<br>• more than 4 km from an uncontrolled aerodrome and the projectile height is to be higher than 120m above surface level. |

Signature of Applicant: _____ Date: _____

## A5.2 Test certificate template for an outdoor pyrotechnic display

**Certificate Number**

**TEST CERTIFICATE**

**OUTDOOR PYROTECHNICS DISPLAY**

Issued pursuant to Section 82 of the Hazardous Substances and New Organisms Act 1996

**Name of organisation/organiser:**

**Name of person in charge of display:**

**Address:**

**Telephone:**

**Location of display:**

**Date of display:**

**Time of display:**

**Name of Approved handler in charge:** **Approved handler telephone:**

**Approved handler number:** **Approved handler competency level:**

**This certificate is issued in accordance with Regulation 40 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001. This certifies that the relevant requirements for the outdoor pyrotechnics display recorded on this certificate have been met.**

Level of Display

☐ Level 1 ☐ Level 2 ☐ Level 3

*(Criteria for display Levels 1 - 3 are provided on the reverse of this certificate).*

**Substances/Classes**

Pyrotechnics Class 1 G *(list number & type)*

**Conditions:**

This certificate must be produced at the request of an enforcement officer appointed under the HSNO Act 1996.

**Special conditions:** ***(if any)***

**Test certifier name:** **Test certifier reg. number:**

**Test certifier signature:** *(in full)* **Issue date:**

## Outdoor Pyrotechnic Display Level Criteria

**Level 1**: Ground level and low level displays less than 60 m in height. Pyrotechnics in this category should only be of hazard classification 1.3G or 1.4G. This category excludes all aerial shells but may include:

- lances (of any size)
- fountains with an internal diameter not greater than 125 mm
- multi-shot cakes/mines (pre-loaded, chain-fused shells in non-reusable mortars) with an internal tube diameter not greater than 30 mm
- mines, comets and other ground fireworks not greater than 75 mm internal diameter
- roman candles with an internal diameter not greater than 50 mm
- cracker chains
- catherine wheels
- falls.

**Level 2**: Level 1 + aerial shells up to 100 mm.
Pyrotechnics in this category should only be of hazard classification 1.3G or 1.4G.
This category may also include:

- multi-shot cakes/mines greater than 30 mm internal tube diameter
- roman candles with an internal diameter greater than 50 mm
- other ground effect pyrotechnics

**Level 3**: Level 2 + aerial shells greater than 100 mm.
Pyrotechnics in this category may be of hazard classification 1.1G, 1.2G, 1.3G or 1.4G.

## A5.3 Test certificate template for a pyrotechnic approved handler

**Certificate Number**

**APPROVED HANDLER TEST CERTIFICATE**

Issued pursuant to Section 82 of the Hazardous Substances and New Organisms Act 1996

**Name:**

**Date of Birth:**

**Residential contact details:** **Work contact details:**

**Telephone:** **Telephone:**

**This certificate is issued in accordance with Regulation 5 of the Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001. This certifies that the handler has met the relevant requirements for the substances and lifecycles specified below:**

| **Substances/Classes** | **Lifecycles** |
|---|---|
| Pyrotechnics Class 1G | *[Manufacture, transport, storage, use, disposal]* |

**Conditions:**

Unless surrendered or revoked beforehand, this certificate shall remain in force until [*expiry date*] and may be renewed thereafter by an authorised test certifier.

This certificate must be produced at the request of an enforcement officer appointed under the HSNO Act 1996.

**Special conditions:**

The certificate is **limited** to handlers in control of substances used in:

☐ Outdoor pyrotechnic displays ☐ Indoor pyrotechnic displays

The certificate is **limited** to handlers in control of:

☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ N/A

outdoor pyrotechnic displays only *(Criteria for display Levels 1 - 3 are provided on the reverse of this certificate).*

The certificate is **limited** to handlers in control of the following display types:

☐ Hand fired ☐ Floating vessels and floating platforms

☐ Electrically fired ☐ Moving platforms

☐ General outdoor ☐ Aircraft

☐ Elevated position ☐ Stadiums

**Test certifier name:** **Test certifier reg. number:**

**Test certifier signature:** *(in full)* **Issue date:**

## Outdoor Pyrotechnic Display Level Criteria

**Level 1**: Ground level and low level displays less than 60 m in height. Pyrotechnics in this category should only be of hazard classification 1.3G or 1.4G. This category excludes all aerial shells but may include:

- lances (of any size)
- fountains with an internal diameter not greater than 125 mm
- multi-shot cakes/mines (pre-loaded, chain-fused shells in non-reusable mortars) with an internal tube diameter not greater than 30 mm
- mines, comets and other ground fireworks not greater than 75 mm internal diameter
- roman candles with an internal diameter not greater than 50 mm
- cracker chains
- catherine wheels
- falls.

**Level 2**: Level 1 + aerial shells up to 100 mm.
Pyrotechnics in this category should only be of hazard classification 1.3G or 1.4G.
This category may also include:

- multi-shot cakes/mines greater than 30 mm internal tube diameter
- roman candles with an internal diameter greater than 50 mm
- other ground effect pyrotechnics

**Level 3**: Level 2 + aerial shells greater than 100 mm.
Pyrotechnics in this category may be of hazard classification 1.1G, 1.2G, 1.3G or 1.4G.

## A5.4 Model pyrotechnics display worksheet

# Pyrotechnic Display Worksheet

### 1 Event Details

| | |
|---|---|
| Event Location: | |
| Date of Display: | |
| Time of Display: : | |
| Pyrotechnics Display Test Certificate No. | |

### 2 Key Personnel

| | |
|---|---|
| **Event Organiser:** | |
| Name | |
| Contact Details | |
| **Person in Charge:** | |
| Name | |
| Contact Details | |
| **Approved Handler in Charge:** | |
| Name | |
| Contact Details | |
| AH Test Cert No: | |
| **Test Certifier:** | |
| Name | |
| Contact Details | |
| | |

### 3 Other approved handlers or pyrotechnics assistants including security and first aid personnel

| Name | Activity/Task | Trained for Task | Details of Training |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

## 4 Pyrotechnics for Display

| Type | Quantity | Method of Firing | SDS | Technical Data Sheet |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Additional Notes:

| |
|---|
| |
| |
| |
| |
| |
| |

## 5 Setting up the Display

- List of equipment used

| |
|---|
| |
| |
| |
| |

- Procedures for setting up provided by person in charge/approved handler in charge? Yes No
- Procedures for setting up followed? Yes No
- Perimeter boundary for exclusion zone erected? Yes No
- Signs in exclusion zone erected? Yes No
- Pyrotechnics event organiser advised of their duty of care obligations? Yes No
- Site perimeter boundary secured Yes No

- Site security provided by:

  How many security personnel:

  Security personnel names:

| Event Organiser | Person in Charge | Both |
|---|---|---|
| | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

- Pyrotechnics and equipment secured

| **Method used** | **Tested?** | |
|---|---|---|
| | Yes | No |
| | Yes | No |
| | Yes | No |

| | | |
|---|---|---|
| • No unnecessary confinement of pyrotechnics | Yes | No |
| • Testing of pyrotechnics and equipment satisfactory | Yes | No |
| • No prohibited pyrotechnics present | Yes | No |
| • Approved handler(s) and assistants wearing correct PPE | Yes | No |

## 6 Firing the Display

| | | |
|---|---|---|
| • Crowd Control Satisfactory? | Yes | No |

- Weather conditions at time of display

| | |
|---|---|
| Wind speed | |
| Wind direction | |
| Rain | |

| | | |
|---|---|---|
| • Incidents or misfires? | Yes | No |

| Details: |
|---|
| |
| |
| |

| | |
|---|---|
| • Approx clearance distances from perimeter boundary for | |

exclusion zone to pyrotechnics:

- Size of exclusion zone:

- Estimated distances verified to be correct: Yes No

- Approved handler(s) and assistants wearing correct PPE Yes No

## 7 Post-display

- Pyrotechnics Equipment certified free from unconsumed pyrotechnics Yes No
- Pyrotechnics Equipment certified free from damage Yes No
- Exclusion zone certified free from pyrotechnics Yes No
- Area beyond exclusion zone free from pyrotechnics Yes No
- Site cleaned up Yes No
- Approved handler(s) and assistants wearing correct PPE Yes No

**Details of searches:**

| | |
|---|---|
| Date | |
| Time | |
| Person conducting the search | |

**Display Site returned to the control of the event organiser:**

| | | |
|---|---|---|
| Date | | |
| Time | | |
| Name of event organiser | | |
| Nature of notification | Verbal | Written |

**Explosives Incident**:

| Was there an explosives incident? | Yes | No |
|---|---|---|

| **Pyrotechnics malfunction?** | Yes | No |
|---|---|---|
| Name of product? | | |
| Supplier of product? | | |
| Supplier notified? | | |
| Details of Malfunction: | | |
| | | |
| | | |

| **Pyrotechnics misfire?** | Yes | No |
|---|---|---|
| Details: | | |
| | | |
| Disposal details | | |
| | | |

| **Injuries?** | | Yes | No |
|---|---|---|---|
| Name of person | | | |
| Status of person | Display staff member | Member of public | |
| Description of event: | | | |
| | | | |
| | | | |
| | | | |

**Complaints**:

| Name of complainant | |
|---|---|
| Date | |
| Time | |
| Details: | |
| | |
| Outcome: | |
| | |
| | |

| Additional Comments: |
| --- |
| |
| |
| |
| |
| |
| |
| |

Signed: _____ Date: _____

Person in Charge

Signed: _____ Date: _____

Approved Handler in Charge

## A5.5 Model display plan

# Display Plan

for

# Millennium Celebration

5th November 2008

| | |
|---|---|
| Event Organiser | Mr. Zak Key |
| Client | Wellington City Council |
| Person in Charge | Ms. Sammy Rambos |
| Approved Handler in Charge | Mr Jonty White |

Issued: 1 July 2008

## Contents Page



**Enquiries -** If you have any questions relating to this Display Plan or other services offered by us, please contact the event organiser (Mr Zak Key).

## Event Organiser

| | | | |
|---|---|---|---|
| Organisation: | | | |
| Name: | | ☎Phone | |
| Postal 🖃: | | Cell | |
| Email | | Fax | |

## Client

| | | | |
|---|---|---|---|
| Organisation: | | | |
| Name: | | ☎Phone | |
| Postal 🖃: | | Cell | |
| Email | | Fax | |

## Person in charge

| | | | |
|---|---|---|---|
| Organisation: | | | |
| Name: | | ☎Phone | |
| Postal 🖃: | | Cell | |
| Email | | Fax | |

## Approved handler in charge

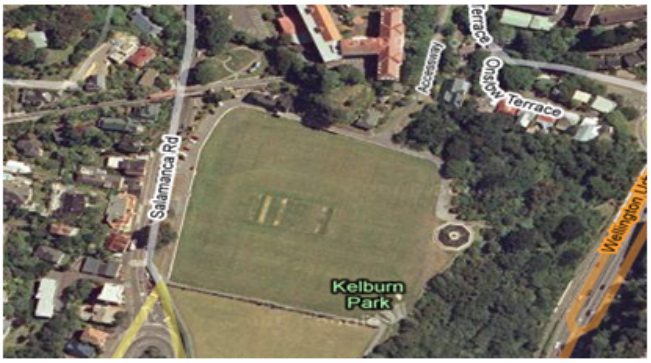
| | | | |
|---|---|---|---|
| Organisation: | | | |
| Name: | | ☎Phone | |
| Postal 🖃: | | Cell | |
| Email | | Fax | |

## Date and Time of Display

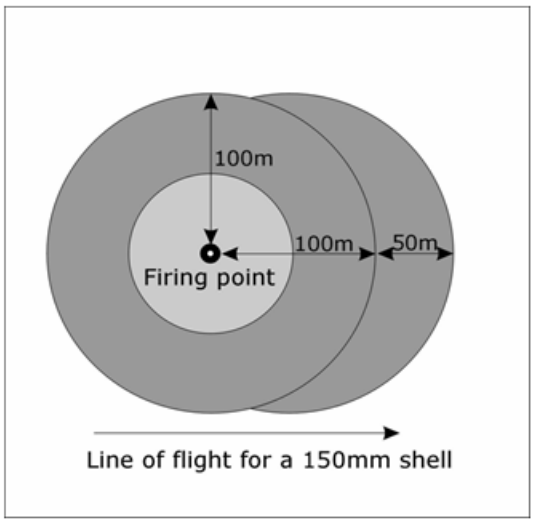
| | | | | | |
|---|---|---|---|---|---|
| Prime Date: | 5th Nov 08 | Start: | 20:00 hours | Conclude: | 23:00 hours |
| Alternate Date: | 6th Nov 08 | Start: | 20:00 hours | Conclude: | 23:00 hours |
| Type: | Aerial Display | Duration: | 8 - 10 Minutes | | |

## Location of Display

| | |
|---|---|
| Location: | Kelburn Park |
| Altitude: | 125 m above mean sea level (AMSL) |
| Latitude: | S 41.16 |
| Longitude: | E 174.46 |



## Fireworks Display Area Site Plan




## List of Aerial Fireworks Used in the Display

| Type of Firework | Diameter of shells | Quantity | Min Clearance Distance | Burst Height | Firing Method |
|---|---|---|---|---|---|
| Titanium Salute | 50 mm (2") | 18 | 50 m | 75 m | Elect - Single Fire |
| Star Shell S/Fire | 50 mm (2") | 30 | 50 m | 75 m | Elect - Single Fire |
| Star Shell S/Fire | 63 mm (2 ½") | 72 | 65 m | 95 m | Elect - Single Fire |
| Star Shell S/Fire | 75 mm (3") | 24 | 75 m | 120 m | Elect - Single Fire |
| Star Shell S/Fire | 100 mm (4") | 16 | 100 m | 170 m | Elect - Single Fire |
| Star Shell S/Fire | 150 mm (6") | 6 | 150 m | 240 m | Elect - Single Fire |
| P/Box Multi-Shell | 50 mm (2") | 1 (36) | 50 m | 75 m | Elect - Single Fire |
| P/Box Mines | 38 mm (1 ½ ") | 1 (16) | 50 m | 5o m | Elect - Single Fire |

## List of Ground Based Fireworks Used in the Display

| Type of Firework | Diameter of shells | Quantity | Min Clearance Distance | Burst Height | Firing Method |
|---|---|---|---|---|---|
| Conic Fountain | Outdoor 1kg | 3 | 50 m | - | Elect - Single Fire |
| Roman Candles | 50 mm (2") | 5 | 50 m | - | Elect - Single Fire |
| Waterfall | 5 m | 1 | 50 m | - | Elect - Single Fire |

## Fireworks Supplier

| | | | |
|---|---|---|---|
| Supplier: | | Email: | |
| Contact: | | Ph: | |
| Postal: | | Fax: | |

