



Queensland code of practice
Control of outdoor fireworks displays

First edition 1 December 2003

PART A

INTRODUCTION

1. Background

On 20 May 2000, at a fireworks display held at the school fete of the Holy Spirit Primary School, Bray Park, Queensland three 2-inch roman candles exploded, and the steel fireworks stands holding those roman candles fragmented, resulting in one fatality and serious bodily injuries to seven people.

Factors contributing to the incident (and its severity) included —

- defective fireworks;
- the unnecessary confinement of fireworks;
- the use of steel fireworks stands; and
- the inadequate training of operators.

The Coroner’s findings from the inquest into the death included recognition of an urgent need for a tightening up of the fireworks industry in all its facets, in particular, in the areas of —

- a general upgrading and revision of the Australian standard or standards in relation to fireworks and the fireworks industry;
- standards and quality control in relation to the manufacture, sale and use of fireworks;
- the importation of fireworks;
- the training, registration and professional supervision of fireworks industry personnel;
- the reporting of all malfunctioning of fireworks to a relevant authority;
- the ongoing education of fireworks industry personnel; and
- the regulation, control and monitoring of fireworks displays.

This Code of Practice (hereafter referred to as “this Code”) aims to prevent the occurrence of another incident like the tragedy at Bray Park to minimise risk at all outdoor fireworks displays. It provides a basis for understanding the reasonable precautions and reasonable care that must be exercised, under Section 32 of the *Explosives Act 1999* by persons involved with fireworks and, under Section 54(2) by persons using fireworks to avoid endangering a person’s safety, health or property.

The duty of care obligations of people involved with the different phases of the life cycle for outdoor fireworks displays, together with minimum performance requirements, are presented as a basis for achieving a safe outdoor fireworks display.

These obligations are based on risk management principles to ensure that displays are only conducted at an acceptable level of risk. This Code will be used as the basis for competency-based training of fireworks contractors and fireworks operators.

2. This Code of Practice

2.1 Application

This Code applies to the control of outdoor fireworks displays including the stages of an outdoor fireworks display, the stages of the fireworks life cycle and the types of fireworks used. This Code identifies the persons involved and applies duty of care obligations on those persons having a role and responsibility in the control of outdoor fireworks displays. This Code also applies minimum requirements for those persons engaged in certain activities associated with outdoor fireworks 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.

2.1.1 Stages of Outdoor Fireworks Display

This Code applies to the phases of an outdoor fireworks display including —

- the supply of fireworks and fireworks equipment;
- the maintenance of fireworks equipment;
- planning the display;
- setting up the display;
- managing the display; and
- post-display activities.

2.1.2 Stages of Fireworks Life Cycle

This Code applies to the management of activities in the different phases of the life cycle of fireworks and the equipment and associated activities for an outdoor fireworks display, including —

- the safety performance of fireworks and fireworks equipment;
- the classification, packaging and labelling of fireworks;
- the purchase, sale and supply of fireworks;
- the storage of fireworks;

- the transport of fireworks;
- the use, handling, possession and disposal of fireworks; and
- the use of fireworks equipment.

2.1.3 Types of Fireworks

This Code applies to fireworks used for outdoor fireworks displays, including —

- ground display fireworks (including mines, fountains, multi-shot box items, Roman candles and lances);
- aerial shells (including salutes);
- strings of firecrackers; and
- close proximity fireworks (designed for indoor use, special effects and theatrical purposes) in an outdoor application at an outdoor fireworks display.

2.1.4 Areas to Which the Code Does Not Apply

This Code does *not* apply to certain activities in the entertainment and other industries.

2.1.4.1 Entertainment Industries

This Code does *not* apply to —

- the use of explosives, firearms, or fireworks for special effects in motion pictures, television, or other entertainment industries;
- close proximity fireworks displays (including indoor displays and theatrical and film sets); or
- the use of flame special effects in the performing arts, when used in compliance with NFPA 160, *Standard for Flame Effects before an Audience* or any other code approved by the Chief Inspector of Explosives.

Operators using blasting explosives on motion picture sets closed to the public must be suitably trained and specially authorised for special effects. The licensing of fireworks

contractors and fireworks operators to conduct outdoor fireworks displays does not cover the use of blasting explosives.

2.1.4.2 *Other*

This Code does not apply to —

- unrestricted fireworks (including, sparklers, streamer cones and model rocket motors) and distress signals unless used in an outdoor fireworks display; or
- the manufacture, transport or storage of fireworks at a manufacturing facility; or
- the use of loose fireworks composition.

2.2 Purpose

The purpose of this Code is to protect fireworks industry personnel and the public from harm from the fireworks used at the displays by providing information for people involved with the different phases of the life cycle of fireworks and the different stages of an outdoor fireworks display.

The Code addresses the skills and knowledge required of people involved with fireworks displays and the application of those skills and knowledge required of people involved with fireworks displays and the application of those skills and knowledge in the workplace. While a responsible attitude and the appropriateness and commitment of persons to follow legislative requirements and practice high standards of safety is paramount to the safe conduct of an outdoor fireworks display and integral to the risk management process, attitude is not further addressed in this Code.

2.3 Approach

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 the development and implementation of control measures which, wherever possible, eliminate the hazards associated with fireworks 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. In order to ensure that fireworks displays present an acceptable level of risk, people with duty of care obligations should ensure that the methods and technology that they implement are consistent with their obligations.

2.4 Equivalency and Variations from the Code

This Code is based on setting minimum requirements that present an acceptable level of risk. However, circumstances may arise where it is possible to operate at an acceptable level of risk outside the requirements set. This Code is not intended to prevent work practices and equipment which provide at least equivalent safety performance to any of its specific provisions, provided that the equivalent safety performance can be demonstrated and the level of risk is acceptable.

The principle is that compliance with the existing minimum requirements presents an acceptable level of risk. A deviation from those requirements now presents an unacceptable level of risk.

Therefore additional risk control measures must be adopted to bring the risk back to an acceptable level.

The process for achieving the outcome of working to a variation involves submission of a proposal to the Chief Inspector of Explosives. Such proposals must be fully documented and supported by a competent person.

The proposal should establish that the level of risk is acceptable. This must be justified, using a risk management approach incorporating a documented risk assessment demonstrating that the additional risk control measures are effective and how they will be adopted. All approved variations should be recorded.

This Code only promotes principles and criteria where there is an acceptable level of risk. The concept regarding equivalent safety performance must always result in an acceptable level of risk being achieved. The obligations of all persons identified in this Code remain extant and are not diminished or transferred to other persons regarding equivalent safety performance.

2.5 Legal Status

This Code has legal authority when called up under the Queensland *Explosives Act 1999* and the *Explosives Regulation 2003* and any legislation that replaces the Act and Regulation. Should there be any inconsistency between the *Explosives Act 1999*, the *Explosives Regulation 2003* and this Code, the *Explosives Act 1999* and the *Explosives Regulation 2003* shall prevail to the extent of the inconsistency.

2.6 Structure

This part (**Part A**) provides an introduction to this Code.

Part B outlines the legislation that applies to an outdoor fireworks display, as well as the roles of regulatory agencies and the duty of care responsibilities of people involved with fireworks displays and fireworks in general.

Part C covers the systems to be implemented to minimise risk of harm from fireworks – i.e. risk management and safety management systems.

Part D covers the general requirements associated with the different phases of the life cycle of fireworks and fireworks equipment.

Part E covers the requirements associated with the different phases of a fireworks display.

Appendix 1 provides definitions of certain words in this document. The remaining appendices provide supporting reference material to assist all users of this Code.

2.7 Transitional Provisions

This Code will come into effect on the date declared by the Chief Inspector of Explosives. It may not be practical or feasible for all persons to immediately comply with all requirements of this Code. The transitional arrangements provided in this section will permit an effective transition from the superseded requirements to the full adoption of all provisions of this Code.

Unless a requirement is stated in this Section of this Code to be a transitional provision, the requirements of this Code will apply on the date printed in this Code or otherwise declared by the Chief Inspector of Explosives to take effect and taking into account the transitional provisions of the *Explosives Regulation 2003*.

The transitional provisions are detailed in the Table 2.1.

Table 2.1 Transitional Provisions

Person	Activity	Issue	Details of transitional provision
Fireworks contractor	Licensing	Fireworks contractors are currently not authorised. When the <i>Explosives Regulation 2003</i> comes into effect, there will be licensing of fireworks contractors.	Fireworks contractors will be authorised as required by the <i>Explosives Regulation 2003</i> .
Fireworks contractor	Safety management system	Fireworks contractors will be required to have a safety management system.	All fireworks contractors must have an operational and documented safety management system in place six months from the date of this Code coming into effect.
Fireworks operator	Purchasing fireworks	Only a fireworks contractor can purchase fireworks and fireworks operators can possess fireworks belonging to the contractor and associated with displays of that contractor.	An authorised fireworks operator will be able to purchase fireworks until 30 June 2004.
Fireworks contractor and fireworks operator	Calculation of minimum clearance distances	The calculation of minimum clearance distances involves consideration of the calculations from information supplied by the supplier in the MSDS and Technical Data Sheet .	Fireworks contractors and fireworks operators must calculate minimum clearance distances but are not required to use information supplied in the MSDS and Technical Data Sheet until one month after the MSDS and Technical Data Sheets are provided by the fireworks supplier.
Fireworks supplier	Provision of MSDS and Technical Data Sheets	The fireworks supplier must provide MSDS and Technical Data Sheets with the supply of fireworks.	Fireworks suppliers must provide MSDS and Technical Data Sheets prepared for supply with the supply of fireworks within six months of the date of this Code coming into effect.
Fireworks supplier	Provide current certificate of compliance with the supply of fireworks	The fireworks supplier must provide a certificate of compliance indicating safe performance with the supply of the fireworks.	Fireworks suppliers must provide a certificate of compliance with the supply of fireworks within six months of the date of this Code coming into effect.
Fireworks supplier	Testing of fireworks to Queensland Fireworks Product Safety Code	The fireworks supplier must ensure that fireworks are tested in compliance with the Queensland Fireworks Product Safety Code.	The fireworks supplier must ensure that fireworks are tested in compliance with the Queensland Fireworks Product Safety Code within six months of this code coming into effect.

Table 2.1 Transitional Provision ... continued.

Person	Activity	Issue	Details of transitional provision
Fireworks Operator	First-aid certificate	All fireworks operators must be the current holder of a first-aid certificate.	Fireworks operators must be the holder of a current first-aid certificate within three months of the date of this Code coming into effect.
Fireworks supplier	Quality system	The fireworks supplier must operate an auditable quality system.	The fireworks supplier has 12 months from the date of this Code coming into effect to implement an operational auditable documented quality system.
Fireworks equipment designers, fabricators and suppliers	Technical Data Sheets	Designers, fabricators and suppliers of fireworks equipment must provide documentation including Technical Data Sheets for equipment.	Designers, fabricators and suppliers of fireworks equipment must provide the documentation within six months of the date of this Code coming into effect.

PART B

LEGISLATION, INVOLVED AGENCIES AND PERSONS

3. Legislation

3.1 Overview

In Queensland, the management of fireworks is covered by the *Explosives Act 1999* (which declares that fireworks are classified as explosives) and the *Explosives Regulation 2003*. The Act applies to all activities involving the safe management of fireworks.

The management of fireworks is also covered by various Australian Standards and Codes of Practice, which include —

- AS2187 Part 0;
- AS2187 Part 1;
- AS2187 Part 3;
- the *Australian Code for the Transport of Explosives by Road and Rail*;
- the *Queensland Code of Practice for the Control of Outdoor Fireworks Displays (this Code)*;
- the *Queensland Fireworks Product Safety Code (under development)*; and
- Explosives Safety Bulletin No.6 *Safe Use of Close Proximity Fireworks*.

The *Explosives Act 1999* is not the only legislation covering fireworks activities. Other legislation relating to certain fireworks activities is listed below. While this Code is primarily focussed on the requirements under the *Explosives Act 1999*, the other legislation applies, as appropriate to outdoor fireworks displays and may involve agencies listed in Section 4 of this Code. The other legislation include —

- the *Workplace Health and Safety Act 1995*;
- the *Environmental Protection Act 1994*;
- the *Fire and Rescue Service Act 1990*;
- the *Transport Operations (Marine Safety) Act 1994*;
- the *Civil Aviation Act 1988*; and
- the *Police Powers and Responsibilities Act 2000*.

3.2 Explosives Act 1999

The *Explosives Act 1999* imposes general duty of care obligations and specific obligations on various people associated with fireworks and fireworks displays. The Act gives force to the *Explosives Regulation 2003* and any Australian standards and codes of practice called up in the legislation. The *Explosives Act 1999* also provides for licensing and other administrative matters.

The *Explosives Act 1999* requires that a person who is engaged in activities involving explosives must take reasonable precautions and use reasonable care to avoid endangering any person's safety, health or property. The *Explosives Act 1999* also requires that a person must not use an explosive if exploding it may reasonably be expected to endanger any person's safety, health or property.

3.3 Responsible Persons – Obligations

3.3.1 General

All persons directly associated with fireworks have general duty of care obligations. These are identified in this Code for the particular classes of person.

However, the list of specific duty of care obligations in this Code is not exhaustive. There remains an overriding general duty of care.

In general, all people involved in the life cycle of fireworks have a general duty of care obligation to —

- comply with the *Explosives Act 1999* the *Explosives Regulation 2003* and this Code; and
- to take all precautions and use reasonable care to achieve an acceptable level of risk.

Note: A person is in breach of the *Explosives Act 1999* should that person direct or permit another person to undertake activities that are in contravention with the *Explosives Act 1999*, the *Explosives Regulation 2003* or this Code.

An example of this would be a fireworks event organiser or a fireworks contractor directing a fireworks operator to conduct the display when it is unsafe to conduct the display.