## Firing Sequence for Scheduled Display

**Schedule of Pyrotechnic Firing for Millennium Celebration**

Date of Display: 5 November 2008, 20:00 – 23:00 hours

Date if Postponed: 6 November 2008, 20:00 – 23:00 hours

**Show Style** - Preloaded electric fired shells and hand fire all other items.

| Qty | 1 – Opening Sequence | | Loom | Location |
|---|---|---|---|---|
| 3 | Conic Fountain Big Outdoor 1kg | | 1 – 1 | In Ground |
| 5 | Roman Candles 8 ball 1 1/2 " blue Crossette | | 1 – 2 | In Ground |
| 1 | Waterfall 20 drops 5m 60sec | | 1 – 3 | In Ground |
| 1 | Preboxed Multi-Mines 1.5" 16 shell all salutes | | 1 – 4 | In Ground |

| QTY | 2 – Second Sequence | | | |
|---|---|---|---|---|
| 6 | Star Shell 50 mm (2") assorted | | 2 – 1 | Mortar Rack |
| 6 | Star Shell 50 mm (2") assorted | | 2 – 2 | Mortar Rack |
| 6 | Star Shell 50 mm (2") assorted | | 2 – 5 | Mortar Rack |
| 6 | Star Shell 50 mm (2") – Titanium Salute | | 2 – 6 | Mortar Rack |
| 6 | Star Shell 50 mm (2") – Titanium Salute | | 2 – 7 | Mortar Rack |
| 6 | Star Shell 50 mm (2") – Titanium Salute | | 2 – 8 | Mortar Rack |

| QTY | 3 – Third Sequence | | | |
|---|---|---|---|---|
| 9 | Star Shell 63 mm (2 ½") – Red to Silver Peony | | 3 – 1 | Mortar Rack |
| 9 | Star Shell 63 mm (2 ½") – Blue to Yellow Peony | | 3 – 2 | Mortar Rack |
| 9 | Star Shell 63 mm (2 ½") – Red Wave w/Ring | | 3 – 4 | Mortar Rack |
| 9 | Star Shell 63 mm (2 ½") – Green Wave w/Ring | | 3 – 5 | Mortar Rack |
| 9 | Star Shell 63 mm (2 ½") – Gold Rain | | 3 – 7 | Mortar Rack |
| 9 | Star Shell 63 mm (2 ½") – Golden Starburst Tiger Tail Slight Crackle | | 3 – 8 | Mortar Rack |

| QTY | 4 – Fourth Sequence | | | |
|---|---|---|---|---|
| 3 | Star Shell 75 mm (3") assorted | | 4 – 1 | Mortar Rack |
| 3 | Star Shell 75 mm (3") assorted | | 4 – 2 | Mortar Rack |
| 3 | Star Shell 75 mm (3") assorted | | 4 – 6 | Mortar Rack |
| 3 | Star Shell 75 mm (3") assorted | | 4 – 7 | Mortar Rack |
| 3 | Star Shell 75 mm (3") assorted | | 4 – 8 | Mortar Rack |

| QTY | 5 – Fifth Sequence | | | |
|---|---|---|---|---|
| 2 | Star Shell 100 mm (4") – Red Peony Coconut Tree Pistil | | 5 – 1 | Mortar Rack |
| 2 | Star Shell 100 mm (4") – Green Peony Coconut Tree Pistil | | 5 – 2 | Mortar Rack |
| 2 | Star Shell 100 mm (4") – Golden Peony Coconut Tree Pistil | | 5 – 3 | Mortar Rack |
| 2 | Star Shell 100 mm (4") – Palm Tree Red | | 5 – 5 | Mortar Rack |
| 2 | Star Shell 100 mm (4") – 2 Rings Silver to Crackling | | 5 – 7 | Mortar Rack |
| 2 | Star Shell 100 mm (4") – Titanium Salute | | 5 – 8 | Mortar Rack |

| QTY | 6 – The Finale | | | |
|---|---|---|---|---|
| 1 | Preboxed Multiple Shell 2" 36 shell mix colours peonies | | 6 – 1 | In Ground |
| 1 | Star Shell 150 mm (6") – Golden Spider | | 6 – 2 | Mortar Rack |
| 1 | Star Shell 150 mm (6") – Golden Wave to red to blue Chrysanthemum | | 6 – 3 | Mortar Rack |
| 1 | Star Shell 150 mm (6") – Red Green Crackle Chrysanthemum | | 6 – 4 | Mortar Rack |
| 1 | Star Shell 150 mm (6") – Saturn Star | | 6 – 6 | Mortar Rack |
| 1 | Star Shell 150 mm (6") – Time Rain to 1000 T/Salute | | 6 – 7 | Mortar Rack |

## Non-Pyro Hardware

| Ignition Description | N° | Ignition Description | N° |
|---|---|---|---|
| Igniter Daveyfire 2m | 40 | Firing System 12vs 50 Q Switch Box | 1 |
| Igniter Daveyfire 3m | 40 | Backup Firing System | 1 |
| Slow Safety Fuse 3mm, green, 100sec/m/m | 10 | 10 Position Slats | 6 |
| Fast Safety Fuse 2.6 mm | 60 | Continuity Tester | 1 |
| Pyro Ignition - Portfire 5 min | 6 | Pyro Ignition - Bamboo holders for Portfires | 6 |

| Hardware Description | N° | Hardware Description | N° |
|---|---|---|---|
| Gaffer Roll 25m - Grey | | Roman Candle Mortar Rack | 5 |
| C Tape Roll 66 m | 1 | 50 mm (2") Fibre Glass Mortars | 48 |
| Aluminium Foil 90 m roll | 1 | 63 mm ($2^{1/2}$") Fibre Glass Mortars | 90 |
| Plastic Bags – Heavy Duty Small | 1 | 75 mm (3") Fibre Glass Mortars | 24 |
| Plastic Bags – Heavy Duty Med | 1 | 100 mm (4") Fibre Glass Mortars | 16 |
| Plastic Bags – Heavy Duty Large | 10 | 150 mm (6") Fibre Glass Mortars | 6 |
| Tie Down Stakes | 10 | | |
| 200 m twin core copper wire | 10 | | 0 |

## Pyrotechnic Storage Details

Provision for storage of Pyrotechnics prior to firing: Locked HAZSUB Store

Distance of firing area from nearest buildings: 100 metres

During display unfired pieces will be kept under cover: Stored in wooden fire-box trailer

## Names and responsibilities of all authorised persons operating the display

| | | | |
|---|---|---|---|
| AH in charge: | | First Aid: | |
| Assistant: | | Security: | |
| Fire Safety/Spotter: | | | |

## Pyrotechnic Display Risk Controls

**The following Hazardous Substance Controls have been considered:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Administrative Controls | ✓ | Identification and Signage | ✓ | Protective Equipment Clothing | ✓ | | |
| Control of the Ignition | ✓ | Emergency Management | ✓ | Personal Protective Equipment | ✓ | | |
| Segregation and Storage | ✓ | Risk Management | ✓ | Spills and Failures | ✓ | | |

## LACES Safety Briefings

**All personnel shall undertake Safety briefings prior to the beginning of ALL firing sessions. The safety briefings will cover:**

❶ Lookouts

❷ Access & Awareness

❸ Communications

❹ Escape Routes & Equipment

❺ Safety Zones

❻ Personal Protective Equipment

❼ Safety requirements during set up/display

❽ Procedures for "On-Site" Emergencies

❾ Display Close Down Procedures

❿ Announcements about emergency exits/ First Aid points

## Personal Protective Equipment

The approved handler and assistants will be issued with the following items of Personal Protective Equipment which shall be worn at ALL times during the set up and conduct of the display.

| No | Description of PPE | No | Description of PPE |
|---|---|---|---|
| 1 | Level 1 Nomex Overalls | 1 | Safety Helmet |
| 1 | Level 2 Nomex Coat | 1 | Grade 4 Ear Muffs |
| 1 | Level 2 Boots | 1 | Safety Goggles |
| 1 | Face Protection | 1 | Gloves |

## Firing Point Fire Suppression Equipment

Provision will be made to ensure that the following resources are supplied by [event organiser] and that they are available at the firing point during the set up, firing of the display and mop-up and patrol after the pyrotechnic display.

| No | Description of Equipment | No | Description of Equipment |
|---|---|---|---|
| 1 | 9 L Water fire extinguisher | 2 | Fire Beaters |
| 1 | 9 kg Dry Powder fire extinguisher | 1 | Bucket of water |
| 2 | 20 L knapsack sprayers | 1 | First Aid & Burns Kit |
| 2 | Shovels | 1 | HAZMAT Signs and Security Fence |

## Fallout Area Fire Suppression Equipment

Provision will be made to ensure that the following resources are supplied by [event organiser] and that they are manned by competent personnel and available at the edge of the fallout area during the set up, firing of the display and mop-up and patrol after the pyrotechnic display.

| No | Description of Equipment | No | Description of Equipment |
|---|---|---|---|
| 1 | 400 L Smoke Chaser | 2 | Fire Beaters |
| 2 | 4.5 kg Dry Powder fire extinguishers | 1 | First Aid & Burns Kit |
| 2 | 20 L knapsack sprayers | 1 | HAZMAT Signs |
| 2 | Shovels | 1 | HAZMAT Security Tape |

## Record of Consents, Approvals and Notifications

**Consent of Owner** – An application was lodged with the Property Owner [Contact details] on Monday 15th August 2008 seeking consent from the owner of the land to conduct an outdoor pyrotechnic display at [event location] on 5th Nov 2008 (alternative date 6th Nov if wet).

**Rural Fire Authority** – An application was lodged with the Deputy Principal Rural Fire Officer (name) on Monday 15th August 2008 seeking approval to conduct an outdoor pyrotechnic display during the current **OPEN FIRE** season within the Rural Fire District. However, should the Rural Fire District move into a restricted fire season, an application for a fire permit will be lodged with the Rural Fire Authority to determine any fire weather imposed conditions.

**CAA Notification** – The Aeronautical Services Officer (ATS) at Civil Aviation Authority of New Zealand was notified on Monday 11th October 2008 in accordance with the provisions of Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001.

**Enforcement Officer Notification** – The DOL enforcement officer was notified on Friday 13th October 2008 in accordance with the provisions of Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001.

**Test Certificate** – An application will be lodged with John Smith (Test Certifier, TC Company Name) for a Test Certificate for an Outdoor Pyrotechnic Display at least 7 working days before the first firing occurs.

**Record of Display** – Provision will be made by the Approved Handler to ensure that this Record of Display is held on site for inspection by the Enforcement Officer.

**Other Notifications** – Provision has been made by the Approved Handler to ensure that:

(a) Those people with companion animals who might be affected by the display receive prior notice of the fireworks display via [state method], on at least two (2) occasions stating that "a firework display will occur between 20:00 – 23:00 hours on 5th November 2005 at [event location].

(b) Those people who live next to [event location] or along [any vulnerable area] who might be affected by the display receive a copy of the enclosed "Public Notice Fireworks Display 15-10-2008.doc" in their mail box or in person at least two weeks prior to the firework display (23rd October 2008);

(c) **St John** personnel have been advised of the event and are asked to be on site to provide first aid to safeguard the public;

(d) **NZ Police** have been advised of the event and are asked to be on site to provide public order and safeguard the public;

(e) [The client/event organiser] has been advised of the event and asked to supply:

- six (6) fire wardens who will be responsible for crowd control and the safety of spectators outside the exclusion zones. These people shall wear fluorescent helmets and vests and patrol the safety area around the park, to prevent the spectator crowd from entering the fireworks display site area so people do not stray into it by mistake. The Fire Wardens are responsible for monitoring the behaviour of all patrons at the venue.
- one (1) event coordinator who will be responsible for making regular announcements about emergency exits, first aid points and where to get help. The event coordinator will also need to instruct the public not to enter the fireworks display exclusion zones site by announcements over a public address system.

## Specific Safety Conditions

**Internal Fire Prevention –** Fire suppression equipment and competent fire fighters will be on site, relative to the fireworks discharge area, firing points, exclusion zones and site buildings, as may be detailed by the Rural Fire Authority/NZ Fire Service to provide fire suppression capabilities to safeguard the firing team, pyro and non-pyro equipment and vegetation within the discharge area and exclusions zones.

**External Fire Prevention –** Provision will be made by the Approved Handler and Person in Charge of Display to formally notify the NZ Fire Service at least 3 working days before the first firing occurs in the area where the display will occur. The Approved Handler will have a means of calling the NZ Fire Service on 0800 FIREINFO (347 346) from the site.

**Fireworks Display –** Preparation and discharge of fireworks associated with the display will be conducted in accordance with the HSNO regulations and guidelines detailed in the Code of Practice for Outdoor Pyrotechnic Displays, and the manufacturers recommendations.

**Storage –** Fireworks will be kept in a covered day box during the performance except as and when required for the preparation of set pieces or discharging individually.

**Protecting Fireworks –** Fireworks not laid out in readiness for the display shall be kept in a covered day box well back from the ignition area. A heavy canvas tarpaulin will be used as a good cover to protect the fireworks from moisture and falling sparks.

**Audit –** We will count the number of items to be included in the display before laying it out, and again after the display to ensure that no live fireworks are left behind.

**Firing Systems –** a 50 Q Switch Box and up to five 10 Position Slats will be used to remotely-electrically fire one or more electric matches. A Continuity Tester will be used to test the continuity of electric matches and circuits. Portfires shall be used to light ground based fireworks.

**Mortars –** The mortars used for the firing of aerial shells are made of fibreglass and HDPE (High Density Polyethylene) pipe.

**Clear Spaces Around Displays –** The discharge area and exclusion zones shall take into account both the firing points and firing lines of the pyrotechnics being used. The discharge point of display items will be carefully selected to suit venue conditions in order to meet minimum isolation distance requirements from any people, structures, vehicles, boats and aircraft as prescribed within the HSNO regulations. Provision will also be made to secure exclusion zones and an adequate fallout area relative to the viewing audience and any adjacent combustible material.

**Display Site –** The display area is the immediate area where the fireworks display will be conducted, and includes the discharge site, the fallout area, and the required separation distance from the mortars to spectator viewing areas. The display area does not include spectator viewing or vehicle parking areas.

**Discharge Area –** The discharge area is the immediate area surrounding the fireworks mortars used during the outdoor fireworks display. Fireworks will only be discharged from within a clearly defined area and that adequate measures will be taken to exclude combustibles, performers and the public from this area. Any dry vegetation within the discharge area will be dampened down prior to any firing.

**Fallout Area** - The fallout area is the area over which aerial shells will be fired. The shells burst over this area, and unsafe debris and malfunctioning aerial shells fall into this area. The fallout area is the location where a typical aerial shell dud falls to the ground depending on the wind and the angle or mortar placement.

**Risk to Safety** – All due precautions shall be taken including either limiting or cancelling the show if necessary to prevent any possible injury to persons or damage to property. [event organiser] reserves the right to alter the conditions or cancel the Pyrotechnic Display at any stage in the interest of public safety.

**Misfired or Unignited Pyrotechnic Products** – The following procedures will be implemented by the approved handler in charge of the display and/or person in charge of the display in the event of a misfire, or suspicion of a misfire, or explosion of pyrotechnic products.

- No one shall approach the misfire area until 60 minutes or more has passed;
- The misfire is not to be touched for 60 min and until the area is totally free of people;
- The area is to be cordoned off to restrict unauthorised entry;
- Misfire cabling is to be disconnected from the firing device and source of ignition removed;
- The cables are to be made safe by twisting together or sources of ignition removed;
- Misfired pyrotechnics must be re-wired or refused and best disposed of by firing it in a manner recommended by the manufacturer in accordance with the Regulations;
- All loose unfired products must be gathered in a suitable container and either be returned to the manufacturer or destroyed in a manner recommended by the manufacturer in accordance with the Regulations;
- Misfired or faulty products must be recorded in the display register and notified to the Department of Labour, the Test Certifier and the manufacturer.

**Post Display** – On completion of the firework display the approved handler in charge of the display shall ensure the firework display site, discharge area, exclusion zones and fall-out areas are left in a safe condition. Any remaining unfired fireworks will be removed and disposed of in a safe manner.

The firework display site, discharge area, exclusion zones and fall-out areas will be thoroughly searched post firing for any ignited materials, any fireworks that have been overlooked, misfired or the components of which have failed to function and fallen to the ground to ensure no subsequent fire will occur.

Any malfunctions of any firework articles associated with the display are to be reported to the Test Certifier. The area will be checked again the following morning where available light prevents a thorough search. All debris, plus stakes, star pickets, wooden frames, mortars and packaging must be removed from the site.

## Managing Public Health & Safety

Provision will be made to ensure that the following risk control measures are implemented by the [event organiser, the client, the person in charge and the approved handler in charge] prior to the commencement of, during and after the fireworks display.

**Affected Persons** – Provision will be made to ensure that members of the public and people with companion animals who might be affected by the scheduled display are notified at least 7 days and not more than 14 days before the to scheduled display via a Mail Drop, that a firework display will occur with details of time, location and noting that the display is approved and licensed.

A copy of this notification shall be left in the letterbox of each premises adjoining the display site or that would adjoin the display site apart from an intervening road or public area. The wording also needs to include a reminder to people regarding their pets, livestock, horses, small children, etc. safety and comfort during the display.

**Safety & Security** - The immediate discharge area (firing point), safety area, and fallout area and exclusion zones shall be restricted from access and be clearly delineated, to reduce the potential for injury. The area of firework display should be continually maintained for fire and general safety. Communications between operators, security staff and the emergency services will be readily available and effective.

**Fire & Safety Equipment** - All personnel involved in the display shall receive instructions in the use of fire, first aid, and safety and communication equipment in case of an incident.

**Access Display Site Area** - If a spectator enters the exclusion zones, safety area, display area or fallout area during the fireworks display, or if the security or barriers are ineffective in controlling the crowd, the approved handler in charge will stop the display.

**Smoke Traffic Hazards** – Smoke is a particular issue that may have an effect on passing motorists. Provision will be made by the [person in charge, approved handler and event organiser] to ensure that NZ Police and/or Transit will be notified and Smoke Hazard Signs are located at appropriate locations alongside the roadside to warn passing motorists who might be affected by the scheduled display.

**Incident During Display** - If an incident occurs during the fireworks display, the emergency plan will be implemented and the fireworks display will be immediately stopped until the approved handler has confirmed that it is safe and appropriate to resume the pyrotechnic display

**Risk to Safety** – If the approved handler considers that adverse weather conditions, or environmental factors, hazards or members of the public present are at risk, then the Approved Handler may suspend, postpone or cancel the pyrotechnic display.

**Managing Fireworks Display** – The approved handler/person in charge will:

(a) Commence operations and fire the display only when:

- All notifications, permits and approvals have been undertaken and are in order,
- The anticipated weather conditions present no risk to firing or scene safety;
- The proper set-up and securing of the fireworks and fireworks equipment;
- The requirements of the HSNO Act have been observed;

- The requirements of the Health & Safety Act have been observed;
- The risk of harm to people, fauna, property and vegetation is at an acceptable level;
- All personnel with duties for the display are ready and in position;
- It is safe to commence the display for the actual conditions;
- The firing area and exclusion zones are cleared of all unauthorised people; and
- The firing area and exclusion zone is secure; and
- The advertised time for the display has arrived; and
- All devices are ONLY fired upon order or signal of the approved handler

(b) Cease operations and the display, when:

- It is UNSAFE to continue the display due to actual conditions;
- The firing area and exclusion zone has been breached by people of fauna;
- The risk of harm to people, fauna, property and vegetation is bellow an acceptable level;
- When electrical storms or lightning are approaching or forecast and move the pyro crew and public to a safe distance from the materials.

**Pre-Display Site Checklist**

- Wear all personal protective equipment appropriate for setup duties.
- Establish site security prior to arrival of pyrotechnic materials
- Discharge, display, and fall out areas are cleared of all unauthorised people prior to loading shells
- Protect all pyrotechnic materials and launching equipment from inclement weather and keep them dry at all times.
- No one is in discharge, display, and fall out areas once loading of shells begins
- Mortars are aimed over fall out area and away from spectators
- Discharge area is cleared of all persons prior to electrical circuit testing
- Prohibit smoking material, matches, lighters or open flames within 50 feet of fireworks or pyrotechnic material.
- Only necessary personnel required to perform the display set up and show shall be allowed at the display site.
- Prohibit persons in the display site who are under the influence of alcohol, narcotics, or medication that could adversely affect judgment, mobility, or stability.
- No cell phones or radio frequency (RF) generating devices are permitted within the immediate discharge area while electrically ignited fireworks or pyrotechnic devices are prepared, loaded, or set up.
- Verify that all mortars and racks are made of approved materials, and are of sufficient strength, length and durability to allow shells to be propelled to safe deflagration heights.

- Make sure all mortars, mortar racks, bundles, pre-loaded box items, cakes, candles, and ground displays have been thoroughly inspected and deemed inherently stable.
- Avoid placing any portion of your body over mortars during loading, wiring, or igniting, and immediately after the display has been fired.
- Use safe handling and loading procedures for all pyrotechnic devices.
- Pre-load larger shells as required.
- Check proper fit of shells in mortars.
- Designate spotter(s).

**Display Site Checklist**

- Verify Urban / Rural Fire Services and EMS units are available and ready to respond.
- Establish good communications between crew, event sponsor, person in charge, approved handler, and fire service/EMS units.
- Maintain crowd control, utilising monitors and/or barriers.
- Use all required personal protective equipment ( head, eye, hearing, and foot).
- Wear long sleeved and long legged flame resistant.
- Avoid placing any portion of your body over mortars when manually igniting them.
- Monitor weather and crowd conditions to maintain safety.
- Comply with directions given by the approved handler, spotters, or NZFS/RFA//EMS units.
- Use only flashlights or other nonincendiary lighting in firing areas.
- During discharging of shells, operator observes activities to ensure wind and trajectory are adequate and makes adjustments if necessary.
- If a misfire occurs, the mortar shall be identified, marked and left undisturbed.

**Post-Display Site Checklist**

- Wear personal protective equipment appropriate for cleanup duties.
- Disable any electric firing switches and disconnect all electric cables.
- No one is permitted to enter display, discharge or fall out areas until the approved handler has determined the area is safe and secure.
- After at least 30 minutes, conduct search of the display and fallout areas.
- Entire display site and fall-out area is to be cleared of all debris at the conclusion of the display with particular care being taken to ensure that there are no misfired items present.
- Entire firing area is inspected by the approved handler and crew to locate any unexploded shells.
- Follow proper marking and warning procedures for unexploded shells.

- Unfired shells removed and returned directly to the supplier or stored in an approved manner.
- Ensure that all unused live product and duds are accounted for, properly handled, repackaged and secured according to regulations and manufacturer.
- Conduct a second site search at first light.
- Any malfunctions of any firework articles associated with the display are to be reported to Test Certifier and Manufacturer.

## Regulation 42 and 43 Requirements

I hereby acknowledge that I have read and fully understand and agree to comply with the requirements of Regulations 42 and 43 of the Hazardous Substances (Classes 1 - 5 Controls) Regulations 2001 in respect of Pyrotechnic displays.

| Signature of Approved Handler | Name | Approved Handler Cert No: | Date Signed |
|---|---|---|---|

## A5.6 Model form for post-display notification of incidents

### Post-Display Notification of Incidents:

This form is to be completed by the person in charge of the pyrotechnics display if an incident occurred as a result of conducting that display. One form is to be completed for EACH display. This form must be completed and submitted to the HSNO enforcement officer at your regional DOL branch, and copied to ERMA New Zealand, within 5 calendar days of the display.

In addition, it is a legal requirement to report any incident that resulted in serious harm or death to the DOL as soon as possible (0800 20 90 20), in accordance with the requirements of the Health and Safety in Employment (HSE) Act 1992 (see http://www.osh.govt.nz/services/notification/accident.shtml).

### 1 Event Details

| | |
|---|---|
| Event Location: | |
| Date of Display: | |
| Time of Display: : | |
| Pyrotechnics Display Test Certification No. | |

### 2 Personnel Details

| | |
|---|---|
| Event Organiser: | |
| Person in Charge: | |
| Test Certifier: | |
| Approved Handler: | |
| Approved Handler Test Certificate No: | |

Was this Display conducted according to the COP for Outdoor Pyrotechnic Displays?

☐ Yes ☐ No

### 3 Incident Details

An " incident" refers to any of the following events:

(a) a pyrotechnic is, or appears to have been, lost or stolen;

(b) any injury or death to a person;

(c) unexpected damage to property;

(d) an event, including a misfire, accidental explosion, fire or spillage that has the potential to cause any of the events in (a) to (c), other than an event that normally happens when handling or using a pyrotechnic.

Which of the following events were involved?

- ☐ Fireworks malfunction
- ☐ Injury
- ☐ Death
- ☐ Property damage
- ☐ Other

Describe the incident, including locations, names of person affected and details of fireworks involved (attach sheet if insufficient space):

_____

_____

_____

Outline actions taken to address the incident (eg, pyrotechnics supplier notified, disposal of misfires) (attach sheet if insufficient space):

_____

_____

_____

## 4 Declaration by Person in Charge

I certify that the above information and all attachments are true and correct to the best of my knowledge.

Signature

Name

Date

You are required to keep a copy of this document. When completed, please email or fax this notification and any attachments to the DOL regional office nearest the area where the display was conducted. A copy should also be forwarded to ERMA New Zealand.

Contact Details:

| | email | fax |
|---|---|---|
| DOL | hsno@dol.govt.nz | Refer to DOL website for list of regional fax nos. (http://www.osh.dol.govt.nz/about/region-office/index.shtml). |
| ERMA | hsincidents@ermanz.govt.nz | (04) 914 0433 |

## A5.7 New Zealand Fire Service guidelines for notification

The New Zealand Fire Service (NZFS) offers the following guidance in applying for written agreement for an outdoor pyrotechnic display (in urban fire districts).

a. Though Regulations (Controls) do not state a statutory timeframe for the processing of applications for written agreement, application must be made at least five working days before the date of firing. This assumes the application is complete in all respects. In exceptional circumstances, and by prior agreement (contact 0800 FIREINFO first before submitting), this may be reduced to three working days before the display is held. No application will be accepted with less than three working days notice before the date of firing.

b. No application is required where a pyrotechnic special effect (e.g. filming/TV) is used, AND its use in not intended for the specific purpose of entertaining the public. Private functions require written agreement where Class 1 Category G pyrotechnics are used.

c. The applicant must lodge an application via the NZ Fire Service Information Unit (website online application or fax). For telephone assistance, please contact 0800 FIREINFO (0800 347 346). The MBIE and the NZFS share a form to reduce duplication of information. Go to the NZFS website at www.fire.org.nz and see Business Fire Safety/Firework Displays or go to www.dol.govt.nz.

d. A person in charge of a display must provide the following details:
   - Name of applicant.
   - Physical address of applicant.
   - Telephone number. The applicant must have a means of calling the Fire Service from the location.
   - Fax or email address for the applicant.
   - Date and time of the display.
   - Physical address for the firing of display. If the location is in a harbour or river then a latitude and longitude is required in addition.
   - A plan view map showing the firing point, exclusion zone, audience location, location of fire-fighting equipment, direction of flight of pyrotechnics, audience evacuation routes. GNS maps can be very helpful.
   - Description of fire-fighting equipment to be used. Any equipment should be commensurate with the size of display, whether normal evacuation routes may block emergency vehicle access or egress, the presence of reticulated/ non reticulated water and the type of vegetation surrounding the display.
   - Description of the steps to be taken so that a fire cannot spread more than 5 metres from the point of ignition. Some examples might be the reduction of fire load by mowing, wetting of fallout area prior to display, additional fire safety staff. Precautions must be adjusted for weather and season of year.
   - The applicant confirms that the approved handler(s) operating the display will conduct a thorough inspection of the site post firing to ensure no subsequent fire will occur.

When providing written agreement a Fire Region may stipulate additional measures they deem appropriate to local conditions. This may include additional fire-fighting equipment, provision of fire-fighting water supplies, certain access for the fire service, etc.

The above will provide the basis for the applicant's written agreement. Any written agreement will normally stipulate that no changes are allowed from what the applicant has submitted, otherwise the applicant's written agreement will be deemed to be void and a new application must be made.

# Outdoor Pyrotechnic Display Written Agreement and Notification Form

**See notes at end of form for guidance and notification times.**

| Applicant information<br>(PRINT IN BLACK OR BLUE PEN) | |
|---|---|
| **Person in Charge of Display** | |
| **Address** | |
| **Contact Telephone Number** | |
| **Mobile Number** | |
| **Fax or Email** | |

| Display Information Requirements<br>(complete form and attached display plan) | |
|---|---|
| **Physical Address**<br><br>[For marine locations include latitude & longitude.] | |
| **Land Owner Consent** | Name …… Date……..<br><br>Signature …… |
| **Date of Firing** | **Date ……** |
| **Number of firings** | |
| **Attached a Display Plan** | It must be plan view diagram showing the firing point, exclusion zone, audience location, location of fire-fighting equipment, direction of flight of pyrotechnics and audience evacuation routes. |

| Display Information Requirements<br>Cont/… | |
|---|---|
| **Name of Approved Handler** | |
| **Specify fire-fighting equipment to be used** | |
| **Describe appropriate steps so that a fire cannot spread more than 5 metres from the point of ignition** | |
| **Describe the evacuation route the audience will use to a place of safety should an emergency arise as a result of the pyrotechnic display.** | |
| **Applicant will organize a thorough inspection of the site post firing to ensure no subsequent fire will occur.** | [Circle answer]<br>YES / NO |
| **Additional Conditions specified by a Chief Fire Officer** | |
| **Written Agreement**<br><br>**NOTE: This application is not subject to variation once signed.**<br><br>**A variation requires a new written agreement.** | Name: ……<br>Position: …… ……<br>Organisation: …… ……<br>hereby agrees to the above display in accordance with the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001, Section 39(2). |

### Guidance

- See ERMA publication – Approved Code Of Practice for Outdoor Pyrotechnic Displays www.ermanz.govt.nz or the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001, Appendix 5.1.
- Your answers should reflect the complexity and size of the display AND have been reached in conjunction with appropriate parties, such as the event organiser building or land owner.

### Notification Timescales

- You will need written agreement from the New Zealand Fire Service or a Rural Fire Authority prior to providing notification to the Department of Labour.
- Urban Fire District – Notify New Zealand Fire Service no greater than 5 working days before date of firing. Lodge with NZ Fire Information Unit. See website www.fire.org.nz.
- Department of Labour – 3 days from date of firing. See www.dol.govt.nz.

## A5.8 Sample pyrotechnics testing form

Pyrotechnic item tested (example) _____

Name of pyrotechnic item _____

Manufacturer/brand _____

Description _____

Supplier _____ Date of supply _____

Consignment identification:

Batch _____ Sample No_____ of _____

Name of tester _____ Date of test _____

Weather conditions _____

_____

Results of tests:

YES/NO ('Yes' means that the pyrotechnic item passes the test. 'No' means that it fails.)

____ label contains accurate description, warning and instructions
____ pyrotechnics composition not escaping from article
____ easily lit with ignition source
____ where applicable, fuse burning time
____ delay to firing of next tube (of multi-tube pyrotechnics) <5 seconds
____ article functions without exploding (not applicable for crackers, salutes, reports, maroons, shells, mines)
____ article or pyrotechnic item functions without erratic or unsafe projection or flight
____ article not likely to cause injury or damage in normal use
____ article remains stable at rest and while firing
____ no burning matter falling or projected >____m away, and <____ m in height
____ debris other than paper, etc., projected laterally <____m from ignition point
____ debris other than paper, etc., falls <____m from ignition point
____ no paper, etc. debris weighing >20 g falls >____ m from ignition point
____ crackers: composition weight <0.3 g per cracker (black powder) and <50 mg (flash powder)

powder weight: _____

single tube pyrotechnics: composition weight: _____

single tube or cone fountain: composition weight: _____

multi-tube pyrotechnics: composition weight: _____

Comments: _____

_____

_____

Signature of tester: _____

# Appendix 6: Design, construction and manufacture of pyrotechnics

## A6.1 General requirements

Pyrotechnics must be designed and constructed to be safe during handling, storage, transport and use.

Only pyrotechnics of known performance, product safety and demonstrated compliance with the published safety and performance information may be supplied.

The pyrotechnics must be properly identified, properly packaged, properly classified and have suitable safety information and performance data provided to the purchaser.

## A6.2 General design

The pyrotechnics must function in a safe and predictable manner. The pyrotechnics must:

- Be designed in such a manner that they are not likely to cause injury or damage when used in accordance with the instructions provided;
- Except for strings of crackers, starshells, salutes, reports and maroons, headed drivers and rockets, be designed and constructed so that, in function, the pyrotechnics case(s) does not rupture except where this is a design feature such as a fountain and report;
- Not contain any mixture of an unstable, toxic or highly sensitive nature which may result in an unsafe pyrotechnic item.

## A6.3 Test certificate to manufacture pyrotechnics

A Test Certificate to manufacture pyrotechnics is required for any operation involving the following manufacturing pyrotechnics devices:

- a step or process for producing a pyrotechnic (e.g. star composition mixing);
- remaking or reconditioning a pyrotechnic
- redesigning, rectifying or otherwise modifying a pyrotechnic;
- altering the chemical or physical properties of an explosive (e.g. match fuse manufacture, granulation of meal black powder to make lifting or bursting charge, rolling or pumping star compound, priming stars and aerial shell manufacture);
- breaking up or sorting out explosives (e.g. dismantling pyrotechnics to recover stars or powder);
- breaking down multishot cakes into smaller cakes;
- manufacturing any pyrotechnics for sale to others;
- removing, modifying or replacing the lift charge from aerial shells unless specifically trained as an approved handler for this.
- using pyrotechnics to produce effects in a manner other than as intended or specified by the manufacturer unless proven by tests.

A Test Certificate to manufacture is not required for the preparation of pyrotechnics for a display, involving fitting igniters and fusing devices (such as attaching and removing fuses quickmatch and electric fuseheads or for preparing set pieces).

Consideration must be given to:

a. ignition method and fuse burning time,

b. pyrotechnics composition,

c. explosive content,

d. construction type and integrity,

e. performance of the pyrotechnics,

f. debris characteristics,

g. size of the area affected during the functioning of the pyrotechnics,

h. the fire, safety and health risks posed by the pyrotechnics or its components or effects,

i. the robustness of the pyrotechnics (including the capability of the construction materials to resist damage and to avoid leaking the composition of the pyrotechnics under normal conditions during transport and handling),

j. the compatibility of the pyrotechnics with the equipment being used,

k. unplanned or uncontrolled explosions and

l. any other feature that presents an unacceptable risk to the health and safety of people.

The suitability of the pyrotechnics will be validated when the pyrotechnics are inspected and tested.

An authorised manufacturer who modifies a pyrotechnics e.g. the lift charge, is taking on the designer's responsibility. A competent person must validate the modification. The suitability of accompanying equipment, such as mortars, must also be reassessed.

## A6.4 Construction

Pyrotechnics must be constructed so that:

- no pyrotechnic composition can escape during normal handling prior to use; and
- pyrotechnics will not break up with normal handling such as fountains cracking internally.

## A6.5 Pyrotechnics composition

The pyrotechnic compositions in the pyrotechnics must be a formulation such that the pyrotechnics are stable and safe during use, transport, handling and storage.

The pyrotechnics manufacturer should list the components of the pyrotechnics composition in the Safety Data Sheet (SDS). For advice on the preparation of these, refer to the HSNO Approved Code of Practice on Safety Data Sheets developed by Responsible Care (formally the New Zealand Chemical Industry Council (NZCIC)). Contact Responsible Care through their website www.nzcic.org.nz.

The composition must not contain:

- toxic products injurious to health, e.g. arsenic;
- compositions that are unsafe during handling, storage, transport and use because of sensitivity to ignition.
- mixtures of chlorates with sulphur, except in smoke compositions
- sulphides, phosphorus, acids, metal powders or any ammonium salts;
- mixtures containing arsenic compounds, lead compounds, white phosphorus or mercury compounds; and mixtures containing picric acid or salts of picric acid.