The general duty of care obligations of persons associated with fireworks include —

- protecting the health and safety of other persons;
- ensuring that all persons directly associated with the handling, storage, use and transport of fireworks are not under the influence of:
 - alcohol;
 - banned drugs; or
 - medication that affects the person's performance and judgement that causes these activities to present an unacceptable risk;
- being an appropriate person. (The appropriateness of persons is defined in Appendix 1. It includes physical fitness i.e. being physically capable of doing the job, mental fitness, suitability from a security and criminal perspective, the person's attitude, etc.);
- controlling ignition sources within the vicinity of fireworks, e.g. when handling, storing, using and transporting fireworks. (The control of ignition sources includes the prohibition of smoking and the possession of smoking materials and equipment e.g. cigarettes, lighters and matches.);
- engaging in appropriate behaviour e.g. no skylarking;

- having the appropriate competencies to perform the duties associated with fireworks safely and correctly; and
- commitment to working to the rules and high standards of safety.

3.3.2 Persons Directly Associated with Fireworks Displays

Key persons (or groups) directly associated with the various phases of an outdoor fireworks display include —

- the *fireworks event organiser*;
- the *fireworks contractor*;
- the *fireworks operator*;
- the *fireworks operator's assistant*; and
- the spectator public.

Responsibilities and obligations for these persons directly associated with fireworks displays are also outlined in Part E of this Code in Sections 14, 15 and 16. (Refer also to Appendix 12 Tables A12.1–A12.5 for a list of the duty of care obligations associated with these people.)

3.3.3 Persons Otherwise Involved with Fireworks Life Cycle

There are also duty of care obligations associated with the different phases of the life cycle of fireworks for persons who are not listed in Section 3.3.2 and who are responsible for activities associated with fireworks and fireworks equipment. This includes persons responsible for the —

- design and construction of fireworks;
- design, construction and manufacture of fireworks equipment;
- purchase of fireworks;
- sale/supply of fireworks;
- sale/supply of fireworks equipment;
- storage of fireworks;
- transport of fireworks; and
- consignment of fireworks for transport.

Further information is outlined in Tables A12.1 – A12.5 (pages 127-130) A12.6 – A12.13 (pages 131-133).

4. Responsible Agencies

Agencies who may be involved in fireworks displays include —

- Explosives Inspectorate, Department of Natural Resources and Mines;
- Queensland Fire and Rescue Service;
- Local authorities;
- Queensland Police Service (including the Water Police);
- Queensland Transport – Marine Safety Office (Harbour Master);
- Civil Aviation Safety Authority;
- Queensland Ambulance Service;
- State Emergency Service;
- Environmental Protection Agency;
- Department of Industrial Relations – Workplace Health and Safety Queensland;
- Queensland Rail;
- Queensland National Parks and Wildlife;
- Great Barrier Reef Marine Authority;
- Volunteer Marine Rescue and Coast Guard; and
- Department of Primary Industries.

A fireworks event organiser, fireworks contractor and fireworks operator must obey a direction (e.g. a direction to cease the fireworks display) from a government official with statutory authority for that display including a police officer, fire officer, Inspector of Explosives, or a Workplace Health and Safety officer.

4.1 Explosives Inspectorate, Natural Resources and Mines

The Explosives Inspectorate has authority under the *Explosives Act 1999* to ensure that a fireworks display is carried out in accordance with the Act and that all people are meeting their duty of care obligations under the Act. The Explosives Inspectorate does not issue permits for individual displays. Instead, a notification system is used to satisfy the Inspectorate that fireworks contractors will meet their duty of care obligations at the planning stage of the fireworks display. The role of the Explosives Inspectorate includes, but is not limited to —

- assessing notifications of fireworks displays from the fireworks contractor or operator;
- inspecting fireworks displays as appropriate;
- licensing fireworks contractors and fireworks operators and sellers, importers, manufacturers, storers and transporters of fireworks;
- setting standards for fireworks safety and performance, and fireworks displays;
- approving training courses associated with fireworks;
- liaising with other agencies involved with fireworks;
- liaising and communicating with the fireworks industry to improve safety in an effective manner;
- providing directions and advice in relation to fireworks; and
- investigating complaints and incidents involving fireworks.

Inspectors of Explosives have powers under the *Explosives Act 1999* to take action in dangerous situations, where a person has not complied with the requirements of the Act. Inspectors also have powers to undertake investigations relating to a breach of the legislation or an incident. These powers are summarised in Appendix 9.

4.2 Queensland Fire and Rescue Service

The Queensland Fire and Rescue Service has power under the *Fire and Rescue Service Act 1990* to take action on public safety and fire safety matters. Fire officers have the authority to give directions, including stopping a display.

The Queensland Fire and Rescue Service needs to be aware of the location of a display should there be any reports of a fire in the vicinity in addition to any legislative requirements under the *Fire Services and Rescue Act 1990*. The fireworks contractor

must send a notification to the appropriate local Area Director (Urban Division) Queensland Fire and Rescue Service at least seven days before the display.

The Queensland Fire and Rescue Service officers will assess the information provided, based on public safety issues and whether there is a fire ban in place.

This assessment is conducted in accordance with Queensland Fire and Rescue Service Standard Operation Procedures *Fireworks Displays Notifications and Protocols Permanent Procedure 356.4*. A copy of the information from this Standard Operating Procedure is available from the QFRS website at www.emergency.qld.gov.au, or a link from the NR&M website. An on-site inspection and consultation may be required.

4.2.1 Fire Bans

Fire bans do not apply to fireworks per se and therefore do not specifically prohibit fireworks displays. However, if fires do develop as a result of a display, the fireworks contractors and fireworks operators would be held liable under the *Fire and Rescue Service Act 1990*, including any subsequent prosecution.

Fire bans are based on a realistic threat to exposed vegetative regimes. Therefore, the restriction or prevention of a fireworks display in a city/urban park, where there is no significant exposure potential for bush or grass fires, would be contrary to the intent of fire bans. However, the application of the fire ban to a fireworks display in, or immediately adjacent to, a bushfire-prone area would be consistent with the intent of the fire ban.

Under the powers of Section 53 of the *Fire and Rescue Service Act 1990*, fire officers may take action to prevent a display from proceeding. However, it is expected that the decision not to proceed with a display would be arrived at by consultation and agreement with the fireworks contractor

and fireworks event organiser, before the need for direct action on behalf of the Queensland Fire and Rescue Service.

On days of total fire ban, fireworks displays may be cancelled if they are believed to threaten fire safety following a risk assessment undertaken by the Queensland Fire and Rescue Service after notification of the fireworks display (refer Section 14.7)

4.3 Local Authorities

Local authorities may have by-laws which limit the conduct of a fireworks 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 fireworks displays in urban areas (Refer to Section 4.9). Fireworks contractors and operators should check with the relevant local authority during the planning of the display.

4.4 Queensland Police Service (including the Water Police)

The fireworks event organiser and fireworks contractor should contact the police for any large display where the display may adversely affect trafficable routes (road or river), neighbours or other facilities.

For any water-based display, the Water Police must be contacted. However, for aquatic events, it may also be necessary to contact one or more of the other authorities listed below.

4.5 Queensland Transport – Marine Safety Office (Harbour Master)

The Marine Safety Office of Queensland Transport must be contacted for fireworks displays being held on waterways, usually from barges or boats. Fireworks contractors and fireworks operators must comply with the requirements of the *Transport Operations (Marine Safety) Act*.

The *Transport Operations (Marine Safety) Act* requires that an aquatic event authority be issued for an aquatic event. An "aquatic event" is defined as a carnival, fireworks display, race, regatta, speed trial, swimming race or water ski competition in circumstances where —

- the holding of the event will affect marine safety; or
- the holding of the event will affect the effectiveness or efficiency of the Queensland maritime industry.

The aquatic event permit must be approved with a minimum of 42 days' notice prior to the fireworks display. However, for major events or events requiring an exemption from regulatory requirements (e.g. a race where a gazetted speed limit is to be exceeded), a minimum period of not less than 90 days is required.

(The regional harbour master reserves the right to extend this period when necessary.) For some large-scale events on harbours and rivers, consultation with the Marine Safety Office should commence six months before the event date. Further information can be found in the Queensland Government - Maritime Safety Queensland document titled *Applying for an Aquatic Event*.

The *Transport Operations (Marine Safety) Act* requires that marine craft involved with the fireworks display must be commercially registered and have a current marine survey compliance. These requirements may vary for barges. The master of the marine craft must have procedures for the transport, loading, unloading and handling of explosives.

4.6 Civil Aviation Safety Authority

The Civil Aviation Safety Authority (CASA), under the *Civil Aviation Regulations*, requires that a fireworks contractor gain permission from CASA before a fireworks display may proceed when at least one of the following occurs —

- fireworks are to be fired within 5.6 kilometres (3 nautical miles) of an airport including airfields and helicopter pads;
- fireworks effects reach heights greater than 122 metres (400 feet); or
- a display of fireworks could mislead an aircraft and hence could endanger the safety of the aircraft.

Details of the firework display must be given with at least two days' notice to CASA.

Information to be provided includes —

- name, address and phone number of person to operate or coordinate the display where fireworks are to be fired within 5.6 kilometres (3 nautical miles) of an aerodrome;
- date, starting time and duration of display;
- location;
- number of projectiles capable of reaching 122 metres above ground level;
- general description of pyrotechnic characteristics of each projectile;
- estimated highest altitude of projectile and
- maximum burst radius of the pyrotechnics in a projectile.

Refer to material safety data sheets and Technical Data Sheets and the fireworks contractor's safety management system for performance data and the effects from aerial shells and ground level fireworks. Refer to Sections 6.1 and 7.1 of this Code.

4.7 Queensland Ambulance Service

At the request of the event organiser, the Queensland Ambulance Service may be present at a large display.

4.8 State Emergency Service

At the request of the event organiser, the fireworks contractor or the fireworks operator, the State Emergency Service may provide crowd control and/or other services.

4.9 Environmental Protection Agency

The Environmental Protection Agency has authority under the Environmental Protection Act for all situations involving environmental harm or the potential for environmental harm, including nuisance noise.

All personnel involved in the conduct of outdoor fireworks displays must take into consideration the Environmental Protection Agency Guideline, *Abatement of Nuisance Noise from the Use of Fireworks*, which is provided as Appendix 6. (Refer also to Section 14.4.1)

4.10 Department of Industrial Relations-Workplace Health and Safety Queensland

Workplace Health and Safety Queensland has authority under the *Workplace Health and Safety Act 1995*.

All activities associated with a fireworks display (which is a workplace), are subject to the provisions of the *Workplace Health and Safety Act 1995*. Obligations are imposed on obligation holders under the *Workplace Health and Safety Act 1995*. This includes compliance with the *Advisory Standard -Plant* for all plant and equipment design, fabrication, maintenance and training issues, *Advisory Standard – Risk Management* for risk management issues, *Advisory Standard – PPE* for PPE issues and other workplace health and safety issues, including the risk to persons watching the display. An obligation is imposed on those involved with the fireworks display under this legislation also, but it is not limited to the safety issues relating to the use and handling of fireworks.

4.11 Queensland Rail

The relevant operations manager for Queensland Rail needs to be advised when fireworks displays may impact upon a rail corridor.

4.12 Queensland National Parks and Wildlife

National Parks and Wildlife must be consulted when a fireworks display is planned to be conducted in the vicinity of a national park.

4.13 Great Barrier Reef Marine Park Authority

The Great Barrier Reef Marine Park Authority is to be consulted when a fireworks display is planned to be conducted which may impact upon a marine park. A permit for a fee is required in the Marine Park Area.

4.14 Volunteer Marine Rescue and Coast Guard

The Volunteer Marine Rescue and Coast Guard needs to be notified when fireworks displays are planned on the coastal fringes and other areas where water craft may be in distress and may use distress flares and rockets. In such instances the fireworks display effects may cause confusion for emergency response agencies. The Volunteer Marine Rescue and Coast Guard may provide perimeter security patrol services at aquatic events in certain areas.

4.15 Department of Primary Industries (Boating and Fisheries)

The Department of Primary Industries may assist the Water Police and Queensland Transport during fireworks displays conducted on waterways in enforcing exclusion zones. The Department of Primary Industries has responsibilities for safety regulations imposed on water traffic.

PART C

SYSTEMS TO ENSURE SAFETY

5. Risk Management

5.1 Overview of Risk Management

Risk management is widely used for managing the hazards and risks involved in organizational activities. The main elements of risk management are described in the Australian Standard *AS/NZS4360-1999 Risk Management*. This Australian Standard defines risk management as an iterative process consisting of well-defined steps which, taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts.

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 —

- quantitatively (as a number); or
- qualitatively (or comparatively) as "low", "medium", "high" or "extreme".

Risk is usually evaluated in terms of "acceptable" (or "tolerable") or "unacceptable" levels or standards.

5.2 Legislation and Risk

5.2.1 Explosives Legislation

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 explosives legislation has traditionally been prescriptive, imposing strict controls (such as licensing) on activities involving explosives.

5.2.2 Workplace Health and Safety Legislation

The *Workplace Health and Safety Act 1995* places obligation on people to manage risk, refer to Section 22(2) of the *Workplace Health and Safety Act 1995*. People with

obligations should meet the requirements of the *Advisory Standard on Risk Management of the Workplace Health and Safety Act 1995*.

5.2.3 Adoption of Risk Management Approach

This Code advocates the adoption of a structured risk management approach, in conjunction with the regulatory measures applied under the explosives legislation to further reduce the risk of fatalities and non-recoverable injuries.

Risk management principles can be applied to all stages in the life cycle of fireworks and fireworks equipment, as well as the different stages of a fireworks display. They can be applied to —

- some acute risks (single incident and traumatic injury);
- most chronic or long-term risks (e.g. risks associated with exposure to chemicals, noise and ergonomic factors such as industrial asthma, deafness and chronic back problems);
- risks of minor (or recoverable) injury (such as burns, cuts and abrasions); and
- nuisance level risks (such as nuisance noise and smoke).