Potassium chlorate or other inorganic chlorates may only be used in the pyrotechnics composition for lances or smokes.

## A6.6 Ignition method

The ignition method must be readily identifiable and must be appropriate as recommended by the manufacturer or supplier. The time elapsed from lighting to functioning must be sufficient to allow the user to retire to a safe distance but not so long that it may appear to be a misfire. This must also apply to the time elapsed between the functioning of successive elements of the pyrotechnics.

Pyrotechnics designed to be ignited by hand must discharge not less than 3 seconds and no more than 10 seconds after lighting; and have a maximum delay between cessation of one tube or star and the firing of the next tube or star in a combination or multi-tube pyrotechnics of five seconds.

Initiation of other pyrotechnics must be by an appropriate method as recommended by the manufacturer or supplier.

Alternate firing systems may be included such as provision for electric and hand firing as well as doubled firing points.

## A6.7 Performance

The performance of pyrotechnics must be such that persons following reasonable instructions for their use from the Safety Data Sheet and Technical Data Sheet (TDS) and observing the pyrotechnics are not, as far as practicable, exposed to unacceptable risk of harm to persons or damage to property.

This requirement means that information must be provided on such aspects as how far projectiles and burning debris are thrown and the size of the area affected during the functioning of the pyrotechnics and, therefore, the minimum distance from which it is safe to conduct or watch the display.

Pyrotechnics must comply with the following:

- The area affected by the functioning of the pyrotechnics at ground level must be specified;
- This must include contributing effects from wind, angling, etc;
- A pyrotechnic item must not project itself or any part of itself through the air in an erratic and unpredictable manner to become dangerous;
- No burning or incandescent debris must be projected laterally beyond the exclusion zone which applies for the pyrotechnics type.

## A6.8 User information

Information must be provided for the safe handling, transport, storage and use of the pyrotechnics. Sufficient information must be provided in documentation such SDS and TDS to enable the safe management of the pyrotechnics and the pyrotechnics display. The way in which the pyrotechnics functions must be described to enable pyrotechnic contractors to select pyrotechnics appropriate to their needs. All information must be easy to comprehend and must be legible. Information and instructions must be in English.

### A6.8.1 Use and disposal

Information must be provided as to the most appropriate method of using and disposing of the pyrotechnics, including

- precautions to be taken prior to the display;
- information on performance to estimate safe clearance distances for displays and setting up;
- information on minimum default clearance distances, effects of angling pyrotechnics, effects of wind;
- hazardous debris fallout;
- appropriate safety equipment, including safety glasses, closed shoes, body coverings, hat, water to extinguish any fire, and the like;
- initiation methods;
- actions to be undertaken in case of a misfire;
- disposal methods;
- handling damaged materials; and
- search and clean-up after the display.

### A6.8.2 Transportation

Information must be provided as to the most appropriate method of transporting pyrotechnics within a vehicle, including:

- location within the vehicle;
- securing the pyrotechnics; and
- segregation and separation from incompatible substances.

### A6.8.3 Storage

Information must be provided as to the most appropriate method of storing pyrotechnics, including:

- segregation and separation from incompatible substances;
- separation from ignition sources;
- keeping in a locked receptacle; and
- keeping away from unauthorised persons.

## A6.9 Testing

### A6.9.1 Safety and performance testing

The importer or supplier of each different consignment and type of pyrotechnics must undertake safety and performance testing.

Additional safety and performance testing should be undertaken whenever circumstances occur which may affect the performance of the pyrotechnics in accordance with the importer's or supplier's quality plan. The following are some of the conditions that may affect the performance of the pyrotechnics:

- stored pyrotechnics can suffer from moisture absorption or desiccation;
- climatic changes, caused by transporting pyrotechnics from a temperate to a tropical climate, can adversely affect their performance; and
- pyrotechnics packaged under conditions of high humidity can become wet if high temperatures or direct sunlight cause evaporation of absorbed moisture followed by its subsequent condensation on the inside of packages, leaving water droplets capable of affecting the pyrotechnics.

Reports, e.g. from a person in charge of the display, that a pyrotechnic item has malfunctioned, would be another reason to carry out additional tests.

The person in charge of the testing must be competent in testing pyrotechnics and in applying this Code. A test plan should be developed to ensure that all features for compliance are being measured to the desired level of accuracy and recorded for assessment against the acceptance criteria.

Examples of some tests to be conducted on sampled pyrotechnics on the testing plan are:

- examine the labelling of the pyrotechnics to ensure that labelling meets requirements;
- examine the pyrotechnics and its packaging for escaped pyrotechnics composition;
- examine the structural type and integrity of the pyrotechnics; and
- measure and record the safety and performance features including effect of the pyrotechnics functioning for assessment of compliance.

Examples of features for measuring and recording may include the effects of the pyrotechnics when functioning, to determine:

- how high and how far laterally stars, sparks or debris are projected;
- any debris that is not composed wholly of paper, cardboard, fabric, plastic-foam or clay which falls outside the exclusion zone; and

- the weight of any piece of paper, cardboard, fabric, plastic-foam or clay which falls outside the exclusion zone.

Some pyrotechnics may naturally perform in a dangerous manner and appropriate precautions should be taken, including appropriate PPE.

The explosive content and expected range in weight for Hazard Division classification and NEQ calculations should be validated.

### A6.9.2 Chemical testing

Qualitative chemical tests may be carried out to establish or confirm the composition of the product. A competent person or an accredited certification body should carry out any chemical testing where needed.

### A6.9.3 Compliance with design criteria

Pyrotechnics must comply with the general design criteria in A16.2 above. Failure to satisfy any one of those criteria constitutes a failure of the pyrotechnics.

Pyrotechnic malfunctions can be categorised as major and minor defects. For major defects, the effects of malfunction can extend beyond the exclusion zone. Such defects represent a failure of the pyrotechnics.

### A6.9.4 Compliance with Safety Data Sheet and technical data sheets

Pyrotechnics must comply with the acceptance criteria for the safety and performance features published in the Safety Data Sheet and the Technical Data Sheets. A sample of each different consignment and type of pyrotechnic should be tested. The tests for the samples should be a combination of operational tests and failure tests (when needed, for such as fountains blowing up due to design failure).

The batch of pyrotechnics must be ultimately accepted or rejected using the established criteria and sampling systems.

Results and methods of testing should be documented and kept for not less than 3 years after the last stock was sold.

See example of testing record in Appendix 5, Forms.

## A6.10 Garnishing, peanut shells and double loading

### A6.10.1 Garnishing

Garnishing is required to be supplied as a pyrotechnic item.

The product must be bagged and labelled, and data sheets must be supplied.

Garnishing requires full training of the approved handler. This training should cover the following points:

- Proportions: garnishing should be no more than 30% by weight of the shell.
- Procedure for inserting the garnish in a controlled manner.
- Procedure for removing the garnish should a misfire occur.

- Procedures for disposing of or returning the garnish to the supplier.

### A6.10.2 Peanut shells

Peanut shells place additional load on the mortar, as the shell weight is twice that of a normal shell.

Mortars used for this purpose must be type proof tested with 1.5 times the normal lift charge and the equivalent weight of the starshell with the equivalent clearance.

Racking systems must be similarly tested, to ensure they will maintain their integrity should a peanut shell explode both shells.

Exclusion zones should be increased by 30%.

### A6.10.3 Double loading with smaller shells

Double loading with smaller shells up to 30% of the weight of the main shell is treated as garnishing.

Removal of the lift charge is the responsibility of the supplier or manufacturer, to be done in a manufacturing situation with an appropriate test certificate.

Shells require labelling and packaging to indicate they are for double loading.

Data sheets must indicate the calibre of the underlying shell with which they are to be used.

### A6.10.4 Double loading with identical shells or shells above 30% of the weight of the main shell

Shells require labelling and packaging to indicate they are for double loading.

Data sheets must indicate the calibre of the underlying shell with which they are to be used.

Mortars used for this purpose must be type proof tested with 1.5 times the normal lift charge and the equivalent weight of the starshell with the equivalent clearance.

Racking systems must be similarly tested, to ensure maintaining their integrity should a double loaded shell explode both shells.

Exclusion zones should be increased by 30%.

## A6.11 Aerial shells

Aerial shells must be constructed so that they fit easily into the appropriate size mortar, and so that the lift charge and delay fuse ensure that the aerial shell reaches a safe altitude before functioning. Each shell should be constructed so that the difference between the inside diameter of the mortar in which it can be safely used and the outside diameter of the shell is:

- not less than 2 mm and not more than 6 mm for shells less than 75 mm diameter; or
- not less than 3 mm and not more than 13 mm for shells larger than 75 mm.

The altitude at which all burning particles or stars are extinguished above ground level must be determined by testing.

If willow style shells are designed to drop effects to the ground the data sheet must indicate this so appropriate allowances can be made in the show plan.

Aerial shells must be classified in terms of the inside diameter of the mortar in which they can be safely used. For example, “75 mm aerial shells“ are only for use in “75 mm” inside diameter mortars.

The length of the internal delay fuse and the amount of lift charge must be sized to ensure proper functioning of the shell in its mortar. If quickmatch fuse is required, it must be long enough to allow not less than 150 mm of fuse to protrude from the mouth of the mortar after the shell is fully inserted and resting on the bottom of the mortar.

A safety cap of a different colour than that used for the paper of the fuse must be installed over the exposed end of the fuse.

The length of exposed black match on a shell cannot be less than 75 mm and must be fully covered.

The time delay between ignition of the tip of the exposed black match and ignition of the lift charge cannot be less than 3 seconds to allow the operator to retreat safely when hand firing.

The manufacturer and supplier must ensure that a Safety Data Sheet and a Technical Data Sheet are prepared for every pyrotechnic.

These documents will provide the person in charge of the display with information to determine work practices for standard operating procedures for the safety management system conduct a risk assessment when planning the pyrotechnics display; and assist in determining calculated minimum clearance distances.

Where appropriate, the Safety Data Sheets and Technical Data Sheets may be combined into a single document for various purposes, including classes/types of pyrotechnics with similar or identical characteristics and features.

## A6.12 Pyrotechnics equipment

### A6.12.1 General safety information

The suppliers, designers, fabricators, owners and operators of the pyrotechnics display equipment are responsible for ensuring that the equipment is properly designed, fabricated and maintained to minimise harm to people including pyrotechnics operators and assistants. Pyrotechnics equipment must not unnecessarily confine pyrotechnics.

The pyrotechnics display equipment must be provided with:

- proper identification;
- the identity of the fabricator; and
- manuals with details on use, maintenance, and pyrotechnics to be used with the equipment.

The equipment must be safe and suitable for use with specified pyrotechnics (taking into account the effect of a catastrophic or extreme malfunction of the pyrotechnics. The performance of the equipment should not be affected); and have suitable documentation prepared on:

- installation (e.g. methods to secure stands, mortars and other holders of pyrotechnics),
- testing and inspection,
- use,
- cleaning, maintenance and repair, and
- service life.

The documentation must be updated with any information that becomes available after supply if this may impact on the safety of the equipment.

### A6.12.2 Materials used for pyrotechnics equipment

*a. Acceptable materials*

Equipment such as mortars, tubes, enclosed racks, waratahs, stands and other types of equipment associated with a pyrotechnics display must be designed and manufactured from other materials, such as paper wound tubes (cardboard); suitable plastic, e.g. high density polyethylene (HDPE), medium density polyethylene (MDPE) fibre reinforced plastic (FRP), glass reinforced plastic (GRP) or fibreglass but not polyvinyl chloride (PVC); and timber.

*b. Metal*

The use of metal pyrotechnics equipment is not recommended because such equipment may produce dangerous fragments when subjected to an explosion, except where it has been established that it does not present an unacceptable risk (e.g., if the metal is not close to the pyrotechnic and an explosion would not produce harmful fragments).

The designer, manufacturer, supplier of pyrotechnics equipment must retain all necessary documentation to demonstrate the safety and suitability of the metal pyrotechnics equipment for its intended application. The person in charge of the display must have completed a risk assessment for these situations. Permissible applications may include the following:

- metal waratah stakes for defining barriers for crowd control;
- round steel rods with a diameter from 10 mm to 20 mm for securing pyrotechnics or pyrotechnics equipment for use at pyrotechnics displays. (The pyrotechnic device may be attached directly to the round rod, i.e. without spacers. Flat metal including angle iron and waratahs are not permitted.); and
- trailers for holding pyrotechnics items where the sides are constructed of wood or other non-metallic material. (The frame of the sides may be made from metal such as light angle iron.).

If trailers with metal sides are used for the set-up of pyrotechnics displays, the following conditions apply:

- all mortars and pyrotechnics devices must be secured in relation to each other, and in relation to the trailer there must be a stand-off between the inside of the trailer and the mortars and pyrotechnics

devices. (This stand-off is to be at least equivalent to the calibre of the largest shell to be or alternatively tested to demonstrate a smaller distance is safe);
- nails, screws, staples, wire or strapping used to secure non-metallic mortars, tubes, base plugs, racks, firing lines etc;
- round metal rods used to secure non metallic items, such as cake boxes, into the ground to ensure stability and direction of the pyrotechnic items contained within the box. (These rods are to be securely hammered into the ground.);
- steel posts and pickets used to support a set-piece;
- metal pegs driven well into the ground, used to secure mortar racks and frames; and
- large steel bins, such as skips or miniskips, in which mortars are supported in sand. (The mortars must be located no closer than a distance equal to the calibre (diameter) of the largest shell to be used. The base end of the mortars in the bin must be positioned on a firm base e.g. positioned on 100 mm of compacted sand. At least three quarters of the mortar is to be buried.)

*c. Polyvinyl chloride*

PVC equipment is prohibited. PVC may fragment unacceptably during abnormal functioning of pyrotechnics.

### A6.12.3 Types of pyrotechnics equipment

*a. Mortars and racks*

The fabricator of mortars and any associated equipment is responsible for ensuring that the mortars and any associated equipment are properly designed and tested.

The person in charge of the display is responsible for ensuring that mortars are inspected, maintained and fully serviceable. The pyrotechnics operator is responsible for ensuring mortars are inspected at pyrotechnics displays.

The manufacturer of mortars must prepare a Technical Data Sheet to be provided with the supply of the mortars. This Technical Data Sheet must provide, amongst other things, information on:
- the types of shells that may be fired from the mortar and limitations on use (e.g. charge weight of the lift charge of an aerial shell);
- the requirements for care, maintenance and inspection.
- the criteria for determining acceptance and suitability of mortars for safe use; and
- the product life requirements, e.g. number of years, number of shells fired or by detailed inspection or other appropriate parameters.

The design of the mortars must be tested and certified by a competent person to ensure that they are safe and suitable for their intended use and function. The following should be considered:
- the suitability of the construction materials;
- the strength and durability of the mortar to safely fire the aerial shells to be used;
- the expected malfunction from explosion or combustion pressure rise;

- the length of the mortar to ensure that aerial shells are propelled to an altitude where the aerial shell breaks without endangering people or property; and
- the intended use and limits for the design, e.g. maximum shell mass, maximum charge weight, maximum shell diameter.

Recognised testing techniques, such as explosives testing techniques should be used, which consider:

- the maximum charge weight of lift charge to be fired. (An overcharge of 50 per cent of the maximum lifting charge weight must be tested. This will be approximately double the normal stress on the mortar. This test must be conducted at a testing facility and not at a display site.)
- the performance of the mortar for the worst case explosion for which the mortar will be used (e.g. a salute shell with the mass of a stated composition); and
- the altitude and drift of shells for safety and performance.

*b. Materials of construction*

Mortars must not be made from metal, PVC, clay, bamboo, timber, ceramics, concrete, glass or any other material that has brittle physical properties that may produce harmful fragments from an explosion and, in particular, a shell explosion in the mortar.

The application of timber for plugs in the mortar is permitted.

*c. Design of racks*

Racks must be designed and constructed so that in the event of a catastrophic malfunction in a mortar the risk of harm to persons and property is reduced to an acceptable level. Such a malfunction must not impact adversely on the orientation, location and performance of the adjacent mortars, nor must it affect the performance of the adjacent pyrotechnics within the rack. The overall integrity of the rack must be preserved.

The design for racks where shells will be fired in mortars must be type-tested and certified.

*d. Design of electric firing units*

A competent person must undertake the design, construction and certification of electric firing units and distribution systems.

An electric firing unit with a built-in circuit tester must be designed to limit the test current (into a short circuit) to 0.02 ampere or to 5 per cent of the no-fire current of the electric fusehead being used, whichever is less. Multimeters, such as volt-ohm meters, must not be used for testing electric fuseheads unless the tester's maximum current delivery potential has been measured and found to meet the requirements in the paragraph above.

The electric firing system should be shunted, or the battery removed while connecting the igniters. Electric firing units must be powered by batteries or isolated power supplies used for firing purposes only.

Batteries, if used, must be self-contained in the firing unit or otherwise covered or protected to prevent accidental contact with wires leading to the pyrotechnics.

Pyrotechnics must not be fired using systems powered by mains power.

The electric firing units must be rated to fire into a maximum load in ohms producing in this load the recommended current by the igniter manufacturer for series firing.

Computer-based electric firing systems must incorporate some form of a deadman switch so that all firings cease from the moment that the switch is released

Manual electric firing units must include a key-operated switch, removable battery or the complete system must be removable to reduce the possibility of unauthorised or unintentional firings.

A handheld electric firing unit must have two switches or require two actions for firing, one to arm the unit and one to fire the unit. The unit must be designed so that it cannot be fired without first being armed. Switches used to apply power to electric firing units for testing, firing or both must clearly indicate the function or functions of each switch. The switches should be protected from accidental firing. The unit must have a light, indicator or both that signals when the unit is armed and ready to fire. Handheld firing units that incorporate a capacitive discharge design must dissipate the stored charge within 15 seconds after the arming switch is released.

# Appendix 7: Common pyrotechnic malfunctions

## A7.1 Starshells

*a. Shell fires from a mortar before it is lit intentionally*

With hand firing shows it is most likely that the cover has come off the ignition delay fuse and sparks have ignited it, or the mortar contains burning material which has ignited the lift charge. Clearing mortars of burning material is problematic as small mortars need to be turned upside down, and large mortars are difficult to see into due to smoke. Also placing your hand inside a mortar could be an hazard if you are not absolutely sure that the shell has fired.

In electrically fired shows, fires from debris amongst the mortars and displacing of fuse covers due to either poor fixing or blast pressures from a low burst will lead to exposed fuse and possible premature firing.

There is no action to be taken as the event has happened.

*b. Shell delays or does not fire*

This is called a hang fire where the lift charge is delayed in firing, and a misfire when it does not fire at all. This is most likely due to defective pipe match leader, or water damage. This mortar should be marked clearly and left for 60 minutes before any attempt to retrieve the shell. It is unknown whether this is a hang fire or misfire until 60 minutes have elapsed.

*c. Mortar burst or flowerpot*

When the shell explodes in the mortar it may rupture the mortar and damage adjacent mortars, either firing shells in them or crushing them so they ignite and toss stars about the adjacent area.

Alternatively it may merely fire upwards like a mine, in a spectacular burst of stars.

Generally this is due to the setback, or impulse given to the shell when the lift fires. The fact that this impulse ignites the stars instantly implies the composition is excessively sensitive.

It may be also due to a missing time fuse giving major fire leak into the shell. Minor fire leaks generally lead to muzzle breaks or very low bursts.

Procedure will be to stop the show at this point and very carefully check that further firing will not lead to a dangerous situation with damaged mortars.

*d. Muzzle break*

The shell bursts just as it leaves the mortar, most likely due to a small fire leak. There is generally a delay from the lift charge firing to the point when the fire leak ignites the burst charge inside the shell, which will burst the shell when it has reached sufficient pressure. The delay is generally a few milliseconds, sufficient time for the shell to have just left the mortar.

A procedure will be to stop the show at this point and very carefully check that further firing will not lead to dangerous situation with displaced mortars.

*e. Low break*

The shell explodes near the ground either on the way up or coming down.

Either the shell is in the wrong size mortar which will give about 1/5 of the usual altitude, it has insufficient lift charge, the time fuse is defective, or the mortar plug is not sufficiently well supported and has blown out.

Procedure in a hand fired show would be to establish that all of the crew are safe, then to check the mortar, and continue firing if all is in order.

Procedure with an electrically fired show would be to continue firing, as this is not an uncommon event.

*f. Dud shell*

A shell which when fired does not burst and lands on the ground. At this point it may burst completely, or just burst open scattering live pyrotechnic debris, or bury itself in the ground.

The usual cause is a badly made time fuse which goes out.

Procedure is to leave the shell until after the show, ensuring that security is maintained. If it has burst open, procedure is to collect the pyrotechnic debris together and ignite by means of a time fuse, ensuring adequate protection for the operator as the burning can be quite vigorous, projecting stars.

If it has not burst open, 60 minutes must be allowed to lapse from the firing before the shell is collected and returned for destruction or remanufacture.

*g. Live pyrotechnic debris lands from a shell burst*

Sometimes timed components or stars in a shell burst do not ignite. It is sometimes instructive to fire a shell over water, or a galvanised iron roof, and observe whether live items descend, either seeing the splashes in the water, or hearing the tinkle on the roof.

Every pyrotechnics site be checked as thoroughly as possible to search for such live components to ensure public safety.

Live components can also kill vegetation as they dissolve in the rain over a period of time.

Procedure is a thorough inspection of the site. Returning in daylight early in the morning after a display is an added precaution.

## A7.2 All other pyrotechnics

All the other pyrotechnics such as Roman candles, mines, multishot mines, fountains, wheels, falls and crackers are subject to variations of the above happenings.

Here is a shortlist of the possible problems.

*a. Roman candles*

Premature firing, misfiring, hang firing, tube burst, flowerpot, muzzle break, low break, dud shell and live debris.

Of particular concern with Roman candles are hang fires, as a multitude of shots can be left, shooting the unwary pyrotechnician as he or she dismantles the display.

Tube bursts are also common particularly with report Roman candles and crossettes.

Procedures as for starshells.

*b. Mines*

Premature firing, misfiring, hang firing and live debris.

Procedures as for starshells.

*c. Multishot mines*

Premature firing, misfiring, hang firing, tube burst, muzzle break, low break, dud components and live debris.

On occasions multishot mines burst the tubes and break the mines open while continuing to fire on the chain fuse.

Precautions are to barricade these, place at appropriate distances, and, for hand firing, ensure adequate PPE is provided and worn.

Procedures as for starshells.

*d. Fountains*

Premature firing, misfiring, hang firing and tube burst.

The explosion of a fountain is very spectacular, and is not uncommon.

Procedures as for the relevant parts of starshells. It is important to ensure that a fountain explosion does not knock over other pyrotechnics, with adequate staking and positioning as well as checking after an explosion before carrying on firing.

In an electrically fired show, given adequate spacing distances, once an explosion has occurred one would carry on firing.

*e. Wheels*

Premature firing, misfiring, hang firing and tube burst.

Wheels are regarded as a insignificant risk, however drivers breaking free and flying about are a risk.

Procedures as for starshells and maintain the correct safety distances.

*f. Falls*

Premature firing, misfiring, fireball risk in bulk and hang firing.

Falls present a significant fireball risk when sitting in a carton. This situation can occur when plans are made to put falls up part way through a display, to avoid premature ignition.

Procedures as for starshells; avoid rigging during a display.

*g. Crackers*

Premature firing, misfiring, duds and hang firing.

Crackers present a very significant dud risk and scrupulous cleanup is necessary after a show to ensure the public do not collect misfired crackers.

Procedures as for the appropriate parts of starshells.

# Appendix 8: United Nations classification system of explosives

## A8.1 Introduction

In 1968, a United Nations group of experts proposed a system for classifying, packaging and labelling dangerous goods, including transport regulations for hazardous goods. Essentially, the recommendations refine existing national classification systems. The recommendations were followed by the Inter-governmental Maritime Consultative Organisation (IMCO) and consequently adopted by most maritime nations, including New Zealand.

## A8.2 The UN classification system

The system is made up of nine classes, of which Class 1 comprises military and commercial types of ammunition and explosives.

Explosives in Class 1 are divided into six divisions in accordance with their behaviour when initiated. The division category is combined with the Class number (1) to form the Hazard Division (HD). The HD defines the type of hazard to be expected when the explosive is initiated. The HD's are defined as follows:

### Hazard Division 1.1

Explosives that have a mass explosion hazard.

The explosion will result in severe structural damage. The severity and range being determined by the amount of high explosives involved. There may be a risk from heavy debris propelled from the structure in which the explosion occur.

### Hazard Division 1.2

Explosives that have a projection hazard but not a mass explosion hazard.

The explosion results in items burning and exploding progressively, a few at a time. Furthermore, fragments, firebrands and unexploded items may be projected in considerable numbers; some of these may explode on impact and propagate fire or explosions. Blast effects are limited to the immediate vicinity.

### Hazard Division 1.3

Explosives that are a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

This division includes some items that burn with great violence and intense heat emitting considerable thermal radiation (mass fire hazard) and others which burn sporadically. Items in this division may explode but do not usually form dangerous fragments. Firebrands and burning containers may be projected.

### Hazard Division 1.4

Explosives that present no significant hazard.

This division includes items that are primarily a moderate fire hazard. They do not contribute excessively to a fire. The effects are largely confined to the package. No fragments of appreciable size or range are to be expected.

An external fire does not cause the simultaneous explosion of the total contents of a package of such items.

Some, but not all, of the above items are called Safety Ammunition or Safety Explosives (Compatibility Group S). These items are so designed and/or packaged that any explosive effect during storage and transport is confined within the package, except when an external fire has degraded this packaging. An external fire must not cause effectively instantaneous explosion of the total contents of the package.

#### Hazard Division 1.5

Explosives which although mass exploding are very insensitive.

The explosion will result in severe structural damage, the severity and range being determined by the amount of high explosives involved. There may be a risk from heavy debris propelled from the structure in which the explosion occurs.

#### Hazard Division 1.6

Articles which contain only extremely insensitive detonating substances.

Demonstrate a negligible probability of accidental initiation or propagation.

The risk is associated with the explosion of a single article.

## A8.3 Compatibility groups

Different kinds of ammunition and explosives can be mixed for storage and transport only if they are compatible. Ammunition and explosives are considered to be compatible if they may be stored or carried together without significantly increasing either the probability of an accident or for a given quantity the magnitude of the effects of such an accident.

### A8.3.1 Formulation of compatibility groups

Ammunition and explosives are formally grouped into 12 compatibility groups: A to H, J, K, L and S. Group I is omitted to avoid possible confusion between the letter “I” and the Roman numeral “I”. Group S is given a distinctive letter since it corresponds to a unique possibility for mixing in storage and transport.

### A8.3.2 Definitions of the compatibility groups

*Group A*

Primary explosive substance.

*Group B*

Article containing a primary explosive substance and not containing two or more effective protective features. Some articles such as detonators for blasting, detonator assemblies for blasting and primers, cap-type are included even though they do not contain primary explosives.

*Group C*

Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance.

*Group D*

Secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features.

*Group E*

Articles containing a secondary detonating explosive substance, without means of initiation with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquids).

*Group F*

Article containing a secondary detonating explosive substance with its own means of initiation, with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquids) or without a propelling charge.

*Group G*

Pyrotechnic substance, or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating, incendiary, tear- or smoke-producing substance (other than a water-activated article or one containing white phosphorus, phosphides, a pyrophoric substance, a flammable liquid or gel, or hypergolic liquids).

*Group H*

Article containing both an explosive substance and white phosphorus.

*Group J*

Article containing both an explosive substance and a flammable liquid or gel.

*Group K*

Article containing both an explosive substance and a toxic chemical agent.

*Group L*

Explosive substance or article containing an explosive substance and presenting a special risk (e.g due to water-activation or presence of hypergolic liquids, phosphides or a pyrophoric substance) and needing isolation of each type.

*Group N*

Articles containing only extremely insensitive detonating substances.

*Group S*

Substance or articles so packed or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder or prohibit fire-fighting or other emergency response efforts in the immediate vicinity of the package.

## A8.4 Use of Hazard Classification Codes

The principal use of the codes is to label explosives with a means of identifying the hazard to personnel if the item is accidentally detonated. The brief but complete description of the item conveyed by the code also enables documents relating to storage and transport to contain all the information required to ensure safe handling. Similarly, safety regulations (including fire-fighting) can also be formulated concisely by framing them in the terms of the hazard classification code.

### A8.4.1 Labels

Class 1 dangerous goods labels are orange with black lettering. The labels for HD 1.1, HD 1.2, and HD 1.3 bear the traditional bursting bomb symbol and the word ‘EXPLOSIVE’, while HD 1.4 and HD 1.5 labels show the hazard division numerals on a plain background with the word ‘EXPLOSIVE’. The compatibility group letter is shown on all labels, as is the Class 1 numeral.

## A8.5 Glossary of compatibility group terms

| | |
|---|---|
| **Primary explosive** | An explosive whose sensitivity is such that it requires similar handling such as mercury fulminate, lead azide and lead styphnate, and to other sensitive explosives such as percussion cap compositions. |
| **Secondary explosive** | An explosive that is comparatively insensitive to stimuli, such as heat, friction and shock. |
| **Deflagrating explosive** | An explosive that reacts by deflagration rather than detonation when used in its normal manner. Deflagration is a rapid chemical action in which the output of heat is sufficient to enable the reaction to proceed and be accelerated without input of heat from another source. The effect of a deflagration under confinement is an explosion. |
| **Detonating explosive** | An explosive that reacts by detonation rather than by deflagration when used in its |

| | |
|---|---|
| | normal manner. Generally known as ‘high explosives’. |
| **Pyrotechnic** | A mixture or compound designed to produce its effect (i.e. heat, light, sound, gas or smoke) as a result of non-detonative, self sustaining exothermic chemical reaction. |
| **With its own means of initiation** | The item has its own means of initiation assembled to it, and this device is considered to present a significant risk during transport. |
| **Without its own means of initiation** | The item may be packed together with its own means of initiation, provided that this device is packaged so as to eliminate the risk of causing detonation of the item, in the event of accidental functioning of the initiation device. The means of initiation can even be assembled to the item provided there are protective features such that the device is unlikely to cause detonation of the item in any credible accident. |

# Appendix 9: Container modification for the storage of pyrotechnics

A non-collapsible general purpose freight container that complies with regulations 23-25 of the Hazardous Substances (Classes 1 – 5) Controls Regulations may be converted for use as a magazine for the storage of pyrotechnics. The suggested construction is for pyrotechnics of classes 1.1G, 1.2G, 1.3G and 1.4G.

## A9.1 General recommendations

The following general recommendations apply:

a. Converted freight containers require no additional cladding where the steel case is at least 2 mm thick.

b. Floors may be made from galvanised steel at least 2 mm thick or timber.

c. Where floors are made from galvanised steel the floor should be covered by timber, rubber matting or a covering of equivalent performance.

d. Where magazines are raised more than 300 mm from the ground the floor should be of galvanised steel or the base clad with galvanised steel at least 2 mm thick. All floors should be constructed in such a manner as to eliminate any areas where residue may accumulate as follows:
   - All nail or screws must be recessed and the centres filled.
   - All cracks or joins must be filled or covered.

e. Where ventilation is desired,
   - The weather shields for side openings should be not less than 2 mm thick.
   - The side openings may be straight through vents.
   - Side opening should be screened to prevent insects, rodents and foreign matter entering.
   - Screens may be made of steel plate 2 mm thick perforated with holes that do not occupy more than 45 per cent of the gross area and are not larger than 3 mm in diameter or another method which delivers equal security.

f. All interior surfaces including the ceiling should be free from exposed ferrous metallic substance.

## A9.2 Locking

Locking devices should consist, at the very least, of two separate heavily shrouded high-security padlocks, situated so that it's impossible to get effective access for cutting equipment. An even more secure arrangement is the use of locking bars operated by a removable handle and locked by a concealed lock.

Doors should be fitted with additional locking bars which engage on the hinge side to prevent the door being opened if the hinges are cut. These do not require to be moveable as closing the door engages them.

If both doors are used to offer open access for safety reasons, the second door requires top and bottom locking bars to internally secure it. Otherwise it should be welded or secured shut internally.

The Australian Standard 2187.1 gives the general arrangements for locking bars. The Australian Standard specifies massive reinforcement of the container. Current thinking following incidents is that such massive reinforcing presents increased debris danger in the event of an explosion. Standard container walls have shown themselves to be sufficiently strong to prevent burglary.

## A9.3 Additional considerations

For modular steel magazines earthing terminals at diagonal corners are recommended for lightning protection.

Electrical installations inside magazines should be avoided. Outside lighting may be arranged to shine through the open door of a magazine, or battery-powered headlamps may be used.

Containers used as magazines should be kept in secure, designated storage areas. Signage must meet the requirements of the Hazardous Substances (Identification) Regulations 2001.

# Appendix 10: Health and safety

## A10.1 General health and comfort

On a pyrotechnics site, where work may start early in the morning and continue until late that night, all staff should be prepared for the complete range of climatic conditions. When packing equipment for shows, allow space for comfort and protection equipment.

## A10.2 Personal protective equipment list

- Clothing worn while firing must be non-synthetic as synthetic clothing can melt with sparks. Wear cotton clothing, suitable for all weather conditions. Cotton overalls, long enough to make sure that sparks do not fall into shoes are recommended. An economical way of making clothes more fire-resistant is to wash the overalls on the day of the show, but not to dry them fully. Store them, slightly damp in a plastic bag. For maximum safety, use fire resistant overalls.
- Sturdy footwear – boots recommended. Changes of footwear and socks.
- Gloves for handling wire and heavy tools, firing and dirty cleanup. While leather gauntlets or gardening gloves are very fire resistant, some are heavy and make movement clumsy. Cotton gardening gloves that have been dampened and wrung out beforehand are recommended.
- Safety glasses and, if applicable, personal eye glasses.
- Hearing protection – ear muffs or ear plugs sufficient to ensure the handlers are not subjected to more than 120 db(peak) during the display.
- Safety helmets (full faced when hand firing).
- Head torches.
- Sun glasses.
- Hats for sun and glare protection, which are secure in the wind, wool hats in cold conditions.
- Raincoat - the tunics which some people make using light plastic bags can be very convenient for light rain.
- If hand firing, the use of a polycarbonate shield fitted to the arm is recommended.
- Personal drink bottle, and backup supplies of water.
- Personal medication, and items for personal comfort.
- Personal tool kit (personal tools are an important factor in maintaining efficiency and reducing frustration).