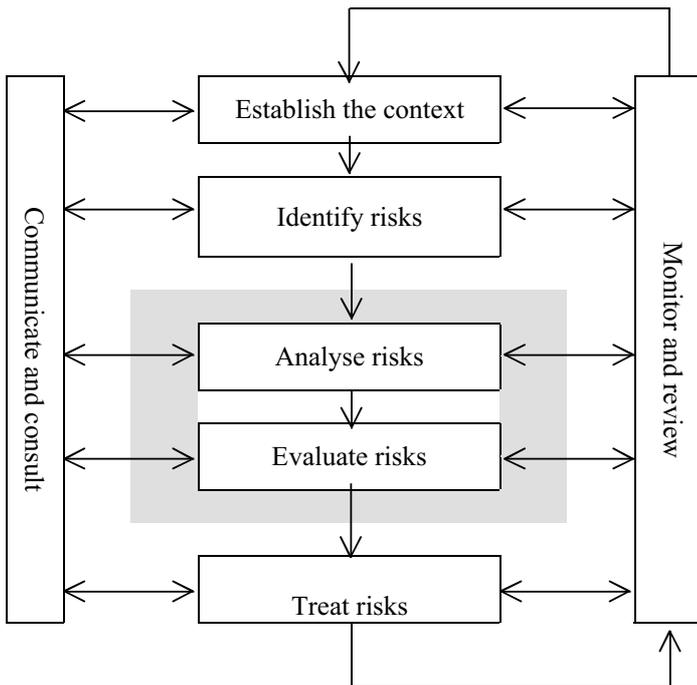
5.3 Managing Risks

5.3.1 Stages of Risk Management Process

The main stages of the risk management process, as shown in Figure 5.1 over, and summarised from the Australian Standard AS4360, are —

- establishing the context;
- identifying the risks;
- analysing the risks;
- evaluating the risks;
- treating the risks;
- monitoring and reviewing the system; and
- communicating and consulting with stakeholders.

Figure 5.1: Risk Management Process



5.3.1.1 Establishing Context

Establishing the context involves scoping and planning the process for managing risk. This process will involve identifying, establishing and developing the full range of environmental and contextual matters and then demonstrating that these matters have been considered. Establishing the context may involve the following processes —

- establishing the strategic context;
- establishing the organisational context;
- establishing the risk management context;
- deciding the structure.

The first stage of the risk management process involves establishing the strategic organisational and risk management context.

5.3.1.2 Identifying Risks

The next stage of the risk management process involves identifying the risks associated with the fireworks display and other related activities (what, why and how incidents can occur).

These include —

- the inherent nature of the fireworks, as described in their formal classification and based on their chemical composition;

- the methods by which the fireworks are normally ignited and how and what can inadvertently ignite them;
- the results of normal ignition (smoke, noise, particles from combustion and any solid projectiles);
- the potential for malfunction of the fireworks in conjunction with its effect on fireworks equipment and adjacent fireworks;
- the effects of malfunctioning fireworks and fireworks equipment on persons;
- the effects of the fireworks on persons outside the viewing area, the environment and other activities in the community (such as aircraft movements and livestock); and
- the effects of external hazards on fireworks such as weather, people, aircraft.

5.3.1.3 Analysing Risks

The existing controls are determined and the risks are analysed in terms of consequence and likelihood in the context of those controls. The analysis should consider the range of potential consequences and the likelihood of their occurrence, such as, carrying out a display in windy conditions, or risk of accidental ignition during set up.

5.3.1.4 Evaluating Risks

Estimated levels of risk are compared against the pre-established criteria. This enables risks to be ranked to identify management priorities. If the levels of risk are low, then risks may fall into an acceptable category and treatment may not be required.

5.3.1.5 Treating Risks

Low priority risks may be accepted and monitored. For other risks, a specific management plan, which includes consideration of funding, would be developed and implemented. Risk, other than offset risk such as insurance, is treated by applying a preferred order of control measures called a "*control hierarchy*". (Refer to Sections 5.4.1 and 5.4.2)

Insurance must be in place to cover residual risk. In addition, risk management processes, both mandatory and of an advisory nature, can be applied by fireworks contractors and fireworks operators to further reduce risk and the consequent injuries.

5.3.1.6 *Monitoring and Reviewing the System*

The performance of the risk management system (and changes which might affect it) are monitored and reviewed.

This involves —

- maintaining operators' work practices in the form of a safety management system (Refer to Section 6.1);
- having procedures in place to incorporate legislative and other evolving best industry practices into management systems;
- maintaining training programs;
- maintaining a work plan;
- reviewing the effectiveness of the safety management system; and
- reviewing incidents and incorporating changes from the lessons learnt.

5.3.1.7 *Communicating and Consulting with Stakeholders*

Communication and consultation with internal and external stakeholders takes place, as appropriate, at each stage of the risk management process and concerning the process as a whole.

5.4 Control Hierarchies

The concept of a "control hierarchy", introduced by occupational hygienists investigating occupationally induced ill health, has been applied to contemporary safety legislation, involving risk management. The term "control hierarchy" refers to a preferred order of controls (or risk control measures).

5.4.1 Six-element Control Hierarchy

A common control hierarchy, the six-element hierarchy consists of —

- elimination (of the hazard and the risk);
- substitution (choosing an alternative with a lower hazard and less risk);
- isolation (of the hazard);
- engineering (adopting engineering controls to engineer out the risk from the hazard);
- administration (adopting administrative controls); and
- personal protective equipment (PPE).

5.4.1.1 *Elimination*

Examples of elimination include —

- the prohibition of certain types of fireworks (e.g. bungers, sky rockets, salutes greater than 75 mm diameter);
- the elimination of poor quality fireworks (by introducing a quality management system);
- the elimination of certain materials for fireworks equipment (e.g. metal or concrete mortars); and
- the elimination of unnecessary confinement of fireworks and fireworks equipment containing fireworks.

5.4.1.2 *Substitution*

Examples of substitution include —

- the substitution of other materials (e.g. high density polyethylene, fibre reinforced plastic, etc.) for metal or concrete mortars;
- the substitution of lower quality fireworks with superior fireworks; and
- the substitution of larger, powerful fireworks with a greater number of smaller colourful varieties.

5.4.1.3 *Isolation*

Even with these high order controls in place, incidents may still occur. Hence, minimum clearance distances are set between the fireworks and the viewing audience, other establishments, dangerous goods stores, and aircraft. Ideally, operators should be as isolated as possible from the fireworks products during firing. For this reason, remote electrical firing is strongly recommended. When fireworks

are lit manually, control measures (such as extended arm techniques and not placing the body over mortars) are very important.

5.4.1.4 Engineering Controls

Engineering controls such as sand bagging, crowd control barriers and screening, methods of securing the fireworks and fireworks equipment are also advocated. Further methods include properly aligning the fireworks in a vertical or known angle position and properly designed and maintained mortars, racks, trailers, etc.

5.4.1.5 Administrative Controls

Administrative controls such as instructions, work procedures, signs etc., are less likely to be reliable and require constant attention and effective supervision. Such controls should be regularly audited and checked for compliance.

5.4.1.6 Personal Protective Equipment

PPE is never a favoured option when using the risk control hierarchy, but it is necessary for operators in this industry when the activity at the display cannot be controlled entirely by other means. The nature and type of PPE to be used are determined from a risk assessment.

PPE for outdoor fireworks displays in the absence of other suitable risk control measures will include the following —

- hearing protection. (The selection may provide for the firing of lifting 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. Short-sleeved 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 objects, such as unexploded shells.

5.4.1.7 Selecting Risk Control Measures

It is generally accepted that lower end measures, i.e. PPE, will not be as effective as those at the top of the hierarchy and that a greater reliance on the lower end reduces control, e.g. isolation of personnel from the firework is a more effective risk control measure than a procedure or sign as a risk control measure and in turn is more effective than PPE. At the same time, it is often necessary to use the lowest element, PPE, either as the sole measure or in combination with other controls.

5.4.2 Thirteen-element Control Hierarchy

The thirteen-element control hierarchy is based on an operational workplace and provides many workplace requirements. This hierarchy provides a more extensive list of control options in essentially the same order as the six-element hierarchy —

- avoiding the risk by eliminating the hazard;
- substituting the firework/equipment with less hazardous firework/equipment;
- reducing the hazard at source (i.e. using less of it);
- removing the person from the hazard (i.e. physically separating to reduce or minimise exposure);
- containing the hazard by enclosure (e.g. containment, isolation);
- guarding or segregating people from the hazard (e.g. barriers or screens);
- reducing exposure (e.g. by using a safe system of work that reduces the risk to an acceptable level);
- adapting work to the individual (e.g. design/ergonomic features);
- providing written procedures that are known and understood by those potentially exposed to the hazard;
- providing adequate supervision;

- providing training in respect of knowing and handling the risks;
- providing information and instruction (e.g. signs, notices and handouts), and
- providing personal protective equipment (PPE).

5.4.3 Economic Factors Affecting Control Measures

In general, the higher up the list, the more effective the control measure. While the higher level controls might be more costly initially, they require less managerial effort in the long term than lower level controls. For example, a design change that eliminates or considerably reduces a hazard has only to be done once. Supervision, the provision of information, training and PPE require continual maintenance and support, which is usually costly. Hence, the level selected on the hierarchy should take into account the ongoing economic factors in addition to the initial cost of the control measure.

5.4.4 Training

The importance of training depends on the frequency with which the task is performed. In an operational workplace where a task may be repeated constantly (e.g. the workplace on which the thirteen-element control hierarchy is based), training may be considered less important than in a workplace where a task is performed less frequently (e.g. fireworks displays which are not held every day). For this reason, comprehensive training must be an important part of the regime to control the risks associated with fireworks displays and related activities.

5.4.5 Safety Management Systems

All operators should develop specific safety management plans for safety management systems to describe their methods to address and control all risks of all activities. Safety management plans are documented safety management systems.

5.5 Controlling Risk Associated with Fireworks Displays and Related Activities

In many cases, a suitable combination of control hierarchies may be appropriate to fully treat the risk. Where the treatment of risk cannot reduce the risk to an acceptable level, the residual risk must be treated. This is an important (although low order) additional risk control measure.

General strategies of risk control should include consideration of technological advances, for example, the automation of hazardous activities such as electric firing versus hand firing. They should include the development of a coherent policy to anticipate future requirements and the potential of new hazards to plan proactively.

5.5.1 Determining Level of Risk

The level of risk can be determined, using a qualitative risk assessment method, based on Appendix E of the Australian Standard *AS4360:1999 Risk Management*.

The steps involved include —

- estimating the levels of consequence and likelihood, using Tables 5.1 and 5.2 below;
- applying the matrix in Table 5.3 to the levels estimated to analyse the risk as "extreme", "high", "medium" or "low"; and
- evaluating the risk against pre-established criteria to determine whether it is "acceptable".

This method can be applied to general hazards in the workplace and specific fireworks activities, including design, work practices and procedures (e.g. exposure to noise, flash, or exploding fireworks). The results of a risk assessment can be used in conjunction with the control hierarchy to significantly reduce the risk from fireworks-related activities.

The qualitative levels of risk e.g. "E", "H", "M" and "L" can indicate where to focus efforts for reducing risk to acceptable levels. The person undertaking the risk assessment and reduction strategies should address the highest contributors to risk, namely all "E" (extreme risk) first, followed by "H" (high risk) and then "M" (moderate risk).

The level of risk at "L" (low risk) is acceptable risk. Under certain circumstances, a moderate level of risk may be acceptable risk if the risk has been minimised as low as reasonably practicable. Levels of risk at "E" and "H" are not acceptable risk.

Table 5.1 – Qualitative Measures of Consequence on Impact

Level	Descriptor	Example of Detailed Description
1	Insignificant	no injuries, low financial loss
2	Minor	first aid treatment, on-site release immediately contained, medium financial loss
3	Moderate	medical treatment required, on-site release contained with outside assistance, high financial loss
4	Major	extensive injuries, loss of production capability, off-site release with no detrimental effects, major financial loss
5	Catastrophic	death, toxic release off-site with detrimental effect, huge financial loss

Table 5.2 – Qualitative Measures of Likelihood

Level	Descriptor	Description
A	Almost certain	is expected to occur in most circumstances
B	Likely	will probably occur in most circumstances
C	Possible	might occur at some time
D	Unlikely	could occur at some time
E	Rare	may occur only in exceptional circumstances

Table 5.3 – Qualitative Risk Analysis Matrix – Level of Risk

	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major	Catastrophic
Likelihood					
A (almost certain)	H	H	E	E	E
B (likely)	M	H	H	E	E
C (moderate)	L	M	H	E	E
D (unlikely)	L	L	M	H	E
E (rare)	L	L	M	H	H

Legend: E: extreme risk H: high risk M: moderate risk L: low risk

6. Safety Management Systems, Including Emergency Planning and Fireworks Incidents

The safety management system is important for safe management of fireworks. Any person who has a duty of care responsibility under any legislation applying to fireworks should have an operational safety management system. The safety management system can be integrated with any other management system such as a quality management system or an environmental management system.

6.1 Safety Management System

The manufacturers, importers/exporters and sellers/suppliers of fireworks are required to operate under a safety management system, as outlined in the *Explosives Regulation 2003*. In addition, the fireworks contractor should have a safety management system in place to ensure the safe management including safe handling and use of fireworks.

Generally, the safety management system should cover issues addressed by this Code. The system must be documented, communicated to all relevant persons, implemented, enforced and reviewed. Smaller operations (e.g., those where the fireworks contractor is also the fireworks operator) need not document the safety management system to the same level of detail as a fireworks contractor who has many fireworks operators operating under the safety management system. A fireworks operator working for a fireworks contractor must operate in accordance with the contractor's safety management system.

The safety management system should be based on a recognised system such as AS4801, Tri Safe etc.

6.1.1 Risk Management Approach

The safety management system should be based on a risk management approach. It should provide details of the hazards identified, the risks assessed and the risk control measures to be adopted. It should

also provide details of the ways that the effectiveness of the risk control measures will be monitored.

(Refer to Section 5 Risk Management.)

6.1.2 Safety Policy

The safety management system should include a safety policy, defined in terms of risk management principles. It should also describe the means of communicating the policy to the workforce and other relevant persons.

6.1.3 Safe Operating Procedures

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

- relevant phases of the life cycle of fireworks and fireworks equipment
- control of the fireworks display site;
- responsibilities and competencies of fireworks personnel; and
- reporting, recording and auditing.