## A10.3 General equipment list

- Light tent under which to rig pyrotechnics. For safety it must have a very light fabric roof to allow pyrotechnics to tear through it, should they accidentally initiate.
- Table and chairs for meal breaks.
- Large umbrellas for sun, wind and rain, to move from rigging site to rigging site.

- Tables and chairs to allow comfortable rigging and keep people's heads away from pyro above.
- Substantial plywood clipboards on which to secure rigging lists, to prevent them blowing away.
- Rigging lists written in waterproof writing or done on computer.
- Adequate meals brought in by outside caterers, or pre-packed food kept in chilled containers.
- Late shift of assistants to come and help pack up the show.
- Overalls to wear during pack out and protect clothing - good wind protection too
- Toilets handy, or a portable toilet.

## A10.4 First aid requirements

- Chilly bin with bags of ice cubes, water and towels in case of burns during the show.
- Good selection of bandages and plasters to deal with knife cuts which are common.
- Accurate fine pointed tweezers to remove splinters - also a magnifying glass.
- Access to fresh water for treating eye injuries.
- Sun block.

## A10.5 Pressures on crew

The following circumstances can affect working conditions and create pressures on the crew of an outdoor pyrotechnic display:

- Cancellation for whatever reason at a late stage, when a display is fully or partially rigged, will lead to extended working hours to dismantle the show carefully and prepare for dangerous goods freight.
- Display preparations on hold due to waiting to see what the weather will do, means the crew may end up working very hard and fast.
- Bad weather during the day, clearing up in the evening, will also mean pressure on the crew, as the show will be expected to go on, no matter how difficult the preparation.
- Late delivery of pyrotechnics, hardware or meals can be stressful for the crew.
- Changing of the display time due to surrounding events running over time can occur.
- Wind and weather can change abruptly. Knowledge of the prevailing conditions is vital.
- Security must be good so that the crew are not troubled with dealing with this.
- There must be good communication with security and the event organiser in case of security breakdowns.
- There must be good communication with police and control towers if present in case of alteration of show time.

The general organisational matters above must be dealt with well ahead of time. The event organiser should be fully aware of the compromises that may have to be made because of weather, late running and matters beyond the pyrotechnic crew's control. This may include the cancellation of the show because of wind, lightning or general audience discomfort with rain and wind. Cancellation because of security breakdown must also be an option.

## A10.6 Burns

The pain of burns to the hand can be generally be controlled by ice water, until medical attention is available. A chilly bin of ice and water with a large towel should be available on all pyrotechnics sites to deal with painful but not life-threatening burns, or as an immediate first aid for serious burns.

Clingfilm can also be useful to prevent air contact with burnt area.

Burns can be serious life-threatening injuries, so they should be checked out medically to make sure they are properly treated.

If there is an incident where someone suffers burns, the first thing to determine before assisting the person is whether there is further danger. If the person who has been burnt is incapacitated in the midst of other pyrotechnics that are exploding, the firing site should not be entered.

One of the crew must be assigned to get medical help to the scene with all possible speed.

Once the person has been moved from danger, cold water should be applied to the burnt area as soon as possible. Clothing may burn on with a glowing combustion for a long period of time. Such combustion must be extinguished as it is very hot and causes extremely deep burns. Watch straps, rings, belt buckles and other metal items may be very hot and continue to burn the skin long after any combustion is extinguished.

Burns that go right around a limb or torso, can form a leathery surface of burnt skin and restrict circulation and breathing.

There may be smoke inhalation, with signs of blackening around the mouth and nostrils. CPR may be necessary.

## A10.7 Cuts from fusing knives

The knives designed to cut fusing are very sharp, and are generally the type with snap off replaceable blades. The sharper they are, the easier it is to cut fusing and avoid injury.

For safety’s sake, fusing should be cut not forcefully but with a clean easy cut.

Cut-resistant gloves are recommended for use when working with fusing knives.

It is essential to have a good range of bandages, band aids and butterfly sutures ready to deal with knife cuts.

# Appendix 11: Mortars and racks

## A11.1 Guidelines for mortar tube design

The information in this section is provided for the assistance and guidance of the designers and manufacturers of mortars. These specifications are not intended to be construed as absolute minimums. Tables A11.1 to A11.3 present details of mortar tube features for cardboard, high-density polyethylene (HDPE) and glass reinforced epoxy. Experience has demonstrated that these recommendations function reliably in use. However, designers must be able to demonstrate the safety, suitability and performance of their designs by suitable tests.

Table A11.1: Cardboard mortars (convolute or spiral) – adequate mortar wall thickness (mm)

| Mortar ID (mm) | Spherical shell | Cylindrical shell single break | Cylindrical shell two break |
|---|---|---|---|
| 50 | 4.5 | 6.25 | 9.25 |
| 62.5 | 4.5 | 6.25 | 9.25 |
| 75 | 6.25 | 6.25 | 9.25 |
| 100 | 6.25 | 8.25 | 12.5 |
| 125 | 7.75 | 10.5 | 15.5 |
| 150 | 9.25 | 12.5 | 18.75 |
| 200 | 12.5 | * | * |
| 250 | 15.5 | * | * |
| 300 | 18.75 | * | * |
| 400 | * | * | * |

Note: The cross-grain tensile strength of the paper should be at least 16,000 kPa.

* = Data not currently available.

Table A11.2: High density polyethylene (HDPE) mortars – adequate mortar wall thickness (mm)

| Mortar ID (mm) | Spherical shell | Cylindrical shell single break | Cylindrical shell two break |
|---|---|---|---|
| 50 | 3.0 | 4.25 | 4.25 |
| 62.5 | 3.0 | 4.25 | 4.25 |
| 75 | 3.75 | 4.25 | 4.25 |
| 100 | 5.0 | 5.0 | 5.0 |
| 125 | 5.0 | 5.0 | 5.0 |
| 150 | 7.5 | 8.0 | 8.0 |
| 200 | 8.0 | * | * |
| 250 | 8.0 | * | * |
| 300 | 9.25 | * | * |
| 400 | * | * | * |

Note: The tensile strength of plastic should be at least 22,750 kPa.

* = Data not currently available.

Table A11.3: Fibreglass mortars – adequate mortar wall thickness (mm) for fibreglass reinforced epoxy

| Mortar ID (mm) | Spherical shell | Cylindrical shell single break | Cylindrical shell two break |
|---|---|---|---|
| 50 | 3.0 | 4.25 | 4.25 |
| 62.5 | 3.0 | 4.25 | 4.25 |
| 75 | 3.75 | 4.25 | 4.25 |
| 100 | 5.0 | 5.0 | 5.0 |
| 125 | 5.0 | 5.0 | 5.0 |
| 150 | 7.5 | 8.0 | 8.0 |
| 200 | 8.0 | * | * |
| 250 | 8.0 | * | * |
| 300 | 9.25 | * | * |
| 400 | * | * | * |

Note: The tensile strength of fibreglass should be at least 76,000 kPa.

* = Data not currently available.

If there is reason to doubt that the strength of a mortar is adequate, a test may be devised to determine whether its strength is sufficient. One possible strength test for mortars is to fire the heaviest aerial shell of a

given size to be used with a charge of lift powder that is 1.5 times the normal quantity. This approximately doubles the normal stress on the mortar. This test must not be conducted at the pyrotechnics display site and must be done before the mortar is used as a certified design at a pyrotechnics display. In addition, mortars meeting the specifications of Tables A11.1, A11.2 and A11.3 generally are believed to have ample strength. Where there is concern that a mortar is too short to cause an aerial shell to be propelled to a safe altitude, a series of test firings should be conducted. However, it generally is believed that mortars of the lengths specified in Table A11.4 are sufficient.

The lengths specified in Table A11.4 are not intended to be construed as absolute minimums; however, experience has demonstrated that these recommendations function reliably in use. The burst height of aerial shells can vary as a function of the length of the mortar tube, clearance between inside the mortar tube wall and aerial shell, etc. The provision of this information by the manufacturer is important to establish realistic clearance distances for the display set-up and conducting the display.

Table A11.4: Minimum inside mortar length (mm)

| Mortar ID (mm) | Single break shell | Double break shell | Up to 4-break shell |
|---|---|---|---|
| 75 | 375 | 450 | 525 |
| 100 | 500 | 575 | 675 |
| 125 | 600 | 700 | 800 |
| 150 | 700 | 800 | 925 |
| 200 | 850 | 1000 | 1150 |
| 250 | 1000 | 1150 | 1350 |
| 300 | 1150 | 1300 | 1550 |

## A11.2 Methods of protection for mortars firing shells

In order to prevent injury to people by mortar explosion firing debris, or mortar explosion displacing other mortars which then fire, the following techniques may be used:

a. Burial of mortars in the ground to an appropriate depth

b. Placement of sandbags around mortars to an appropriate height

c. Burial of mortars in the ground with additional sandbag protection

d. Placement of mortars in wooden troughs with internal bulkheads, as necessary, to support the trough, and with sand or other suitable filling to support the mortars

e. Placement of mortars in wooden troughs with internal bulkheads, as necessary, to support the trough, and with wood blocking to support and separate the mortars as appropriate

f. Placement of mortars in plastic drums with wood blocking to support and separate the mortars as appropriate, or sand or other suitable filling to support the mortars

g. Placement of mortars in wooden racks

h. Placement of mortars behind a barrier or wall, shown by witnessed tests to be resistant to fragments generated by explosion of the starshell and rupture of the mortar - this barrier or wall to be on the audience side, and adequate clearance given in other directions where there is no protection by barricading

i. Support for mortars or for mortar racks, troughs or drums to ensure that the mortars are not realigned.

j. Placement of mortars inside resilient cladding to maintain alignment

k. Placement of mortars inside metal racking

l. Any other technique which can be tested and demonstrated to support the mortars in the event of a mortar explosion and rupture.

All methods must be tested to demonstrate that displacement of adjacent mortars does not occur, and that dangerous fragmentation does not occur should a mortar explosion break apart a mortar.

# Appendix 12: Floating vessels and floating platforms

## A12.1 Special hazards

Firing pyrotechnics from a floating platform, such as a raft, pontoon or barge, presents special hazards since this type of platform can be unstable from waves and currents. The floating platform can recoil from the pyrotechnics being fired, causing it to shift and the trajectory of an aerial shell to deviate. Space is also much more confined than on conventional land sites, and the pyrotechnics operator and pyrotechnics operator's assistants cannot move about the platform as freely as on land. Additional hazards and risks on vessels and platforms include

- The closeness of the pyrotechnics operator and the operator's assistant(s) to the pyrotechnics;
- The increased potential for the pyrotechnics operator or the operator's assistant to slip or trip; and
- Hazards associated with the water itself.

## A12.2 Requirements for a floating vessel or platform

### A12.2.1 Construction

A floating vessel and/or floating platform must be of sufficient strength, room and stability to enable all activities associated with the firing of the display to be conducted safely. The types of pyrotechnics and the placement of the pyrotechnics and pyrotechnics equipment (including mortars and securing equipment) must not jeopardise the stability and seaworthiness of the floating vessel when the pyrotechnics are fired. Deck strength must be considered.

### A12.2.2 Identification

The floating vessel or floating platform must be identified as an explosives vessel or platform from the time that the pyrotechnics are taken on board at initial set up until the pyrotechnics operator declares the vessel or platform free from pyrotechnics. The platform or vessel must be fitted with standard pyrotechnics warning signs. The number of signs used should be based on permitting the ready identification of the presence of pyrotechnics on the barge from the perimeter of the exclusion zone during day and night in:

- All conditions of weather; and
- All directions of approach.

The platform or vessel may also be required to fly flags and display a red light at night in accordance with the Meanings of International Maritime Signal Flags.

### A12.2.3 Staffing

A floating vessel or floating platform may be staffed or unstaffed, provided that:

- The pyrotechnics operator remains in control at all times of the floating vessel or floating platform and firing of the display; and
- The security of the exclusion zone is maintained.

### A12.2.4 Freedom from flammable and combustible materials

Floating vessels and floating platforms must be free of all nonessential flammable and combustible materials. Any permanently mounted equipment on board the vessel not being used and containing flammable or combustible material (such as a motor fitted with a fuel tank) must be shielded from exposure to the pyrotechnics. Portable power generation equipment and material-handling equipment deemed necessary for the performance of the display may be permitted.

### A12.2.5 Safety shelters

Floating vessels and floating platforms that are staffed during electric firing must have a safety shelter which is located as far as practicable away from the pyrotechnics. The safety shelter must be designed and constructed to withstand the impacts and effects from the pyrotechnics to be fired (such as low bursting aerial shell, impact from a dud aerial shell, direct impact from a Roman candle, barrage or cake). It must be able to withstand a direct impact from a fired shell. The design must also:

- Be of sufficient size to accommodate all personnel present during the actual firing of the display; and
- Provide adequate protection for these personnel from the pyrotechnics display set-up and above, e.g. malfunctioning pyrotechnics and dud aerials. The design may include an observation window made of laminated glass protected by expanded metal or LEXAN to allow observation of the firing by the pyrotechnics operator and the pyrotechnics operator's assistants. This window must be tested, or else closed circuit TV used for observation.

## A12.3 Requirements for Pyrotechnics

### A12.3.1 Types

Small calibre pyrotechnics, such as ground level pyrotechnics, may be fired from a floating platform, such as a raft, if:

- They are fired electrically; and
- The appropriate calculated minimum clearance distances are complied with. (The calculation of the clearance distance must include an additional provision for the pyrotechnic firing up to an additional angle of 10 degrees to the horizontal.) Aerial pyrotechnics must be fired only from a vessel or platform of substantial size where stability is ensured.

### A12.3.2 Storage

Pyrotechnics for a future display must not be stored on board a floating vessel or platform when the floating vessel or platform is already set up for a display.

## A12.4 Setting up the display

The setting-up phase of the display varies from other types of displays in that the display may be set up on vessels (such as barges) away from the planned display site and the set-up display may be transported to the display site on the vessel. The set-up display can rest in two locations:

- the set up location; and
- the display site.

### A12.4.1 Additional requirements

a. Only electric firing of displays on a floating vessel or platform is permitted. Hand firing is prohibited.

b. The display must be set up to provide a minimum of two separate egress paths which are unobstructed. Only one egress path is required from a safety shelter.

c. The display must not be set up (either at the set-up location or the display site) where there are overhead obstructions such as bridges and overhead wires.

d. The requirements for calculating the exclusion zones for setting up the display and for transporting the display set-up on the vessel are the same as in Section 5.2 of this Code. The exclusion zone must be defined so that unauthorised persons and unauthorised vessels and vehicles are restricted from entry.

e. The methods for securing the pyrotechnics and associated equipment must be directed by the person in charge of the display. Methods for securing may be different from land-based applications.

f. Wheelhouse windows of the vessel on the side facing the pyrotechnics must have substantial protection in case of a direct hit from a starshell.

g. A dedicated watercraft ready and capable of providing rapid emergency response must be present during set up, display and clean up stages. It should have a crew of at least two people.

h. During the display, only necessary personnel must be aboard the floating vessel or floating platform. All personnel, other than the spotters or the fire watch, must be in safety shelters.

i. All personnel aboard a floating vessel or floating platform during the display should have ready access to lifejackets, and should wear them at appropriate times, such as when transferring to or from small craft. These lifejackets should have a visual location device.

j. Two effective communication systems, such as mobile phones, or two-way radio, must be available on the vessel to communicate with the emergency support team, the pyrotechnics event organiser and other agencies.

# Appendix 13: Methods of securing pyrotechnics

Table A13.1 below provides information on recommended methods of securing pyrotechnics that may be used by person in charge of the displays for different surfaces and applications. These methods cover the different types of pyrotechnics and applications where the pyrotechnics must be secured.

Table A13.2 below provides details on the methods of securing pyrotechnics items which are presented in the columns in Table A13.1. These methods are described by a brief description and notes on the method of securing.

Table A13.3 provides notes for the applications and notes described in Table A22.1 and A22.2.

Some illustrations are provided.