6.1.3.1 Life Cycle of Fireworks and Fireworks Equipment

The phases of the life cycle of fireworks and firework equipment addressed by the safe operating procedures may include the —

- supply or purchase of fireworks products, equipment and services (including details of the suppliers, contractors and purchasing controls);
- maintenance of fireworks equipment and accessories (including maintenance schedules);
- transport of fireworks (including the receipt of fireworks at the site);
- storage and security of fireworks (including the segregation of incompatible materials);
- use and handling of fireworks including the preparation for display (including the selection, maintenance and use

of appropriate personal protective equipment with particular emphasis on hazards, housekeeping, dealing with misfires and accident prevention);

- activities during the phases of the display including setting-up, sleeping the display, managing the display and post-display; and
- disposal of fireworks waste and fireworks ingredients.

6.1.3.2 Control of the Fireworks Display Site

The safe operating procedures should include the procedures and practices the fireworks contractor determines must occur relating to the control of the fireworks display site for all activities during setting-up, sleeping the display, managing the display and post-display, including —

- the control of sources of ignition, e.g. restrictions on smoking and smoking materials;
- the control of other hazards potentially causing a risk of harm to people and property, e.g. alcohol, drugs and some medications;
- the supervision of personnel, visitors and contractors present in the fireworks display area;
- the safe storage and security of fireworks on site;
- the security measures;
- the measures to accommodate changing circumstances during the display, such as adverse weather conditions (e.g. lightning or changes in wind direction or speed) or an aerial shell misfire;
- the identification of fireworks personnel including the person in charge, e.g. uniforms, tabards, monogrammed caps.
- low flying aircraft; and
- unacceptable audience behaviour (such as intrusion in the display site area or the throwing of missiles/projectiles).

6.1.3.3 Responsibilities and Competencies of Fireworks Personnel

The safe operating procedures should address the responsibilities and competencies of fireworks personnel, including —

- the assigned responsibilities and organisational structure, including a resource assessment for tasks undertaken; and
- the required competencies of personnel for tasks and the maintenance of these competencies.

6.1.3.4 Reporting, Recording and Auditing

The safe operating procedures should address issues relating to reporting, recording and auditing, including —

- responding to complaints regarding fireworks (e.g. defective fireworks);
- maintaining records (e.g. the fireworks register, details of fireworks displays, etc.);
- ensuring the availability of current safety and technical information (e.g. Material Safety Data Sheets and Technical Data Sheets);
- implementing self-auditing systems and procedures;
- reporting incidents to supervisors and the Explosives Inspectorate;
- notifying Workplace Health and Safety Queensland of a dangerous event;
- providing post-display notifications; and
- developing, maintaining and recording an incident database for the fireworks contractor, fireworks supplier, etc.

6.1.4 Information and Communication

The safety management system should address information and communication matters, including —

- the provision of information, education and training to the workforce, contractors and visitors (e.g. induction);
- consultation regarding safety with the fireworks workforce and agents; and

- the maintenance of records of the system, activities, internal audits and inspections and statistics.

6.1.5 Emergency Planning and Procedures

The safety management system should include details of emergency planning and procedures.

6.1.5.1 Emergency Plan

The fireworks event organiser, the fireworks contractor and the fireworks operator should have a documented emergency plan in place, which includes details of —

- the aims and objectives of the plan, including a definition of an emergency;
- the roles, responsibilities and functions of all key stakeholders (e.g. the fireworks event organiser, the fireworks contractor, operator, assistants, police, etc);
- the hazards and the types of emergencies that may arise from those hazards;
- emergency procedures for the types of emergencies that may arise;
- an emergency response plan, including an evacuation plan, appropriate fire fighting controls, consequence minimisation steps (e.g. control of duds) and appropriate off-site response (e.g. first aid, evacuation);
- the emergency equipment required to undertake tasks identified in the emergency procedures;
- the training and education of staff and other stakeholders in the emergency plan and emergency procedures;
- the activation of the emergency plan and termination of the emergency; and
- the reporting of the emergency.

6.1.5.2 Emergency Procedures

Emergency procedures should address only emergency situations rather than standard practices addressed by the safe operating procedures, such as the following —

- the outbreak of a fire (such as a bushfire or a fire in a building or fireworks store);

- hazardous malfunctions of fireworks;
- the firing of a firework into the audience; and
- an injury or medical emergency involving the fireworks operator, the fireworks operator's assistant(s) or a spectator during the fireworks display.

6.1.6 Fireworks Incidents

The safety management system should include details on reporting and responding to incidents involving fireworks.

6.1.6.1 Fireworks Accidents, Incidents and Near Misses

All fireworks accidents and incidents which are emergencies must be reported in the usual manner to seek emergency assistance from the police, Queensland Fire and Rescue Service or Queensland Ambulance Service as appropriate. In addition, any accident, incident or near miss, whether or not it causes injury or damage, must be reported to the local Inspector of Explosives and all circumstances outlined. In the case of a serious explosives incident (e.g. one involving serious bodily injury), the local Inspector of Explosives should be notified immediately.

Other agencies (e.g. Workplace Health and Safety Queensland, Department of Industrial Relations) will require notification of an accident, incident or near miss under the requirements of their legislation.

In addition to rendering assistance to people in the case of an accident or incident, the fireworks operator is required to —

- ensure that the accident or incident area is isolated and undisturbed until the control of the site has been handed over to the police, the Explosives Inspectorate or any other agency (or as otherwise directed by those agencies); and

-
- record, and make available for the investigation, the names and other details of the persons injured by, involved in or witness to, the accident or incident.

If an accident or incident causes a fire during the fireworks display, the fireworks operator must immediately stop the display and instigate the appropriate emergency procedures.

6.1.6.2 Loss and Theft of Fireworks

Any theft or loss of display fireworks must be immediately reported to the police and to the Explosives Inspectorate, Department of Natural Resources and Mines, as soon as practicable after the loss or theft is detected. The report must include a description of the missing display fireworks (including quantities and types), the potential hazards, and the steps taken to prevent recurrence.

PART D

FIREWORKS AND FIREWORKS EQUIPMENT

– GENERAL

7. Design, Construction and Manufacture of Fireworks and Fireworks

Accessories and Equipment.

The persons responsible for the design, construction and manufacture of fireworks and fireworks accessories and equipment have several duty of care obligations. The importers of fireworks and fireworks accessories and equipment assume the duty of care obligations associated with manufacture and are regarded as the manufacturer. Refer also to the *Trade Practices Act 1974*.

The fireworks, fireworks accessories and fireworks equipment must not be of a design or construction that is prohibited or contain ingredients or combinations of ingredients or in any other way is prohibited, Refer to Appendix 2.

7.1 Design, Construction and Manufacture of Fireworks

7.1.1 Authority to Manufacture Fireworks

An authority to manufacture fireworks is required for any operation involving the following —

- manufacturing fireworks devices;
- a step or process for producing a firework (e.g. star composition mixing);
- remaking or reconditioning a firework (e.g. attaching a new lift charge to a shell to replace damaged powder);
- redesigning, rectifying or otherwise modifying a firework;
- 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 fireworks to recover stars or powder);
- breaking down multishot cakes into smaller cakes;

- preparing any fireworks for sale to others;
- possessing black powder, pyrotechnic compositions or stars of any kind (unless specifically authorised to do so) except for the possession arising from their disposal resulting from defective product from displays;
- removing, modifying or replacing the lift charge from aerial shells;
- re-using tubes from fired items designed for single use, e.g. candles, multishot items, for fireworks devices; and
- using fireworks to produce effects in a manner other than as intended or specified by the manufacturer.

An authority to manufacture is not required for the preparation of fireworks for a display, involving fitting igniters and fusing devices (such as attaching and removing fuses quickmatch and electric fuseheads or for preparing set pieces, logos, etc).

7.1.2 General Safety Considerations

Fireworks must be designed, constructed, manufactured and tested to be safe for handling, storage, transport and use. The requirements for design, construction, manufacture and testing are detailed in Appendix 16 of this Code.

The following must be considered —

- the chemicals used within the firework;
- the robustness of the firework (including the capability of the construction materials to resist damage and to avoid leaking the composition of the fireworks under normal conditions during transport and handling);
- the compatibility of the firework with the equipment being used;

- unplanned or uncontrolled explosions; and
- any other feature that presents an unacceptable risk to the health and safety of people.

The suitability of the fireworks will be validated when the fireworks are inspected and tested under the quality requirements of Section 9.1 of this Code.

An authorised manufacturer who modifies a firework 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. (Refer to Section 7.2)

7.1.3 Types of Fireworks

7.1.3.1 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 3 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.

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.

Single-break and multi-break salute aerial shells must not exceed 75 mm in diameter or 75 mm in length (exclusive of the lift charge).

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 the fuse is not to be folded or doubled back under the safety cap. 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.

7.1.3.2 Strings of Firecrackers

The requirements for strings of firecrackers are detailed in Appendix 19.

7.1.4 Material Safety Data Sheets and Technical Data Sheets

The manufacturer and supplier must ensure that a *Material Safety Data Sheet* and a *Technical Data Sheet* are prepared for every firework.

These documents will provide the fireworks contractor with information to —

- determine work practices for standard operating procedures for the safety management system;
- conduct a risk assessment when planning the fireworks display; and
- assist in determining calculated minimum clearance distances.

Where appropriate, the Material Safety Data Sheet and Technical Data Sheet may be combined into a single document for various purposes, including for certain types of fireworks with similar characteristics and features.

7.2 Design, Construction, Manufacture and Maintenance of Fireworks Equipment

7.2.1 General Safety Information

The suppliers, designers, fabricators, owners and operators of the fireworks display equipment are responsible for ensuring that the equipment is properly designed, fabricated and maintained to minimise harm to people including fireworks operators and assistants.

Fireworks equipment must not unnecessarily confine fireworks.

The fireworks display equipment must be provided with —

- proper identification;
- the identity of the fabricator; and
- manuals with details on use, maintenance, and fireworks to be used with the equipment.

The equipment must —

- be safe and suitable for use with specified fireworks (taking into account the effect of a catastrophic or extreme malfunction of the fireworks. 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 fireworks),
 - 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.

If specific requirements for design are not identified in this Code, the designer should meet the requirements of the Advisory Standard on Plant of the *Workplace Health and Safety Act 1995*.

7.2.2 Materials Used for Fireworks Equipment

7.2.2.1 Acceptable Materials

Equipment such as mortars, tubes, enclosed racks, star pickets, stands and other types of equipment associated with a fireworks display must be designed and manufactured from other materials, such as —

- paper wound tubes (cardboard);
- suitable plastic, e.g. high density polyethylene (HDPE), fibre reinforced plastic (FRP), glass reinforced plastic (GRP) or fibreglass but not polyvinyl chloride (PVC); and
- timber.

7.2.2.2 Metal

The use of metal fireworks equipment is prohibited because such equipment may produce lethal fragments when subjected to an explosion.

In certain applications, the use of metal may be permitted where it has been established that it does not present an unacceptable risk (e.g., if the metal is not close to the firework and an explosion would not produce harmful fragments). The designer, manufacturer, supplier of fireworks equipment must retain all necessary documentation to demonstrate the safety and suitability of the metal fireworks equipment for its intended application. The fireworks contractor must have completed a risk assessment for these situations. Permissible applications may include the following —

- metal star pickets for defining barriers for crowd control;
- round steel rods with a diameter from 10 mm to 20 mm for securing fireworks or fireworks equipment for use at fireworks displays. (The firework device may be attached directly to the round rod, i.e. without spacers. Flat metal including angle iron and star pickets is not permitted.);

- trailers for holding fireworks 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.);
- trailers for the set-up of fireworks displays with metal sides on the following conditions:
 - the trailer must be lined with at least 12 mm plywood,
 - all mortars and fireworks devices must be secured in relation to each other, and in relation to the trailer,
 - there must be a stand-off between the wood lining of the trailer and the mortars and fireworks devices. (This stand-off is to be at least equivalent to the calibre of the largest shell to be used and/or the diameter of the fireworks device e.g. 75 mm for a 75 mm shell. Further, this stand-off distance must be secured e.g. wood blocks or other secured spacers.);
- 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 firework 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 fully into the ground, used to secure mortar racks and frames; and
- large steel bins, such as skips or mini-skips, 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.)

7.2.2.3 Polyvinyl Chloride

PVC equipment is prohibited. PVC may fragment unacceptably during abnormal functioning of fireworks.

7.2.3 Types of Fireworks Equipment

7.2.3.1 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 fireworks contractor is responsible for ensuring that mortars are inspected, maintained and fully serviceable. The fireworks operator is responsible for ensuring mortars are inspected at fireworks displays. Refer to Section 13.3 of this Code and Appendix 11.

7.2.3.1.1 Design and Construction of Mortars

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. (Refer to Appendix 11.);
- 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, etc.

Mortars must be designed to safely fire mines and also aerial shells to the height recommended by the supplier.

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 Chief Inspector of Explosives should be consulted regarding the provision of the additional lift charge.);
- 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.

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 detonation. The application of timber for plugs in the mortar is permitted.

Strength and Durability

Mortars meeting the specifications of Tables A11.1, A11.2 and A11.3 generally are believed to have ample strength.

Length of Mortars

As a guide, information on appropriate minimum mortar specifications is provided in Appendix 11. This information is sourced from the National Fire Protection Association's document, NFPA 1123 *Code for Fireworks Display*.

The manufacturer must provide a Technical Data Sheet with the supply of mortars.

This Technical Data Sheet must provide amongst other things, information on —

- the types of shells and mines that may be fired from the mortar and limitations on use (e.g. charge weight of lift charge of aerial shell);
- requirements for care, maintenance and inspection. (Refer to Section 13.3 of this Code and Appendix 11.);
- criteria for determining acceptance and suitability of mortars for safe use; and
- product life requirements, e.g. number of years, number of shells fired, etc

7.2.3.1.2 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 fireworks within the rack. The overall integrity of the rack must be preserved.

Aboveground timber frame mortar racks with lightweight mortar materials (such as paper, HDPE, or fibreglass) generally will not withstand such a malfunction.

The design for racks where shells will be fired in mortars other than by instantaneous chain fusing must be type-tested and certified. The design of the rack must not unnecessarily confine mortars containing aerial shells.

7.2.3.2 Design of Electrical Firing Units

7.2.3.2.1 General

A competent person must undertake the design, construction and certification of electrical firing units.

Electrical firing units and accompanying junctions must be manufactured specifically for use in the electrical ignition of pyrotechnic devices or explosives.

An electrical firing unit with a built-in circuit tester must be designed to limit the test current (into a short circuit) to 0.05 ampere or to 20 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 electrical firing system should be shunted while loading the fireworks.

Electrical 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 fireworks.

Fireworks must not be fired using systems powered by mains power without the prior approval of the Chief Inspector of Explosives.

In addition to the requirements listed in this section, the electrical firing units must be capable of providing a minimum electrical current of 1 ampere through the maximum load (cable length and number of fuseheads) recommended by the manufacturer.

7.2.3.2.2 Computer-based Electrical Firing Systems

Computer-based electrical firing systems must incorporate some form of a dead-person switch so that all firings cease from the moment that the switch is released

7.2.3.2.3 Manual Electrical Firing Unit

Manual electrical firing units must include a key-operated switch or similar device that greatly reduces the possibility of unauthorised or unintentional firings.

7.2.3.2.4 Handheld Electrical Firing Units

A handheld electrical 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 electrical 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.

7.3 Documentation and Sources of Information

Information must be provided for the fireworks and fireworks equipment as required by Sections 7.1.4 and 7.2.1 of this Code. Fireworks contractors may also source information for the safety management system from the literature and technical journals. Many technical journals provide validated and peer reviewed articles on the performance of fireworks and fireworks equipment.

8. Classification, Packaging and Labelling

8.1 Classification of Fireworks

All fireworks must be classified under the United Nations classification system. For information of the United Nations classification system, refer to Appendix 4.

All fireworks must be classified, using the default classifications as detailed in Appendix 10, unless the supplier can demonstrate that the fireworks 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 Chief Inspector of Explosives. This will normally be an Inspector of Explosives.

8.1.1 Overall

The classification of mixed fireworks, (i.e. when more than one type of firework is packaged, stored or transported together), is based on the most hazardous firework type. For example, if Class 1.2, 1.3 and 1.4 fireworks are packaged, stored or transported together, the total combination of those fireworks, using Table 11.1, must be classified as Class 1.1.

8.2 Packaging

The packaging for fireworks must be approved and the packages properly marked and labelled. Approved packages are packages that have passed the United Nations tests as outlined in the *Australian Dangerous Goods Code 6th Edition*. The approved packages are marked with approval markings such as —

"4G/Y140/S/97AUS/9014".

The package approval usually applies to a carton packed with one type of item,

as supplied by the manufacturer (for example, a carton of cakes of one product code). These approved cartons are not approved for other combinations within the package (as occurs with composite cartons provided by the supplier to the fireworks operator or packaged by the fireworks operators for use at the fireworks display).

However, the transport of selected orders in approved packages (including cartons which contain non-approved combinations) is permitted by this Code, provided that the packages —

- are fully taped closed;
- are marked and labelled for the contents in the package; and
- do not contain fireworks which have been prepared by fitting with electric fuseheads for the fireworks display in a preparation area or dedicated workshop.

Fireworks which have been prepared by fitting with electric fuseheads have an additional hazard and increased risk of ignition arising from the fusehead. The packaging approval may no longer be valid unless the packaging approval test included testing with fused fireworks.

To overcome this issue, fireworks prepared for the fireworks display under the direction of the fireworks contractor or fireworks operator in the workshop must have additional risk control measures adopted to mitigate the increased risk from the fusing of the fireworks to reduce the risk back to an acceptable level of risk. Methods may include —

- introducing additional packaging materials and methods to protect the fusehead from ignition due to friction, induced currents, etc;
- may be transported to the display site packaged in a superior package, such as a day box or ready box; or
- the fireworks may be packaged and transported in a trailer complying with the Australian Explosives Code.

8.3 Package Marking and Labelling

The 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.

They must not be located with other package markings that could substantially reduce their effectiveness. Generally the package will need explosives markings on three sides to be readily visible.

The outer packaging must be clearly marked on the outside surface with the —

- proper shipping name and authorised name i.e. the words "FIREWORKS" and the UN number of the fireworks in the package. (When there is more than one type of firework in the package, details for each type of fireworks in the package must be marked on the outside surface of the package.);
- class label, e.g. Class 1.3G, appropriate to the fireworks in the package. (Where there is more than one hazard division in the package, e.g class 1.3 and class 1.4, the resultant division for the package. Refer to Section 11.4 of this Code.);
- the name and address in Australia of the manufacturer or consignor or the agent of one of these for the fireworks;
- packaging performance and specification markings as required by Section 8.2 above.

8.3.1 Marking of Superior Packages

Superior packages (such as carry boxes for fireworks) must be marked with a 100 mm sided orange 'diamond' i.e. the appropriate class label for the fireworks contained.

Where more than one division of fireworks is loaded in the ready box, the class label must be determined according to Section 8.1.1, Table 11.1 and in Section 11.4 of this Code.

8.4 Labelling of Fireworks

8.4.1 General

All fireworks must be labelled to provide essential identifying information, essential safety information and instructions. All required information must be printed —

- within a borderline;
- in English; and
- in a colour sharply contrasting with the background.

The labelling must be in a prominent visible position on the firework. The printing on the label must be in a font and form that can be easily read.

As a minimum, all fireworks must be identified with —

- the name of the manufacturer or the name of the supplier in Australia;
- contact details within Australia;
- the trade name of the firework;
- identifying marks signifying batch or lot details;
- a warning statement bearing the words in upper case letters:
"WARNING. DANGEROUS EXPLOSIVE. DO NOT HANDLE. CONTACT POLICE"; and
- the United Nations number for the firework.

If the manufacturer's batch or lot marking details are absent, the supplier should assign a batch or lot number. This lot or batch number must be legitimate within the principles of lotting and batching. For example, the batch number would be of the type and model of firework from the same source of origin.

8.4.2 Aerial Shells

To clarify the information required in Section 8.4.1 above, as a minimum, each aerial shell must be labelled with the following information —

- a description of the size of the aerial shell in terms of the internal diameter of the mortar to be used (e.g. "75 mm AERIAL SHELL");

-
- a description of the type of aerial shell (e.g. "TO-BREAK WITH REPORT"). (The label or wrapper of any type of aerial salute must be conspicuously marked with the word "SALUTE".);
 - the warning statement bearing the words: "WARNING. DANGEROUS EXPLOSIVE, DO NOT HANDLE— CONTACT POLICE"; and
 - an instruction advising the correct direction of firing by the phrase and symbol: "THIS WAY UP ↑".

8.4.3 Ground Display Fireworks and Strings of Firecrackers

Fireworks (including firecrackers too small to carry a label) may be labelled only on an outer pack, provided that they are sold in the outer pack only and not as unlabelled single items. The fireworks contractor must ensure through the safety management system that risk control measures are implemented that ensure unlabelled fireworks cannot leave their direct and immediate control at the display.

Fireworks sold individually must be labelled individually. The labels must contain the following information —

- instructions for use;
- appropriate warnings; and
- a description of the principal effect of the firework after ignition.

Labels must effectively and unambiguously convey the required information either by—

- words in plain English on a contrasting background; or
- graphics.

8.4.4 Instructions

All fireworks must be provided with instructions, written in English.

9. Purchase, Sale and Supply of Fireworks and Fireworks Equipment

9.1 Fireworks

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

9.1.1 Authority to Purchase or Sell Fireworks

Only an authorised seller may sell and supply fireworks to a person who is authorised to possess those fireworks. A person authorised to possess fireworks may include a person who is authorised —

- to sell those fireworks;
- as a fireworks contractor;
- to store those fireworks; or
- to transport those fireworks.

An authorised seller must view the purchaser's authority and sell to the purchaser only those fireworks approved under that authority. The seller must ensure that any person employed in the sale of fireworks complies with the relevant procedures and regulations.

9.1.2 Prohibited Fireworks

A person cannot possess, buy or sell prohibited fireworks, regardless of whether or not that person possesses a fireworks authority, unless specifically approved in writing by the Chief Inspector of Explosives.

9.1.3 Competencies of Person Employed in Sale of Fireworks

A person authorised to sell fireworks must ensure that any person employed in the sale of fireworks is aware of —

- the hazards of the particular fireworks;
- appropriate procedures for safe handling; and
- the regulations relevant to the sale of fireworks.

9.1.4 Record-keeping

An authorised seller of fireworks must ensure that records and procedures relevant to the sale of fireworks are maintained, including legitimate validation of the purchaser's authority at the point of sale. These requirements apply to any staff or agents of the authorised seller.

9.1.5 Reporting of Incidents

An authorised seller of fireworks must ensure that, as soon as practicable, details of an explosives incident involving any fireworks provided by the seller are reported to the Chief Inspector of Explosives. These requirements apply to any staff or agents of the authorised seller.

9.1.6 Quality Management

An authorised seller has a duty of care obligation to ensure that all fireworks supplied have been tested in accordance with a recognised quality standard or code of practice and have been certified to be of acceptable quality and to meet the safety and performance requirements of that recognised standard or code of practice. The seller should operate a documented quality management system and demonstrate that this system will consistently provide products that meet customer and regulatory requirements. Elements of the quality management system may include —

- a quality policy;
- purchasing records;
- sales and supplies records (including maintaining copies of the purchaser's authority);
- customer related processes;
- monitoring and measuring;
- control and disposal of non-conforming product; and
- communication.

For further information, sellers or suppliers may refer to Australian Standard AS/NZS ISO9003:1994, *Quality systems – Model for quality assurance in final inspection and test*, and the *Queensland Fireworks Product Safety Code*.

9.1.7 Certificate of Compliance

The seller must provide a current certificate of compliance to the purchaser for the fireworks being supplied. The purchaser must not accept the fireworks or supply those fireworks to another person (e.g. the fireworks operator) without a current certificate of compliance. The certificate of compliance must detail the standards and performance to which the fireworks comply. This should include a certification that the fireworks have been tested and comply with the Queensland Fireworks Product Safety Code or Appendix 16 of this Code as appropriate, the provisions of the Material Safety Data Sheet, the performance stated in the Technical Data Sheet, etc.

9.1.8 Material Safety Data Sheets and Technical Data Sheets

The seller or supplier of the fireworks must supply a current copy of the Material Safety Data Sheet and the Technical Data Sheet with each fireworks product to the purchaser of the fireworks, unless it has been established that the purchaser has current copies of those documents.

The seller must also supply copies of the Material Safety Data Sheet and the Technical Data Sheet on request to the purchaser.

9.1.9 Purchase of Fireworks

As the authorised purchaser of fireworks, the fireworks contractor must satisfy the contractor's duty of care obligations by —

- ensuring that fireworks used in a fireworks display comply with Queensland Fireworks Product Safety Code;
- providing a fireworks operator conducting a display on the contractor's behalf with a copy of a certificate of compliance for the fireworks to be used in the display; and
- ensuring that the fireworks have no known history of unsafe or inappropriate performance and will satisfy the requirements in the contractor's safety management system.

9.2 Fireworks Equipment

No licence is required for the sale or supply of fireworks equipment. However, the supplier has general duty of care obligations, including ensuring that —

- the equipment is safe for use with specified fireworks;
- the purchaser of the equipment is provided, on supply, with suitable information on:
 - installation (e.g. methods to secure stands, mortars and other holders of fireworks),
 - 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.

10. Storage of Fireworks

10.1 Legislation and Australian Standards

The storage of fireworks is governed by the *Explosives Act 1999* and the *Explosives Regulation 2003*. Details of the full requirements for storage are laid down in Australian Standard AS2187 *Explosives - Storage, transport and use*, Part 1: Storage. The following subsections explain these legislative requirements and permissible deviations from the Australian Standard.

10.2 Authority to Store Fireworks

An authority to store explosives is required for the following quantities —

- more than 50 kg (gross weight) of fireworks class 1.1G, 1.2G and 1.3G; or
- more than 250 kg (gross weight) of fireworks of class 1.4G.

Unless otherwise approved, a fireworks storage must be separated or adequately protected from inhabited buildings and other high-risk property which may be damaged by an explosion or fire. The quantity and type of fireworks and their associated hazards influence separation distances and other precautions.

A fireworks store must comply with Australian Standard *AS2187.1-1998 Explosives-Storage Transport and Use Part 1: Storage*. Appendix 14 of this Code, *Guidelines for Container Modification for the Storage of Fireworks*, provides requirements for a permitted alternative to the standard of the building or structure to store the fireworks.

10.2.1 Storage of Small Quantities

An authority to store explosives is not required for a person with an authority under the *Explosives Act 1999* e.g. fireworks contractor for the following small quantities —

- not more than 50 kg (gross weight) of fireworks class 1.1G, class 1.2G or 1.3G; or
- not more than 250 kg (gross weight) fireworks of class 1.4G.

Should the person be authorised to possess gunpowder, an authority to store is required for more than 25 kg of gunpowder.

Unless otherwise approved, small quantities of fireworks must be kept in a dedicated, secure storage building or explosives magazine, separated from inhabited buildings, workshops and other explosives. The storage of small quantities must comply with the general requirements of Sections 10.3 to 10.11 of this Code.

10.3 Prohibitions

Fireworks must not be repackaged in the storage area.

A magazine or storage area must not be used as a workshop to undertake any activity on the fireworks such as preparing the firework for a fireworks display.

Fireworks for displays must be prepared in a dedicated area separate from the storage area.

Fireworks cartons must not be opened nor orders selected from opened packages within the storage area. The packages must be moved to a separate area from the storage area where orders may be selected.

10.4 Classification of Fireworks Stores

A single fireworks store where more than 500 kg (gross weight) or 250 kg NEQ of display fireworks are stored must be classified as a Class 1.1 storage. This classification applies regardless of the default classification as presented in Section 8.1 and Appendix 10 of this Code or any other classification of the fireworks. For a store where more than one division of explosives is stored and the total quantity is less than 500kg (gross weight), the resultant division must be determined using Table 10.1 over.

**Table 10.1 Determination of Division—
stores containing more than one division**

DETERMINATION OF DIVISION				
Division	1.1	1.2	1.3	1.4
1.1	1.1	1.1	1.1	1.1
1.2	1.1	1.2	1.1	1.2
1.3	1.1	1.1	1.3	1.3
1.4	1.1	1.2	1.3	1.4

Using Table 10.1, a store containing fireworks of Division 1.2 and Division 1.3 would have a resultant division of Class 1.1 and must be treated as a store of Class 1.1.