Table A13.1: Securing pyrotechnics before firing: methods matrix

| Type of Firework Item & Application | | Method 1 | Method 2 | Method 3 | Method 4 | Method 5 | Method 6 | Method 7 | Method 8 | Method 9 | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mortars, single** | Earth | A | A | | | B | | | | B | Rack or bucket |
| | Sand | | | | | B | | | | A | Rack or bucket |
| | Hardstand | | | | | | | | A | A | Rack or bucket |
| | Barges | | | | | | A | | A | | Rack, bucket or skip full of sand |
| | Trailers | | | | | | A | | A | | Rack or bucket |
| **Mortars in racks** | Earth | | A | | | | | | A | | |
| | Sand | | A | | | B | | | A | | At least 600mm into ground |
| | Hardstand | | | | | | | | A | | Timber feet |
| | Barges | | | | | | A | | | A | Timber feet, skip full of sand |
| | Trailers | | | | | | A | | | | |
| **Flares, strobes** | Earth | A | B | | | | | | | | |
| | Sand | A | B | | | | | | | | |
| | Hardstand | | | | | | | A | | | Ply panels |
| | Barges | | | | | | | A | | | Ply panels |
| | Trailers | | | | | | | A | | | Ply panels beside trailer |
| **Fountains** | Earth | A | B | | | | | | | | |
| | Sand | A | B | | | B | | | | | |
| **Fountains (cont)** | Hardstand | | | | | | | A | A | A | Ply panel, rack or bucket |
| | Barges | | | | | | | A | A | A | Ply panel, rack or bucket |
| | Trailers | | | | | | | A | A | A | Ply panel, rack or bucket |
| **Candles** | Earth | A | A | | | | | | A | | Rack minimum 2 stakes |
| | Sand | | A | | | B | | | A | | Rack minimum 2 stakes |
| | Hardstand | | | | | | | | A | | Rack with timber feet |
| | Barges | | | | | | | A | A | | Rack with timber feet |
| | Trailers | | | | | | | A | A | | Rack with timber feet |
| **Unstable cakes** | Earth | | A | A | | | | | | | minimum 2 stakes |
| | Sand | | A | A | | | | | | | At least 300mm into ground minimum 2 stakes |
| | Hardstand | | | A | | | | | | | |
| | Barges | | | A | | | | | | | |
| | Trailers | | | A | | | | | | | |
| **Stable cakes** | Earth | | A | A | | | | | | | At least 150mm in ground minimum 2 stakes |
| | Sand | | A | A | | | | | | | At least 300mm into ground minimum 2 stakes |
| | Hardstand | | | A | | | | A | | | Ply panels |

Table A13.1: Securing pyrotechnics before firing: methods matrix (continued)

| Type of Firework Item & Application | | Method 1 | Method 2 | Method 3 | Method 4 | Method 5 | Method 6 | Method 7 | Method 8 | Method 9 | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barges | | | A | | | | A | | | Ply panels |
| | Trailers | | | A | | | | A | | | Ply panels |
| Wheels | Earth | | | | A | | | | | | 3" X 4" Timber post, purpose designed attachment, post secured by star pickets |
| Wheels (cont) | Sand | | | | A | | | | | | 3" X 4" Timber post, purpose designed attachment, post secured by star pickets |
| | Hardstand | | | | A | | | | | | 3" X 4" Timber post, purpose designed attachment, post secured by brackets |
| | Barges | | | | A | | | | | | 3" X 4" Timber post, purpose designed attachment, post secured by brackets |
| | Trailers | | | | A | | | | | | 3" X 4" Timber post, purpose designed attachment, post secured by brackets |

Matrix Key A First choice for securing item
B Second choice, or additional measure for extra security needed, such as sandbags or barriers

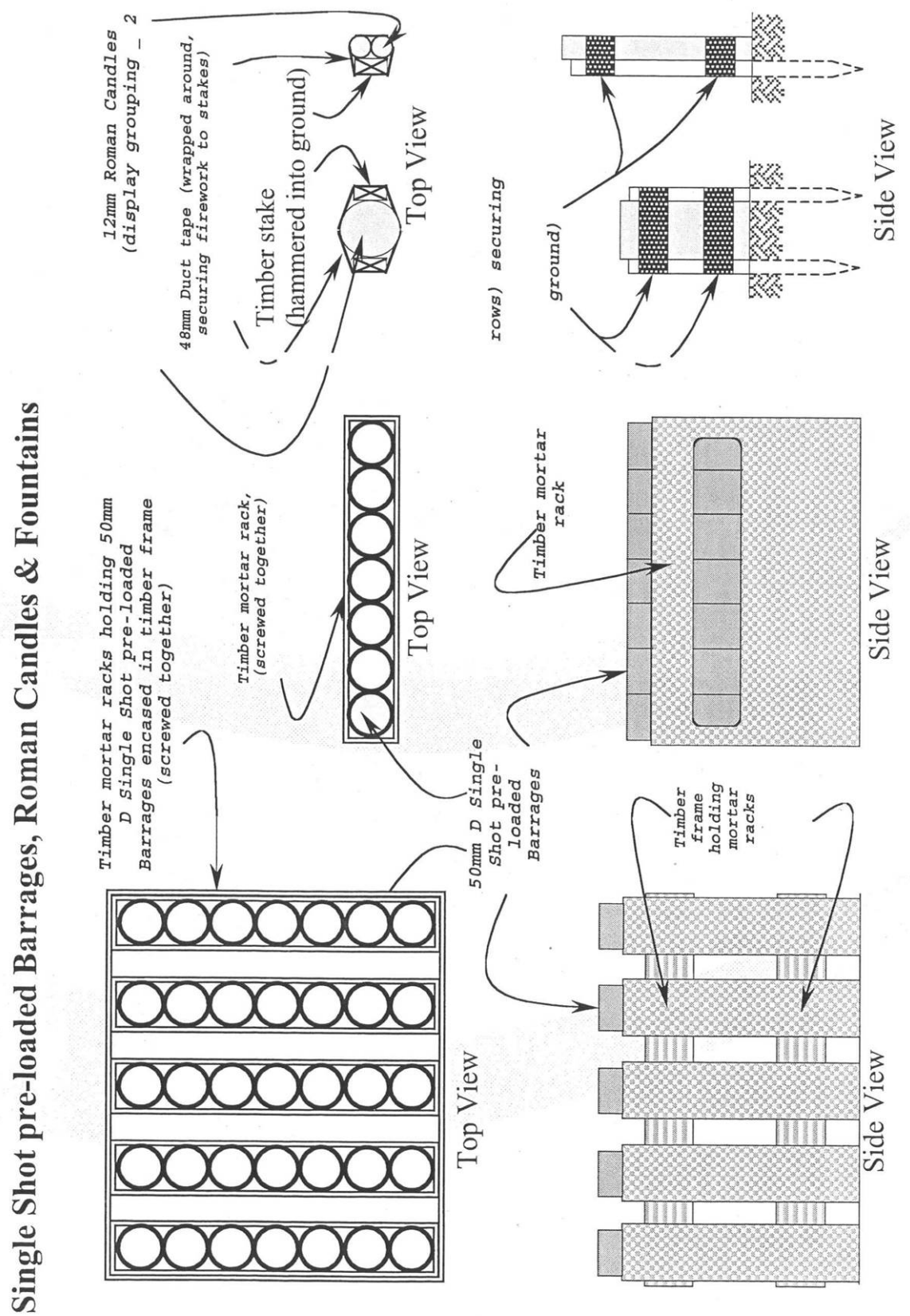
Table A13.2: Details of recommended methods of securing pyrotechnic items

| Method number | Brief description | Notes |
|---|---|---|
| Method 1 | Stake and tape and/or tie wire | Single stake of appropriate length, and several turns of strong wide adhesive tape. Item to be rigidly immobilised. |
| Method 2 | Multiple stake and tape | As for (1) but using more than one stake, includes staking racks. |
| Method 3 | Box | Box with wide, stable base with or without sandbags. Item to be rigidly immobilised within box using pins, tape, brackets or wedges. |
| Method 4 | Purpose built support | 3” x 4” timber post, purpose-designed attachment, post secured by waratahs. |
| Method 5 | Burial | Burial to depth, or sandbag sufficient to immobilise item. |
| Method 6 | Bolt to frame | Rack or box bolted to frame in case of trailer mounting. |
| Method 7 | Ply panels | Secure to horizontal ply panels using tape and screws, or brackets. Item to be rigidly immobilised. |
| Method 8 | In rack | Mount in rack, secure rack by staking, sand-bagging or bolting on anchor points; or massed assembly of multiple racks. |
| Method 9 | In bucket or bin | Mount in self-supporting bucket or handi-skip full of sand. Item to be buried almost to full depth. |

Table A13.3: Notes for applications and items in tables A13.1 and A13.2

| | |
|---|---|
| Barges | Floating launch vessels including pontoons. |
| Barrier | A solid wall able to physically separate item and its effects from audience in event of worst-case malfunction. |
| Box | Wooden or plastic container large enough to contain item and to direct all effects upwards in event of worst-case malfunction. |
| Earth | Ground solid enough to accept and hold steel rod stake. Stake must be able to anchor item rigidly with no lateral or upward movement possible. |
| Hardstand | Ground or surface too hard to accept stakes. |
| Sand | Ground not solid enough to accept stake as above. |
| Sandbags | Unrestrained sand should not be used to secure items unless in massive quantities, e.g. on a beach. In all other circumstances, sand should be bagged or contained in box, tub, skip, trench, plywood panels etc. |
| Staking | Preferable steel rod, or hardwood. Exposed stake not to protrude above item. Driven sufficiently deep to fix item rigidly with no lateral movement possible. |
| Taping | Heavy duty adhesive tape, at least 25 mm wide. Gaffer tape, packaging tape, duct tape, reinforced fibre tape. Multiple turns required, item must be rigidly held. |
| Trailers | Towed wheeled vehicle, holding racks of mortars. |
| Unstable cakes | Multi shot items with centre of gravity above one third item height and small fanned multi shots. |
| NB: The methods for securing pyrotechnics described in this matrix are not meant to be comprehensive. Alternative methods of securing pyrotechnics may be available, and if they offer better security and freedom from debris danger, they should be used. | |

Figure A13.2: Illustration of methods of securing single shot pre-loaded barrages, roman candles and fountains



# Appendix 14: Labelling of hazardous substances

This material is taken from the EPA's document entitled "Labelling of hazardous substances: hazard and precautionary information", July 2006. This document is available on the EPA website at www.epa.govt.nz.

This document describes a procedure for manufacturers and suppliers to determine the pictograms, signal word, and hazard and precautionary statements required on the label of a pyrotechnic item. It is based on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

From an evaluation of a substance's hazardous properties, the substance will be given a classification according to the Hazardous Substances (Classification) Regulations 2001. This classification must be known before hazard and precautionary information requirements can be determined. The following procedure is then used to find the required signal words, hazard pictograms and hazard and precautionary statements that need to be displayed on the label of the substance's packaging.

The pictograms, signal word, and hazard and precautionary statements required on the label of a hazardous substance can be obtained using Table A14.1 and accompanying Tables A14.2 to A14.6 of this document. Table A14.1 provides the signal word, pictograms, and codes for the hazard and precautionary statements required for every HSNO classification. Tables A14.2 to A14.6 provide a means of converting hazard and precautionary statement codes into the actual statements required.

- Step 1 Note the signal word, pictogram, and hazard and precautionary statement codes in Table A14.1 required for each of the HSNO classifications of the substance.
- Step 2 Convert the applicable hazard and precautionary codes into text using Tables A14.2 to A14.6.
  - The core parts of the hazard and precautionary statements are written in bold text.
  - The following symbols and italicised text are used to depict, and provide guidance, when flexibility and variation is appropriate in the construction of a statement:
  - a forward slash [/] depicts that a choice needs to be made between the words it separates, and only the words appropriate to the substance should be selected, e.g. "… avoid breathing dust/fumes/gas/mist/vapours/spray" could read "avoid breathing vapours";
  - three equally spaced full stops […], indicates missing words where the manufacturer/supplier is able to incorporate further information specific to their substance into the hazard statement;
  - the use of 'less than' [<] and 'greater than' [>] symbols enclosing italicised text provides guidance as to the type of information required at the preceding full stops […];
  - the use of an asterisk [*] followed by italicised text provides guidance where information in the statement varies according to specific hazard types;
  - the use of italicised text following a dash [–] provides guidance of certain conditions when the statement may or may not be applicable.
- Step 3 Apply the following principle of precedence to avoid excessive labelling and duplication:
  - If the signal word "danger" applies, the signal word "warning" should not appear.

- Where there is both a GHS and Transport of Dangerous Goods pictogram for a given HSNO classification, and a Transport pictogram appears on a label, a GHS pictogram for the same hazard should not appear.
- A Transport pictogram can be used on a label in the workplace instead of a GHS pictogram but the reverse cannot apply.
- Transport pictograms must be used for transport.

Table A14.1: Hazard and precautionary information for HSNO classifications

**Physical Hazards**

| HSNO Hazard Classification | Transport of Dangerous Goods Pictogram | GHS Pictogram | Signal word | Hazard statement code | Precautionary statement codes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Prevention | Response | Storage | Disposal |
| Unstable explosives[a] | No pictogram assigned in *UN RTDG*. (Transport not allowed) |  | Danger | H200 | P201<br>P202<br>P281 | P372<br>P373<br>P380 | P401 | P501 |
| 1.1 |  |  | Danger | H201 | P210<br>P230<br>P240<br>P250<br>P280 | P370 + P380<br>P372<br>P373 | P401 | P501 |
| 1.2 |  |  | Danger | H202 | P210<br>P230<br>P240<br>P250<br>P280 | P370 + P380<br>P372<br>P373 | P401 | P501 |
| 1.3 |  |  | Danger | H203 | P103*<br>P210<br>P230<br>P240<br>P250<br>P280 | P370 + P380<br>P372<br>P373 | P401 | P501 |
| 1.4 |  |  | Warning | H204 | P103*<br>P210<br>P240<br>P250<br>P280 | P370 + P380<br>P372[b] /P374[c]<br>P373 | P401 | P501 |

[a] Not a HSNO category and not allowed for transport.

[b] Use this prevention statement for substances that do not have a HSNO 1.4S classification and are ammunition or components thereof.

[c] Use this prevention statement for substances that have a HSNO 1.4S classification and are ammunition or components thereof.

* Use only if substance is available to the general public.

Table A14.2: Codification of hazard statements

| Code | Hazard Statement |
|---|---|
| H200 | Unstable explosive. |
| H201 | Explosive; mass explosion hazard. |
| H202 | Explosive; severe projection hazard. |
| H203 | Explosive; fire, blast or projection hazard. |
| H204 | Fire or projection hazard. |

Table A14.3: Codification of prevention statements

| Code | Prevention statement |
|---|---|
| P103 | Read label before use.<br>This statement applies only where the substance is available to the general public. |
| P201 | Obtain special instructions before use. |
| P202 | Do not handle until all safety precautions have been read and understood. |
| P210 | Keep away from heat/sparks/open flames/hot surfaces* <specify applicable ignition source(s)>. No smoking.<br>* In the case of a HSNO 3.1D substance, specify to keep away from flames and hot surfaces.<br>* In the case of a HSNO class 5.1.1 substance; specify to keep away from heat. |
| P230 | Keep wetted with ... <specify appropriate material(s)>.<br>This statement applies only where drying out increases the explosion hazard, except as needed for manufacturing or operating processes (e.g. nitrocellulose). |
| P240 | Ground/bond container and receiving equipment.<br>In the case of a HSNO class 1 substance, this statement applies if the substance is electrostatically sensitive.<br>In the case of a HSNO 3.1A-C substance; this statement applies if the electrostatically sensitive material is for reloading, or the substance is volatile so as to generate a hazardous atmosphere.<br>In the case of a HSNO class 4.1.1 substance, this statement applies if electrostatically sensitive material is for reloading. |
| P250 | Do not subject to grinding/shock/friction/ ... <specify any other applicable type(s) of rough handling>. |
| P280 | Wear protective gloves/protective clothing/eye protection/face protection*.<br>* In the case of a HSNO class 1 substance, specify face protection.<br>* In the case of a HSNO class 3.1, 4.1.1, 4.1.2, 4.2, 4.3, 5.1.1, or 5.2 substance; specify to wear protective gloves and eye/face protection.<br>* In the case of a HSNO 6.1A-D (dermal) substance, specify to wear protective gloves/clothing.<br>* In the case of a HSNO class 8.2 substance, specify to wear gloves/clothing and eye/face protection.<br>* In the case of a HSNO 6.3A or 6.5B, specify to wear protective gloves.<br>* In the case of a HSNO 6.4A or 8.3A, specify to wear eye/face protection. |
| P281 | Use personal protective equipment as required. |

Table A14.4: Codification of response statements

| Code | Response statement |
|---|---|
| P372 | Explosion risk in case of fire.<br>don't use if explosives are 1.4S Ammunition and Components thereof |
| P373 | DO NOT fight fire when fire reaches explosives. |
| P374 | Fight fire with normal precautions from a reasonable distance.<br>use if explosives are 1.4S ammunition and components thereof |
| P380 | Evacuate area. |

Table A14.5 Codification of storage statement

| Code | Storage statement |
|---|---|
| P401 | Store in accordance with … <specify the relevant site and storage provisions>. |

Table A14.6 Codification of disposal statement

| Code | Disposal statement |
|---|---|
| P501 | *In the case of a substance that is in compliance with a HSNO approval other than a Part 6A (Group Standards) approval, a label must provide a description of one or more appropriate and achievable methods for the disposal of a substance in accordance with the Hazardous Substances (Disposal) Regulations 2001. This may also include any method of disposal that must be avoided. |

# Appendix 15: Safe distances for electric igniters

## Single Source Safe Distances Calculated For Electro-Explosive Devices

| Serial | Description of equipment | Frequency Range | Maximum transmitted power | Safe distance (see Note 2) metres |
|---|---|---|---|---|
| 1 | Radar | > 5 GHz | 100 kW peak | 500 |
| 2 | Radar | 1 to 5 GHz | 6 MW peak<br>50 kW continuous work | 800 |
| 3 | Radar | 0.2 to 1 GHz | 6 MW peak<br>50 kW continuous work | 1500 |
| 4 | SHF: radio relay | ≥ 3 GHz | 20 W | 80 |
| 5 | VHF: radio relay | 0.3 to 3 GHz | 20 W | 150 |
| 6 | UHF: fixed installation broadcast | ≥ 0.3 GHz | 5 MW | 600 |
| 7 | UHF: movable (see Notes) | ≥ 0.3 GHz | 50 kW | 150 |
| 8 | VHF: fixed, broadcast | 30 to 300 MHz | 50 kW | 900 |
| 9 | VHF: movable | 30 to 300 MHz | 5 kW | 150 |
| 10 | HF: broadcast | 3 to 30 MHz | 500 kW | 1000 |
| 11 | MF: broadcast | 0.3 to 3 MHz | 500 kW | 1000 |
| 12 | LF: broadcast | 30 to 300 kHz | 500 kW | 500 |
| 13 | VLF: broadcast | <30 kHz | 200 kW | 100 |
| 14 | Mobile radio (see Note 6) | Any frequency | 100 to 500 W | 40 |
| 15 | Mobile radio (see Note 6) | Any frequency | 10 to 100 W | 20 |
| 16 | Mobile radio (see Note 6) | Any frequency | <10 W | No hazard, provided no direct contact is made with the aerial |
| 17 | High frequency ovens (providing there is no significant r.f. leakage) | | | No hazard outside the equipment |
| 18 | Civil aircraft equipment. All types at maximum permitted power. | | | 50 |

NOTES:

1 If there are two or more significant transmitting sites radiating powers in excess of 50 kW, each within 3000 m (see also Note 2) of the hazarded firing site, then a detailed site assessment should be undertaken.