10.5 Compatible Storage

Only explosives and fireworks which are compatible may be stored together.

Fireworks of Classes 1.1G, 1.2G, 1.3G and 1.4G are not compatible with gunpowder (black powder), dangerous goods of Classes 2, 3, 4, 5, 6, 7, 8 and 9 (e.g. fuels, solvents, pool chemicals, and gas cylinders) fire risk substances and combustible liquids. However, gunpowder may be stored in these magazines with fireworks to a maximum limit of 30 kg of gunpowder under this Code. Other incompatible combinations of fireworks, explosives and other dangerous goods must not be stored together. Compatibility charts are attached at Appendix 21.

Compatible fireworks of different divisions may be stored together. In such cases the division of the store must be determined in accordance with Table 10.1 above.

10.6 Separation Distances

Stores must be located at suitable minimum distances apart and at minimum distances to protected works to reduce the level of risk to acceptable levels. They should be separated to minimise —

- the communication of explosion between different stores; and
- harm to people or damage to property, whether or not this might be directly associated with the fireworks.

(Appendix 17 presents information on separation distances.)

The separation distances for fireworks storages are defined in AS 2187 Part 1. For example, an authorised store of between 100 kg (gross weight) and 500 kg (gross weight) of Class 1.3G fireworks must be separated —

- from occupied buildings by at least 60 metres; and
- from other fireworks stores by at least 25 metres.

Quantities greater than 500 kg (gross weight) are treated as Class 1.1 and must be separated by distances appropriate for that classification. For example, they must be separated —

- from occupied buildings by at least 180 meters; and
- from other unrounded fireworks stores by at least 39 meters.

10.7 Fire Protection

10.7.1 Minimisation of Fire Risk

A person storing fireworks must ensure that fire risk to the fireworks is minimised from within and outside the store —

- by storing the fireworks in a secured structure detached from any dwelling or shop unless specifically approved; and
- where the quantity exceeds 5 kg (gross weight), in a location appropriately placarded:
 - in accordance with Section 10.11 of this Code, and
 - with signs stating: "No Smoking" or "Keep Fire Away".

Combustible material should be kept to a minimum in the general vicinity.

Combustible materials include natural vegetation and undergrowth (e.g. long grass), fuel stores (e.g. petrol, diesel, LP gas), paper, cardboard, timber and hay. Persons should ensure that combustible equipment including fireworks equipment is not stored near fireworks magazines e.g. mortars, racks, set pieces, securing devices, etc.

10.7.2 Fire Protection Equipment

A fire risk assessment should be conducted to determine the type of fire extinguishers to be used. Unless otherwise advised, the minimum fire protection equipment required consists of—

- one 80B dry chemical extinguisher;
- one 2A 20B foam extinguisher; or
- one 9-litre water fire extinguisher.

The fire protection equipment must be readily accessible to prevent a fire from reaching the fireworks. Fire protection equipment must not be used to fight a fire involving fireworks.

10.8 Security

10.8.1 General

A security risk assessment may be undertaken to identify the additional appropriate control measures to be undertaken. Additional factors to be taken into account in relation to security include the impacts of external factors, such as fire, vehicles, equipment, weather and watercourses.

A person storing fireworks must—

- secure the fireworks by storing them in their original packaging or other spark-proof receptacles which remain closed and sealed (except when the fireworks are being put in or taken out);
- secure the fireworks by preventing access to them by unauthorised or unintended users as far as practicable; and
- maintain fireworks inventories and records of damages and losses.

Security measures will include selecting suitable construction materials for the store and using security standard locking mechanisms (with a six-pin lock as a minimum standard to Australian Standards AS 4145.4 Locksets – Padlocks and AS 4145.2 Locksets – Mechanical locksets for doors in buildings) or shrouded covers over the padlock location to restrict access to the

padlock. The standard locking mechanisms on a vehicle are deemed to meet this requirement. The immediate area around the store must have effective barriers to prevent unauthorised entry.

10.8.2 Permanent Storage

The requirements identified in AS 2187 Part 1 are the minimum-security provisions to be adopted for permanent storage.

10.8.3 Transit Storage

If a site for transit storage is not secured by adequate controls (such as perimeter security fencing external to the store to keep people out of the immediate vicinity), suitable control measures must be provided to ensure effective security (e.g. security guards).

10.9 Adverse Weather Conditions and Spills

A person storing explosives (including fireworks) must ensure that—

- the storage area is dry and weatherproof;
- the store is maintained in a clean and tidy state;
- any spillage of fireworks and fireworks compositions is immediately cleaned up and properly disposed of. (Instructions on correct disposal methods are available from the documentation supplied with the fireworks by the fireworks supplier.); and
- no person handles fireworks or is present in a fireworks store during a thunderstorm.

10.10 Design and Construction of Boxes

A person storing fireworks must ensure that all ready boxes and portable magazines are designed and constructed to a suitable standard or to the satisfaction of the Chief Inspector of Explosives.

10.11 Storage Information for the Emergency Services

10.11.1 General

Placards, manifests and site plans provide information to the emergency services for

their safety and health about the location and nature of the hazards and risks at a site during an emergency situation.

The person responsible for the fireworks at the site must ensure the proper placarding of the site and the provision of manifests and site plans unless the fireworks will be stored at the fireworks display site for more than 24 hours. In this case, the shipping documentation for the types of fireworks stored must be provided as an alternative. (Refer to Section 11.9)

10.11.2 Placards

Premises for the storage of fireworks and gunpowder exceeding 5kg (gross weight) must be placarded, regardless of the class and division. Placarding requirements also apply to transit storage.

A HAZCHEM Outer Warning Placard, as specified in Appendix 15, must be provided for entrances where emergency services may gain entry to the premises where the aggregate quantity exceeds 5kg (gross weight).

A placard, as specified in Appendix 15, must be displayed on the storage area or magazine. This placard must incorporate the appropriate class labels for the class, division and compatibility group for the fireworks. For example, if fireworks of classes 1.1G, 1.3G and 1.4G are stored in a magazine, the appropriate class label is one class label Class 1.1G. Should gunpowder also be stored in the magazine, an additional class label, Class 1.1D, will be required.

The placard must be positioned so that it is —

- clearly visible from normal approaches;
- adjacent to an outside storage area;
- at the main entrance to a building; and
- at every entrance to the area or adjacent to the fireworks.

(Refer to Section 10.12 for details on the placarding of transit storage.)

10.11.3 Manifests and Site Plan of Premises

The person responsible for the fireworks (i.e. the fireworks contractor, the fireworks operator or storer) must ensure that a manifest is prepared and recorded for the premises, where the total quantity of fireworks exceeds 5 kg (gross weight).

A manifest must contain the following information —

- the date when the information was prepared;
- the name of the person responsible for the occupier and address of the premises;
- the contact information for two people who may be contacted in case of emergency; and
- the location and type of storages.

The person responsible for the fireworks must ensure that the manifest —

- is located in a position in a specially marked container marked "Manifest" adjacent to the HAZCHEM Outer Warning Placard or other location determined in consultation with the Queensland Fire and Rescue Service;
- is readily accessible to the Queensland Fire and Rescue Service; and
- is revised to reflect significant changes in any information required as soon as practicable, and in any event within seven days.

The occupier must ensure that the manifest contains —

- the UN number, proper shipping name and the gross quantity in kilograms for the fireworks and gunpowder in each Class Division and compatibility group, e.g. total amount of Class 1.1G, total amount of Class 1.3G etc; and
- the site plan of the premises.

The occupier must ensure that the site plan of the premises is located with the manifest and contains —

- the main entrance and other entry points to the premises;
- the plan of the site including location of fireworks and gunpowder; and
- the nature of adjoining sites or premises.

(Refer to Section 10.12 on requirements for transit storage.)

10.11.4 Location of Manifest and Site Plan

The manifest and site plan must be kept in a box adjacent to the HAZCHEM outer warning placard at the entrance to the site. The box should be locked with a "003" service key.

10.12 Transit Storage – General

For transit storage, the fireworks contractor and the person responsible for the fireworks must ensure that —

- the general requirements of Sections 10.3 to 10.11 of this Code are met; and
- the placarding, manifest and site plans comply with Section 10.11 of this Code.

If transit storage is provided in a vehicle, the vehicle placarding is regarded as meeting the placarding requirements. (Refer to Section 11.8.) If transit storage is provided in a portable magazine, the placarding of the portable magazine is regarded as meeting the placarding requirements.

10.13 Transit Storage at Fireworks Display Site

A site or location used for transit storage in connection with a notified fireworks display does not have to be authorised when the threshold in Section 10.2.1 is exceeded, provided that the only fireworks involved are for use with that notified fireworks display.

The requirements of this section are in addition to those in Sections 10.3 to 10.10 above. The storage area must be more than 10 metres from fixed ignition sources and public access areas. In accordance with AS1319, additional placarding with a pictorial sign for no smoking and ignition sources must be provided in the area adjacent to the storage. Proper security must be provided for the fireworks. A minimum separation distance of 60 metres must be provided from adjacent premises and 25 metres from other fireworks storage.

The provision of vehicle placarding and shipping documents complying with the *Australian Explosives Code* (e.g. the fireworks display notification form) satisfies the requirements for placarding, manifests and site plans for transit storage in vehicles at the fireworks display site. Fireworks must not be left unattended at the display site.

11. Transport of Fireworks by Road

11.1 Legislation and Codes

In general, all persons transporting fireworks must comply with the *Queensland Explosives Act 1999*, the *Explosives Regulation 2003* and the *Australian Explosives Code*.

The following subsections provide an explanation of these legislative requirements and permissible deviations from the *Australian Explosives Code*.

11.2 Authorities

11.2.1 Vehicles

An authority to transport fireworks for road transport is required when a person transports any quantity of fireworks unless the person is authorised to use the fireworks where the threshold quantity for an authority to transport is 250 kg.

11.2.2 Drivers

A person driving a vehicle transporting fireworks must be —

- competent under the *Explosives Act 1999* to drive a vehicle transporting explosives and possess a statement of competency to the satisfaction of the Chief Inspector of Explosives and trained in:
 - the areas of required response when an explosives incident occurs;
 - areas where the fireworks cannot be safely transported; and
 - transit storage requirements; or
- authorised under the *Explosives Act 1999* to possess the explosives being transported if the quantities are less than those listed in Section 11.1 above.

A person who is an employee of an authorised fireworks contractor may transport fireworks on behalf of an authorised contractor.

The driver must be trained in the use of the types of fire extinguishers carried on the vehicle and be able to supply documentary evidence of such training when requested.

11.3 Compatible Loads

Only fireworks and other dangerous goods which are compatible may be transported together.

Compatibility charts are attached at Appendix 21. Refer also to compatibility requirements in Section 10.5 of this Code which are also applied to transport.

11.4 Classification of Load

A load of fireworks being transported in quantities greater than 500kg (gross weight) or 250kg NEQ must be classified as Class 1.1G, regardless of the default classification or any other classification of the fireworks.

A load of fireworks of mixed divisions (e.g. Class 1.1, Class 1.2, Class 1.3 and Class 1.4) has a resultant division as indicated by Table 11.1.

Table 11.1 Determination of Division – loads, packages and ready boxes containing more than one division

DETERMINATION OF DIVISION				
Division	1.1	1.2	1.3	1.4
1.1	1.1	1.1	1.1	1.1
1.2	1.1	1.2	1.1	1.2
1.3	1.1	1.1	1.3	1.3
1.4	1.1	1.2	1.3	1.4

For example, a vehicle transporting fireworks of Division 1.2 and Division 1.3 would have a resultant Division of Class 1.1 and must be treated as a total load of Class 1.1.

11.5 Packaging

Fireworks must be transported in approved packaging or superior packages which is correctly marked and labelled in accordance with the *Australian Explosives Code*. (Refer to Section 8.3.1 of this Code.). The superior package (such as a day box or self-closing carry box) must be of suitable design and construction.

11.5.1 Composite Cartons
(Refer to Section 8 Packaging in
Classification, Packaging and Labelling.)

11.6 Standard of and Design of Vehicle

A vehicle carrying quantities greater than those listed in Table 11.2 for Category 2 and 3 quantities must be modified to comply with the *Australian Explosives Code*. This includes lining the body of the vehicle or a box in the body of the vehicle with wood or other material which provides equivalent non-spark generating performance.

If the quantities of fireworks to be carried exceed 500kg (gross weight) or 250kg NEQ of fireworks of Class 1.1, 1.2, 1.3, 1.4 or any combination of those, the vehicle must comply with the Category 3 requirements of the *Australian Explosives Code*. This includes fitting the vehicle with —

- fire screens;
- electrical wiring in conduit;
- a battery isolation switch;
- fire extinguishers; and
- insulation in the body, etc.

The vehicle must be mechanically sound and clean and carry a 30B dry chemical fire extinguisher in a readily accessible location.

For more information refer to Section 6 of the *Australian Explosives Code*.

11.7 Control of Ignition Sources

All ignition sources must be controlled to prevent accidental ignition of the fireworks. This includes —

- not smoking within a distance of 10 metres from any vehicle containing fireworks;
- not carrying matches and cigarette lighters in the vehicle unless they are in a sealed container in the vehicle cabin; and
- not taking mobile phones, radio transmitters, pagers etc into the fireworks carrying compartment.

11.8 Placarding of Road Vehicles

A vehicle transporting fireworks in excess of the minimum quantities listed below must be placarded in accordance with the *Australian Explosives Code*.

The minimum quantities are —

- 10kg (gross weight) or 5kg NEQ of Class 1.1;
- 10kg (gross weight) or 5kg NEQ of Class 1.2;
- 100kg (gross weight) or 50kg NEQ of Class 1.3; and
- 500kg (gross weight) or 250kg NEQ of Class 1.4.

The vehicle must be placarded with a 250mm class label appropriate to the highest classification and compatibility group of the fireworks. For instance, if the fireworks to be transported are Class 1.1G, Class 1.3G and Class 1.4G, the vehicle must be placarded as Class 1.1G once the total quantity exceeds 10kg (gross weight) or 5kg NEQ.

The placards must be fixed to the front and rear of the vehicle. The sides of a trailer used for the transport of fireworks must also be placarded.

11.9 Documentation

A vehicle transporting fireworks must carry the following documentation —

- an Emergency Procedure Guide for the fireworks being transported; and
- a shipping document identifying:
 - the class,
 - UN numbers,
 - names,
 - number of packages,
 - quantity (mass), and
 - types of fireworks.

When fireworks are being transported to a fireworks display, a fireworks display notification form is acceptable as an alternative to the shipping document required by the *Australian Explosives Code*.

11.10 Insurance

The *Australian Explosives Code* requires that a person transporting fireworks in Category 2 or 3 quantities must be covered by a policy of insurance or other form of indemnity in respect of —

- property damage, personal injury and other damage (excepting consequential economic loss) arising out of any fire, explosion, leakage or spillage of explosives in, on or from the vehicle or a container transported on the vehicle; and
- costs incurred by or on behalf of a government authority or other agency in a clean-up resulting from any event of the kind referred to above.

The insurance cover for a road vehicle transporting fireworks is dependent on the risk category of the explosives (Refer to Table 11.2 below). For a quantity not more than that specified for —

- Category 2, the insurance cover is \$1.0 million per event; and
- Category 3, the insurance cover is \$2.5 million per event.

11.11 Safe Stowage and Load Security

Packages of fireworks and fireworks equipment must be stowed and secured on a vehicle in accordance with the Load Restraint Guide so that they will remain in position on the vehicle regardless of vehicle movements of starting, stopping, jolting or swaying. The packages must be kept away from heavy articles or equipment likely to cause damage. Packages of different shapes or containing different materials must be stowed to prevent their damaging one another. The fireworks load must not project horizontally beyond the periphery of the vehicle.

Consideration must be given to the friction and impact sensitivity of fireworks and any potential leaking composition from those fireworks, to enable safe transportation and handling. All due precautions must be taken to prevent theft, damage and accidents (such

as inadvertent initiation) involving the fireworks and fireworks equipment.

11.12 Precautions During Loading and Unloading

All practicable precautions must be taken during the loading or unloading of explosives from a road vehicle to ensure that the packages are not dropped, thrown or otherwise mishandled. Fireworks must not be loaded or unloaded during thunderstorms.

11.12.1 Prohibitions

The carriage of reusable mortars loaded with aerial shells on public roads is strictly prohibited. This does not apply to ground level fireworks and barrages that are manufactured articles consisting of pre-loaded, non-reusable mortars as supplied by the manufacturer or supplier.

Passengers not directly assisting with the fireworks display must not be permitted on a vehicle transporting fireworks.

Vehicles containing fireworks must not be left unattended.

Table 11.2 Risk Categories for Explosives

RISK CATEGORIES FOR EXPLOSIVES						
Type of Explosives (2)	Quantity per Vehicle (Net Explosive Quantity) ¹					
	Category 1 (Low Risk)		Category 2 (Moderate Risk)		Category 3 (High Risk)	
	NEQ	Gross Weight	NEQ	Gross Weight	NEQ	Gross Weight
Division 1.1	≤5 kg	≤10 kg	>5–250 kg	>10-500 kg	>250 kg	>500 kg
Division 1.2	≤5 kg	≤10 kg	>5–250 kg	>10-500 kg	>250 kg	>500 kg
Division 1.3	≤50 kg	≤100 kg	>50–250 kg	>100-500 kg	N/A	N/A
Division 1.4 except 1.4S	≤250 kg	≤500 kg	N/A	N/A	N/A	N/A
Division 1.4 S	Any quantity	Any quantity	N/A	N/A	N/A	N/A

1. If the actual net explosive quantity is not available, the actual gross mass of the fireworks must be used.
2. When the total quantity of explosives exceeds 500 kg (gross) or 250kg NEQ, the total must be considered Division 1.1 and categorised accordingly.

12. Use, Handling and Possession of Fireworks

12.1 Legislation, Standards, Codes

A person using fireworks at a fireworks display must ensure that the fireworks —

- comply with the Queensland Fireworks Product Safety Code; and
- have demonstrated safe performance.

The fireworks must be used in accordance with this Code. However, a person using fireworks in a safe manner and in accordance with a safety management system of at least equivalent safety may use fireworks at variance with this Code. In such circumstances the person must justify the equivalent safety levels.

12.2 Authorities

A person using or possessing fireworks must be authorised for that activity under the *Explosives Act 1999*. Persons required to be authorised include —

- the fireworks supplier, manufacturer and/or importer;
- the fireworks contractor;
- the fireworks operator;
- the fireworks transporter (if relevant); and
- the fireworks storer (if relevant).

12.2.1 Fireworks Contractor

If the fireworks contractor is an individual, the fireworks contractor must also be an authorised fireworks operator. If the fireworks contractor is a corporation, at least one director or principal of the corporation must be an authorised fireworks operator and that fireworks operator must qualify as a fireworks contractor. The provisions of the fireworks contractor's authority may limit the category and size of the fireworks display that can be undertaken by the contractor.

12.2.1.1 Qualifications for a Fireworks Contractor

To qualify as a fireworks contractor, a person must —

- be over 21 years of age;
- be an appropriate person;

- have documented experience, acceptable to the Chief Inspector of Explosives (minimum 3 years and 40 displays as the fireworks operator for a range of types and sizes of displays);
- be adequately insured for carrying out fireworks displays;
- have a safety management system to the satisfaction of the Chief Inspector of Explosives;
- be competent to the satisfaction of the Chief Inspector of Explosives; and
- have satisfactorily completed an approved course of training as a fireworks contractor.

12.2.1.2 Competencies of a Fireworks Contractor

A fireworks contractor would need to demonstrate competencies in —

- operating as a fireworks operator;
- assessing the suitability of a fireworks display site;
- conducting fireworks displays;
- undertaking hazard and risk identification, risk analysis, risk assessment and risk management;
- developing and applying a safety management system;
- workplace health and safety;
- organisational management; and
- this Code.

For competencies for a fireworks contractor for approved training courses, refer to Section 12.2.3 of this Code.

12.2.1.3 Training and Competencies of Other Personnel

A fireworks contractor must ensure that the fireworks operator, the fireworks operator's assistant(s) and any other personnel, such as security personnel, are properly trained and competent. The contractor must also ensure that the person conducting this training is competent and that training records are kept.

12.2.2 Fireworks Operator

12.2.2.1 Qualifications for a Fireworks Operator

A person who prepares for use, or uses, fireworks must be a qualified and properly authorised fireworks operator. To qualify as a fireworks operator, a person must —

- be an adult;
- be physically able to carry out the duties of a fireworks operator;
- have
 - satisfactorily completed an approved course of training as a fireworks operator; or
 - competencies otherwise acceptable to the Chief Inspector of Explosives;
- have demonstrated knowledge of:
 - the requirements of the *Explosives Act 1999* and the *Explosives Regulation 2003* in relation to the storage, transport, manufacture, sale and use of explosives;
 - the requirements of standards and codes of practice referred to in the *Explosives Act 1999* and the *Explosives Regulation 2003*;
 - this Code;
 - the hazards of particular types of fireworks, their firing characteristics, safe handling procedures and methods of use; and
 - relevant emergency procedures, including the handling of misfires and the disposal of fireworks;
- be an appropriate person to have access to fireworks; and
- satisfy a competency assessment if required by the Chief Inspector of Explosives.

12.2.2.2 Conditions Applied to a Fireworks Contractor or Operator

A fireworks contractor or operator must comply with the assigned authority conditions, including the type of fireworks and the purpose authorised. The authority may prescribe one or more categories of fireworks use, including —

- strings of firecrackers;
- outdoor fireworks displays (The authority may limit the size of aerial fireworks that may be fired by the fireworks operator to a specified maximum diameter of the shell.);
- close proximity fireworks (indoor, theatrical, stage, etc.); and
- special effects.

Operators or contractors limited to ground level fireworks must use only commercially available ground display fireworks of the following types —

- fountains, gerbs and lances of all sizes;
- barrages (pre-loaded, chain fused shells in non-reusable mortars) up to 50mm (2 inch) diameter (or length if shells are cylindrical);
- mines, Roman candles, comets and other ground fireworks less than 75mm (3 inch) diameter; and
- multishot cakes.

A fireworks operator or contractor qualified to use aerial shells who wishes to upgrade the maximum size of aerial shell that can be fired will need to demonstrate experience with firing aerial shells under their existing maximum shell size. The operator or contractor will need to provide documented records as well as demonstrated competence commensurate with the increase in the hazard in areas of knowledge, skills and attitude.

12.2.2.3 Other Competencies of Fireworks Operator

For competencies for a fireworks contractor for approved training courses, refer to Section 12.2.3 of this Code.

The fireworks operator must hold a current first aid certificate for a recognised first aid course, e.g. a course provided by St John, Red Cross, Queensland Ambulance or other private course providers.

12.2.3 Competency-based Training for Authorities

Fireworks contractors and fireworks operators will have to undertake competency-based training. This training is a prerequisite for an authority. This competency-based training will consist of initial training and periodic refresher training. The performance criteria, range statements, evidence guides and key competency levels for the three FSH competency units. FSH is the identifying code for the course.

Fireworks operators will be required to complete FSH1 and FSH2. In addition, fireworks contractors will have to complete FSH 3. These competencies have been developed jointly between the fireworks industry associations and the Explosives Inspectorate. These competencies may be obtained from the Queensland Department of Employment and Training.

12.2.4 Gunpowder and Flashpowder

Gunpowder (black powder) and flashpowder are classed as mass explosives belonging to Hazard Division 1.1D and 1.1G respectively. A person must hold an authority to carry out blasting or special effects and/or an authority to manufacture explosives to possess or use gunpowder or flashpowder. A fireworks operator or contractor authorised to carry out aerial or ground level displays or strings of firecrackers is not authorised for the possession or use of loose gunpowder or flashpowder or indeed, any loose firework composition.

12.2.5 Fireworks Certificate of Compliance

A fireworks contractor must not supply fireworks for a display unless the fireworks are covered by a current certificate of compliance. The fireworks operator must not use fireworks at a fireworks display unless the fireworks contractor has certified that the fireworks are covered by a current certificate of compliance.

12.2.6 Training and Competencies of Other Personnel

An employee or agent of a fireworks contractor (e.g. a fireworks operator or a fireworks operator's assistant) may only possess fireworks relating to the contractor's activities. The fireworks contractor and operator are responsible for ensuring that a fireworks operator's assistant (or other employee or agent) engaged to assist in preparing fireworks for use, testing fireworks, loading fireworks, tying up fireworks or any other fireworks handling activities —

- is at least eighteen years of age;
- is physically capable of carrying out those duties; and
- complies with the *Explosives Act 1999*, the *Explosives Regulation 2003*, and this Code.

A fireworks operator's assistant under the constant and direct supervision of a fireworks operator does not need to be authorised but needs to be trained and competent in the activities undertaken under the direction of the fireworks operator. Competencies of a fireworks operator's assistant may include an operational understanding of —

- the safe handling of fireworks (including a sound understanding of the hazards at the display from fireworks and any other relevant hazards, safety rules, operating procedures and instructions);
- fireworks equipment;
- the safety management system;
- fire safety equipment;
- PPE;
- emergency procedures;
- incident reporting;
- crowd control; and
- the securing of fireworks.

12.3 Prohibited Explosives

High explosives, such as detonating cord, detonators, packaged blasting explosives, boosters and ANFO are not to be used in public fireworks displays under any circumstances. (This does not apply to the use of such explosives by suitably trained and authorised persons for special effects such as motion picture sets that are closed to the public.)

13. Use of Fireworks Accessories and Equipment

13.1 Confinement of Fireworks

Fireworks must not be unnecessarily confined. Necessary confinement is the confinement of fireworks by equipment that is essential for the operation of the fireworks. For example, single aerial shells and mines require confinement in a mortar for their operation. Fireworks such as multishot cakes, barrages and candles use confinement in their design to project the fireworks effects. Unnecessary confinement involves the use of equipment in addition to the fireworks which will produce the desired effect. For example, securing fireworks (such as candles or cakes) with equipment or encasing or enclosing the firework may lead to unnecessary confinement.

A firework is subjected to unnecessary confinement when —

- more than 25 per cent of the sides (not counting the top and base) of the firework are enclosed by the equipment; or
- there is a clearance of less than 25 mm between the firework article and the equipment.

The fireworks contractors in their safety management system and standard operating procedures and fireworks operators at the display set-up must not unnecessarily confine fireworks such as supporting a Roman candle or fountain in a mortar. Unnecessary confinement of fireworks is avoidable and thereby increases the risk of harm to people during a display, should the firework malfunction. Fireworks such as a Roman candle or fountain can be properly supported without confinement. The elimination of confinement is the preferred risk control measure from the risk control hierarchy.

13.2 Securing Fireworks and Equipment

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

The methods of securing fireworks should take into account —

- weather conditions, such as rain (which will reduce the strength of cardboard and render adhesives and fasteners through the cardboard ineffective); and
- the surface on which the fireworks are being secured (such as a barge, dirt, clay, sand and hard surfaces, e.g. rock and roof tops, etc.).

The fireworks contractor must develop methods to properly secure fireworks. The safety management system must document the methods, procedures, practices, equipment and materials for securing the fireworks. The fireworks operator during a display should only be securing fireworks in accordance with the fireworks contractor's safety management system. The fireworks equipment must be capable of withstanding a large force without being disturbed, dislodged or knocked over, or having its orientation changed. The use of gravity only as a method of securing any fireworks is not an acceptable method of securing fireworks under any circumstances. Suggested methods of securing fireworks are presented in Appendix 22 of this Code.

13.3 Mortars

Mortars must be used only in accordance with the manufacturer's recommendations and stated design, testing and performance criteria. Their age and serviceability must be readily identifiable. Refer to Section 7.2.3.1.1 and Appendix 11 of this Code.

13.3.1 Condition of Mortars

Information on assessing the condition, suitability and serviceability must be provided by the supplier of the mortars.

13.3.1.1 Inspection of Mortars

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 being bent or curved, 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.

13.3.1.2 Damaged or Defective Mortars

Damaged or defective mortars must be tagged as “REJECTED” OR “UNSAFE FOR USE”. If they cannot be repaired, they must be disposed of or destroyed as soon as practicable. Cardboard mortars that have sustained undetected damage to their interiors may result in serious malfunctions during firing.