2 The tabled distances do not necessarily apply to transmitters utilizing 'troposcatter'.

3 The distances apply directly in the case of standard commercial igniters with leads unwound or partially unwound during normal handling and when connected into firing circuits. The distances are from the transmitter to the nearest point of the proposed firing circuit.

4 This table may require amendment as further information on radiation sources becomes available.

5 'Movable' implies vehicle-borne equipment which requires erection of a portable aerial for operation.

6 'Mobile' implies capable of operation whilst vehicle is moving (seagoing vessel radios should not be assumed 'mobile' in this context).

# Appendix 16: Assignment of pyrotechnics to hazard divisions

## A16.1 Classification Codes

A classification code is a statement of the class, hazard division and compatibility group to which an explosive has been assigned as shown in Figure A16.1. Table A16.1 lists all the codes that are used.

Figure A16.1: Components of explosives classification code

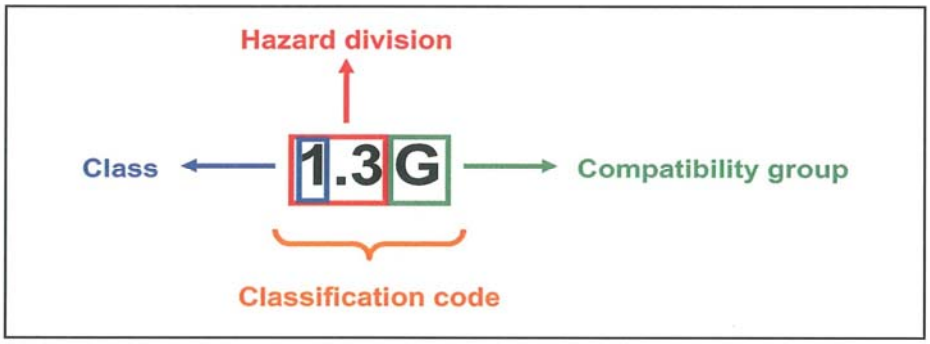



Table A16.1 Classification codes for explosives

| | A | B | C | D | E | F | G | H | J | K | L | N | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HD 1.1 | 1.1A | 1.1B | 1.1C | 1.1D | 1.1E | 1.1F | 1.1G | | 1.1J | | 1.1L | | |
| HD 1.2 | | 1.2B | 1.2C | 1.2D | 1.2E | 1.2F | 1.2G | 1.2H | | 1.2K | 1.2L | | |
| HD 1.3 | | | 1.3C | | | 1.3F | 1.3G | 1.3H | 1.3J | 1.3K | 1.3L | | |
| HD 1.4 | | 1.4B | 1.4C | 1.4D | | 1.4F | 1.4G | | | | | | 1.4S |
| HD 1.5 | | | | 1.5D | | | | | | | | | |
| HD 1.6 | | | | | | | | | | | | 1.6N | |

## A16.2 Default classification of pyrotechnics

The default pyrotechnics classification system adopted here (Table A16.2) is taken from chapter 2.1 of Recommendations on the Transport of Dangerous Goods. Model Regulations, Volume 1 (14th Revised Edition), published by the UN in 2005.

Pyrotechnics are normally assigned to HD 1.1, 1.2, 1.3, and 1.4 on the basis of test data derived from Test Series 6 in Recommendations *on the Transport of Dangerous Goods - Manual of Tests and Criteria (4th Revised Edition)*, published by the UN in 2003. However, since the range of such articles is very extensive and the availability of test facilities may be limited, assignment to a particular hazard division may also be made in accordance with the procedure outlined below.

Assignment of pyrotechnics to UN Numbers 0333, 0334, 0335 or 0336 may be made on the basis of analogy, without the need for Test Series 6 testing, in accordance with Table A16. Items not specified in the table must be classified on the basis of test data derived from Test Series 6.

Where pyrotechnics of more than one hazard division are packed in the same package, they must be classified on the basis of the highest hazard division unless test data derived from Test Series 6 indicate otherwise.

Table A16.2: Default pyrotechnics classification

| Type | Includes/ synonym | Definition | Specification | Classification |
|---|---|---|---|---|
| Shell, spherical or cylindrical | Spherical display shell: aerial shell, colour shell, dye shell, multi-break shell, multi-effect shell, nautical shell, parachute shell, smoke shell, aerial shell<br>Report shell: maroon, salute, sound shell, thunderclap, aerial shell kit | Device with or without propellant charge, with delay fuse and bursting charge, pyrotechnic unit(s) or loose pyrotechnic composition and designed to be projected from a mortar | All report shells | 1.1G |
| | | | Colour shell: ≥ 180 mm | 1.1G |
| | | | Colour shell: < 180 mm with > 25% flash composition, as loose powder and/or report effects | 1.1G |
| | | | Colour shell: < 180 mm with ≤ 25% flash composition, as loose powder and/or report effects | 1.3G |
| | | | Colour shell: ≤ 50 mm, or ≤ 60 g pyrotechnic composition, with ≤ 2% flash composition as loose powder and/or report effects | 1.4G |
| | Peanut shell | Device with two or more spherical aerial shells in a common wrapper propelled by the same propellant charge with separate external delay fuses | The most hazardous spherical aerial shell determines the classification | |
| | Preloaded mortar, shell in mortar | Assembly comprising a spherical or cylindrical shell inside a mortar from which the shell is designed to be projected | All report shells | 1.1G |
| | | | Colour shell: ≥ 180 mm | 1.1G |
| | | | Colour shell: > 50 mm and < 180 mm | 1.2G |
| | | | Colour shell: ≤ 50 mm, or < 60 g pyrotechnic composition, with ≤ 25% flash composition as loose powder and/or report effects | 1.3G |
| | Shell of shells (spherical) (reference to percentages for shell of shells are to gross mass of fireworks article) | Device without propellant charge, with delay fuse and bursting charge, containing report shells and inert materials and designed to be projected from a mortar | > 120 mm | 1.1G |

| Type | Includes/ synonym | Definition | Specification | Classification |
|---|---|---|---|---|
| | | Device without propellant charge, with delay fuse and bursting charge, containing ≤ 25 g flash composition per report unit, with ≤ 33% flash composition and ≥ 60% inert materials and designed to be projected from a mortar | ≤ 120 mm | 1.3G |
| | | Device without propellant charge, with delay fuse and bursting charge, containing colour shells and/or pyrotechnic units and designed to be projected from a mortar | > 300 mm | 1.1G |
| | | Device without propellant charge, with delay fuse and bursting charge, containing colour shells ≤ 70 mm and/or pyrotechnic units, with ≤ 25% flash composition and ≤ 60% pyrotechnic composition and designed to be projected from a mortar | > 200 mm and ≤ 300 mm | 1.3G |
| | | Device with propellant charge, with delay fuse and bursting charge, containing colour shells ≤ 70 mm and/or pyrotechnic units, with ≤ 25% flash composition and ≤ 60% pyrotechnic composition and designed to be projected from a mortar | ≤ 200 mm | 1.3G |
| Battery / combination | Barrage, bombardos, cakes, finale box, flowerbed, hybrid, multiple tubes, shell cakes | Assembly including several elements either containing the same type or several types each corresponding to one of the types of fireworks listed in this table, with one or two points of ignition | The most hazardous firework type determines the classification | |
| Roman candle | Exhibition candle, candle, bombettes | Tube containing a series of pyrotechnic units consisting of alternate pyrotechnic composition, propellant charge and transmitting fuse | ≥ 50 mm inner diameter, containing flash composition, or < 50 mm with > 25% flash composition | 1.1G |
| | | | ≥ 50 mm inner diameter, containing no flash composition | 1.2G |
| | | | < 50 mm inner diameter and ≤ 25% flash composition | 1.3G |

| Type | Includes/ synonym | Definition | Specification | Classification |
|---|---|---|---|---|
| | | | ≤ 30 mm. inner diameter, each pyrotechnic unit ≤ 25 g and ≤ 5% flash composition | 1.4G |
| Shot tube | Single shot Roman candle, small preloaded mortar | Tube containing a pyrotechnic unit consisting of pyrotechnic composition, propellant charge with or without transmitting fuse | ≤ 30 mm inner diameter and pyrotechnic unit > 25 g, or > 5% and ≤ 25% flash composition | 1.3G |
| | | | ≤ 30 mm inner diameter, pyrotechnic unit ≤ 25 g and ≤ 5% flash composition | 1.4G |
| Mine | Pot-a-feu, ground mine, bag mine, cylinder mine | Tube containing propellant charge and pyrotechnic units and designed to be placed on the ground or to be fixed in the ground. The principal effect is ejection of all the pyrotechnic units in a single burst producing a widely dispersed visual and/or aural effect in the air; or: cloth or paper bag or cloth or paper cylinder containing propellant charge and pyrotechnic units, designed to be placed in a mortar and to function as a mine | > 25% flash composition, as loose powder and/or report effects | 1.1G |
| | | | ≥ 180 mm and ≤ 25% flash composition, as loose powder and/or report effects | 1.1G |
| | | | < 180 mm and ≤ 25% flash composition, as loose powder and/or report effects | 1.3G |
| | | | ≤ 150 g pyrotechnic composition, containing ≤ 5% flash composition as loose powder and/or report effects. Each pyrotechnic unit ≤ 25 g, each report effect < 2 g; each whistle, if any, ≤ 3 g | 1.4G |
| Fountain | Volcanos, gerbs, showers, lances, Bengal fire, flitter sparkle, cylindrical fountains, cone fountains, illuminating torch | Non-metallic case containing pressed or consolidated spark and flame producing pyrotechnic composition | ≥ 1 kg pyrotechnic composition | 1.3G |
| | | | < 1 kg pyrotechnic composition | 1.4G |
| Sparkler | Handheld sparklers, non-handheld sparklers, wire sparklers | Rigid wire partially coated (along one end) with slow burning pyrotechnic composition with or without an ignition tip | Perchlorate based sparklers: > 5 g per item or > 10 items per pack | 1.3G |
| | | | Perchlorate based sparklers: ≤ 5 g per item and ≤ 10 items per pack; nitrate based sparklers: ≤ 30 g per item | 1.4G |

| Type | Includes/ synonym | Definition | Specification | Classification |
|---|---|---|---|---|
| Bengal stick | Dipped stick | Non-metallic stick partially coated (along one end) with slow-burning pyrotechnic composition and designed to be held in the hand | Perchlorate based items: > 5 g per item or > 10 items per pack | 1.3 G |
| | | | Perchlorate based items: ≤ 5 g per item and ≤ 10 items per pack; nitrate based items: ≤ 30 g per item | 1.4G |
| Low hazard fireworks and novelties | Table bombs, throwdowns, crackling granules, smokes, fog, snakes, glow worm, serpents, snaps, party poppers, bonbons | Device designed to produce very limited visible and/or audible effect which contains small amounts of pyrotechnic and/or explosive composition | Throwdowns and snaps may contain up to 1.6 mg of silver fulminate; snaps and party poppers may contain up to 16 mg of potassium chlorate/ red phosphorous mixture; other articles may contain up to 5 g of pyrotechnic composition, but no flash composition | 1.4G |
| Spinner | Aerial spinner, helicopter, chaser, ground spinner | Non-metallic tube or tubes containing gas- or spark-producing pyrotechnic composition, with or without noise producing composition, with or without aerofoils attached | Pyrotechnic composition per item > 20 g, containing ≤ 3% flash composition as report effects, or whistle composition ≤ 5 g | 1.3G |
| | | | Pyrotechnic composition per item ≤ 20 g, containing ≤ 3% flash composition as report effects, or whistle composition ≤ 5 g | 1.4G |
| Wheel | Catherine wheel, Saxon | Assembly including drivers containing pyrotechnic composition and provided with a means of attaching it to a support so that it can rotate | ≥ 1 kg total pyrotechnic composition, no report effect, each whistle (if any) ≤ 25 g and ≤ 50 g whistle composition per wheel | 1.3G |
| | | | < 1 kg total pyrotechnic composition, no report effect, each whistle (if any) ≤ 5 g and ≤ 10 g whistle composition per wheel | 1.4G |
| Aerial wheel | Flying Saxon, UFO, rising crown | Tubes containing propellant charges and sparks-, flame- and/or noise producing pyrotechnic compositions, the tubes being fixed to a supporting ring | > 200 g total pyrotechnic composition or > 60 g pyrotechnic composition per driver, ≤ 3% flash composition as report effects, each whistle (if any) ≤ 25 g and ≤ 50 g whistle composition per wheel | 1.3G |
| | | | ≤ 200 g total pyrotechnic composition and ≤ 60 g pyrotechnic composition per driver, ≤ 3% flash composition as report effects, each whistle (if any) ≤ 5 g and ≤ 10 g whistle composition per wheel | 1.4G |

| Type | Includes/ synonym | Definition | Specification | Classification |
|---|---|---|---|---|
| Selection pack | Event selection box, event selection pack, garden selection box, indoor selection box; assortment | a pack of more than one type each corresponding to one of the types of fireworks listed in this table | The most hazardous firework type determines the classification | |
| Firecracker | Celebration cracker, celebration roll, cracker chain | Assembly of tubes (paper or cardboard) linked by a pyrotechnic fuse, each tube intended to produce an aural effect | Each tube ≤ 140 mg of flash composition or ≤ 1 g black powder | 1.4G |
| Banger | Salute, flash banger, lady cracker | Non-metallic tube containing report composition intended produce an aural effect | > 2 g flash composition per item | 1.1G |
| | | | ≤ 2 g flash composition per item and ≤ 10 g per inner packaging | 1.3G |
| | | | ≤ 1 g flash composition per item and ≤ 10 g per inner packaging or ≤ 10 g black powder per item | 1.4G |

**Notes:**

Table A16.2 taken from table 2.1.3.5.5 of *Recommendations on the Transport of Dangerous Goods. Model Regulations, Volume 1 (14th Revised Edition)*.

Unless otherwise stated, references to percentages are to the mass of all pyrotechnic composition (e.g. rocket motors, lifting charge, bursting charge and effect charge).

“Flash composition” refers to pyrotechnic compositions containing an oxidising substance, or black powder, and a metal powder fuel that are used to produce an aural report effect or used as a bursting charge in pyrotechnic devices.

Dimensions in mm refer to:

- spherical and peanut shells - diameter of sphere of shell
- cylinder shells - length of shell
- shell in mortar, Roman candle, shot tube pyrotechnic or mine - inside diameter of tube comprising or containing pyrotechnic
- bag mine or cylinder mine - inside diameter of mortar intended to contain mine.

Classifications only apply to articles packed in fibreboard (cardboard) boxes.

Environmental Protection Authority
Te Mana Rauhī Taiao

Environmental Protection Authority, Level 10, 215 Lambton Quay, Wellington 6011, New Zealand

New Zealand Government