13.3.2 Size of Mortars

The size of mortars is measured by their internal diameter. Because the pressure safety margins generally decrease with increasing mortar size, mortars may be restricted by size. For example, cardboard mortars must be no greater than 200 mm. There may also be restrictions on the number of mortars of a specified size that may be grouped together. (See Section 13.3.3.1 Securing Mortars by Rack Systems and Section 13.3.4.7 Supporting Clusters of Mortars).

To assist in their ready identification during setting-up and at the display site, mortars may be colour-coded in terms of their different sizes.

13.3.3 Support, Protection and Securing of Mortars

The systems used to support, protect and secure the mortars and fireworks must perform satisfactorily during normal or abnormal functioning of the fireworks. 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 the fireworks operator, the fireworks operator’s assistant(s) 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. The use of sand, including sandbagging, is strongly recommended for all applications with mortars.

Sandbagging should be regarded as providing a method of protection and not as a method of adequately securing the mortars. Sandbags used for protection from the mortar should be located at a minimum of one calibre distance away from the mortar to prevent additional high-energy missiles arising from a malfunction.

13.3.3.1 Securing Mortars by 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.

13.3.4 General Limitations on Numbers of Mortars per Rack

In general, mortars per rack are restricted to a maximum of —

- 16 mortars for 50 mm maximum nominal internal diameter mortar tubes;
- 12 mortars for 62 mm to 100 mm nominal internal diameter;
- 5 mortars of 125 mm to 150 mm nominal internal diameter; and
- 1 mortar of greater than 150 mm nominal internal diameter.

13.3.4.1 Limitations on Mortars for Chain-fused Shells

Racks must not be used for delay chain-fused shells over 75 mm diameter. The rack for such mortars must be of sufficient strength to withstand a failure that might cause the mortars to reposition.

13.3.4.2 Limitations on Mortars for Aerial Shells

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.

13.3.4.3 Boxed Items

The above restrictions do not apply to boxed items containing tubes of 75 mm or less in diameter.

13.3.4.4 Securing Mortars by Trailer-mounted Rack Systems

Mortars no greater than 100 mm in diameter may be fixed to racks mounted on a trailer. The trailer for a rack system must be —

- of sufficient strength and with adequate supports to provide a stable horizontal platform during firing;
- fitted with an appropriate frame for attachment of the mortar tubes;
- fitted with a removable top to permit firing from the mortar; and
- provided with sides constructed of wood or lined internally with wood or other non-metallic material. (The frame of the sides may be made from metal, such as lightweight angle iron.)

13.3.4.5 Securing/Supporting Mortars for Star Shells

Mortars for star shells may be secured to stakes or posts. There must be a minimum 20 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 star shell may strike the stake or post on firing. Mortars for star shells may also be supported by the placement of sandbags around the mortar to an appropriate height above the position of the star shell in the mortar.

(Appendix 11 outlines other methods of support for mortars firing star shells.)

13.3.4.6 *Securing Chain-fused Aerial Fireworks*

All chain-fused aerial fireworks 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.

13.3.4.7 *Supporting Clusters of Mortars*

All mortars in a cluster must be of the same diameter and no larger than 75 mm inside diameter. No more than seven mortars are permitted in a cluster. Each cluster must have an appropriate independent means of support (such as duct tape and posts or stakes).

13.3.5 Separation and Positioning of Mortars

Where practical, greater separation distances than those specified below should be used to provide more space for the fireworks operator and the fireworks operator's assistant(s) to work and to reduce the chances of crew injury particularly where hand firing is to be employed.

13.3.5.1 *HDPE Mortars and Star Shells*

The manufacturer or supplier must provide information on the power of shells together with the recommendations from the manufacturer and supplier of the HDPE mortars and racks (if applicable). The minimum separation distances for HDPE mortars and standard star shells using perchlorate-based composition are provided in Table 14.1 (page 61) below regardless of the HDPE mortar manufacturer's recommendations.

Table 13.1 Minimum 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	0.25 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 (See Note 2)
more than 300 mm	protection and separation are required

1. These separation distances may be reduced if a competent person can demonstrate and document by witnessed test firings that a malfunctioning aerial shell exploding in the mortar will not damage or realign a neighbouring loaded mortar. The reduced separation distances will apply only to the revised conditions determined by the competent person.

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. $0.25 \times 150 \text{ mm} = 37.5 \text{ mm}$.

13.3.5.2 *Mortars for Aerial Salute Shells*

The mortars for aerial salute shells must be individually supported and separated from other mortars by at least ten times the inside diameter of the mortar. (Appendix 11 provides a complete outline of protection procedures suitable for mortars used to fire aerial salute shells.) Only one salute and no other aerial shells are permitted per rack.

13.3.5.3 *Clusters of Mortars for Aerial Shells*

All clusters 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 cluster of loaded mortars. Only one salute and no other aerial shells are permitted per cluster.

13.3.5.4 *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. However, where the separation distance is twice that required in Table 14.1, buried mortars must be separated by a minimum distance of the diameter of the largest mortar in the sequence. (Table 14.1 provides for doubling the minimum clearance distances for the chain-fusing of fireworks.)

If the strength of the racks holding mortars for delay chain-fused aerial shells is uncertain, the separation distances from the racks to spectators must be twice those listed in Table 14.1 for the largest mortar in the sequence. Racks for mortars of chain-fused aerial shells must be positioned perpendicular to spectator viewing areas.

13.3.5.5 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 follows —

- 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 the fireworks operator time.)

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 use of not more than 50 mortar tubes for firing shells;
- the application of the requirements applying to individual racks in the sections above e.g. stand-off distances;
- the permitting of electrical firing of shells only;
- the permitting of instantaneous chain-fusing;
- the securing of racks together e.g. by cross braces. (Methods of securing the system must meet the general requirements for securing.);
- the loading of mortars from the inside to the outside and after firing checked from the outside towards the inside;
- a minimum spacing between the mortars in all directions of one half of the internal diameter of the mortar tube;
- a maximum permitted shell size of 100 mm diameter;
- a system no wider than 800 mm or longer than 1 metre.

13.3.6 Loading of Aerial Shells

Aerial shell fireworks 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 fireworks display is prohibited.

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 (i.e. close sliding fit) into the mortar. Shells that do not fit into their appropriate mortars must not be used. They must be labelled “reject”, put aside and the supplier notified as required under the Fireworks Contractor Safety Management System and the Suppliers Quality Management System. They should be dealt with as specified in Section 15.8.2. Aerial shells must have the clearance specified in Part D Section 7.1.3 of this Code.

13.4 Electrical Firing of Fireworks Displays

Electrical firing involves the use of electric fuseheads and an electrical firing unit (or controller). The electrical firing unit can range from a very simple device to a computer-driven unit synchronised to music. With proper training, experience and equipment, the electrical firing of fireworks increases safety for the fireworks operator and the fireworks operator's assistant(s) who are isolated from the fireworks as they are fired. This is a higher order risk control measure using the "Control Hierarchy" and is strongly recommended.

13.4.1 Electrical Firing Hazards

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 firework);
- radio transmissions and radio frequency energy;
- stray electricity (such as electrostatic discharges and electrical storms, inadvertent contact with phones, radio, pagers or other ignition sources).

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

- maintaining appropriate distances from the sources of electromagnetic radiation;
- twisting (shorting) the wire at all times;
- not coiling wires;
- not using staple guns to secure quickmatch that is connected to aerial shells, mines, or comets;
- evacuating the display site of all personnel to the perimeter of the exclusion zone and returning loose products to storage at the approach of an electrical storm;
- not using portable communication systems (such as radios and mobile telephones) within 5 metres of electrically fired fireworks;
 - ensuring that fireworks operator and fireworks operator's assistants do not carry a portable communication system while handling fireworks with an electrical

fusehead. (Refer to the Institute of Makes of Explosives (IME) publication #20, page 11 for full details.)

Appendix 7 – Extraneous Electricity provides more information on the hazards and precautions to be adopted.

These communication systems may be used after the display is set-up and all personnel are away from the fireworks.

13.4.2 Location of Electrical Firing Point

When only electrical ignition is to be used, the fireworks operator and the fireworks operator's assistant(s) should be positioned as far as practicable from any mortar preferably behind a suitable protective barrier. For fireworks 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 fireworks of similar low hazard. The electrical firing point must be positioned so that there is a clear line of sight to the set-up area and all the fireworks primed for electrical firing.

If both manual firing and electrical ignition are to be used during a display, the mortars to be used for manual firing must be separated from the mortars to be used for electrical ignition by a distance of at least 10 metres.

13.4.3 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 fireworks is permitted are —

- all salute shells;
- all star shells 100 mm in diameter and greater;
- all multiple racks secured together (Refer Section 13.3.5.5); and
- all fireworks on floating vessels and floating platforms.



PART E

OUTDOOR FIREWORKS DISPLAYS

14. Planning the Fireworks Display

Fireworks displays often involve a contractual arrangement between a fireworks event organiser and a fireworks contractor. The planning of the display includes all activities undertaken from the time that the fireworks event organiser contracts the fireworks contractor until the fireworks operator begins to set up the fireworks display.

Planning should include the main plan for the stages of the display and any contingency plans to account for conditions and circumstances being different from those conditions and circumstances anticipated during planning and would have otherwise prevented the stages of the fireworks display from being safely undertaken including changed conditions at the time of firing the display.

14.1 Responsibilities of Persons Involved in Planning

14.1.1 Fireworks Event Organiser

The fireworks event organiser has a duty of care as the person who owns the risk and hence should undertake a formal process to select a fireworks contractor. (Refer to Appendix 13 for issues to be considered in this selection process, including some of the questions that may be asked).

14.1.2 Fireworks Event Organiser and Fireworks Contractor – Shared Responsibilities

The fireworks event organiser and the fireworks contractor will need to jointly agree on matters where they both have duty of care obligations and responsibilities. To achieve these outcomes, meetings and regular communication between the fireworks event organiser, the fireworks contractor, the fireworks operator, relevant agencies and any other concerned stakeholders should be held in advance of the display to ensure that these obligations

and responsibilities are carried out. Such matters will include. —

- selecting the fireworks;
- consulting with the local community near the fireworks display;
- determining the location for preparing the fireworks;
- ensuring the provision of security measures for crowd control and control of access to the fireworks display area, including:—
 - the provision of security personnel; and
 - the creation of physical barriers;
- ensuring the provision of first aid attendants;
- emergency planning;
- the auditing and inspection of compliance and activities relating to the display;
- effective supervision of fireworks operators and assistants;
- auditable control and security of fireworks; and
- ensuring post-display notification.

14.1.3 Fireworks Contractor

The responsibilities of the fireworks contractor at the planning stage should be detailed in the fireworks contractor's safety management system and should include —

- ensuring that fireworks event organisers are aware of their obligations;
- ensuring that the fireworks display site is suitable for the fireworks to be used;
- ensuring that the fireworks display equipment is suitable and fully serviceable;
- ensuring that the fireworks for the display are suitable;
- ensuring that the local community is notified of the display;
- providing fireworks display insurance;
- selecting the fireworks operator;

- ensuring that the fireworks operator is appropriately authorised and trained;
- ensuring that the fireworks operator has been appropriately educated in the fireworks contractor's safety management system;
- ensuring that all relevant agencies are notified and that the necessary approvals have been obtained;
- identifying the site for the preparation and transit storage of the fireworks;
- ensuring the provision of security measures; and
- ensuring the provision of first aid attendants;
- ensuring the provision and use of appropriate personal protective equipment (PPE);
- providing a system for auditable control and security of fireworks;
- providing a system for effective supervision of the fireworks operator and the fireworks operator's assistants;
- ensuring that fireworks are only used in accordance with the manufacturers' recommendations; and
- providing a system for submission of post-display notification.

14.1.4 Fireworks Operator

The fireworks operator's responsibilities include —

- ensuring that at the time of the display the fireworks display site is suitable for the fireworks to be fired and the equipment to be used;
- providing a system for the effective supervision of the fireworks operator's assistants;
- ensuring that the fireworks for the display are suitable;
- identifying the site for preparation and transit storage of the fireworks;
- ensuring compliance with transport requirements for fireworks to the display;
- ensuring that the equipment to be used is suitable, properly maintained, serviceable and safe;
- ensuring all required PPE is provided, available, serviceable and used;

- identifying the fireworks operator's assistants and ensuring that they are appropriately trained and instructed;
- ensuring that all fireworks are fully secured;
- ensuring that the clearance distances to be used are suitable
- ensuring that the display is properly cleared after the display; and
- providing post-display notification to the contractor.

14.2 Selecting and Purchasing the Fireworks

14.2.1 Selecting the Fireworks

Fireworks contractors are to exercise responsibility when selecting fireworks for a display. In particular, salutes or fireworks containing reports should be confined to large public displays at a significant distance from sensitive and vulnerable locations, including residential or rural residential areas. A maximum of three salutes per display is permitted. The fireworks 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, homes, animals such as horses and dogs, etc;
- prevalent environmental conditions (e.g. wind); and
- the limitations of the proposed fireworks display site in conjunction with the display requested.

14.2.2 Purchasing the Fireworks

The fireworks contractor must purchase the fireworks to be used at the fireworks display and provide these to the fireworks operator. All fireworks must be —

- of an acceptable safety performance and quality;
 - safe for use;
 - provided with a current copy of a certificate of compliance; and
 - recorded and traceable until point of use.
- Refer also to Section 9.1 on Purchase, Sale and Supply of Fireworks.

14.3 Selecting the Preparation Site

The fireworks contractor and fireworks operator (if applicable) are responsible for determining the location for preparing the fireworks depending on the circumstances and constraints imposed. Fireworks may be prepared —

- in the set-up area; or
- indoors or outdoors in a controlled area at, or near, the fireworks display site; or
- in a workshop before being transported to the fireworks display site.

They must not be prepared in any fireworks or explosives magazine. The fireworks preparation site must not be in a direct line of sight to fireworks magazine doors or vehicles used for transporting the fireworks within the separation distances.

14.3.1 Controlled Area at Fireworks Display Site

If the fireworks must be prepared at the display site, the fireworks event organiser, the fireworks contractor and the fireworks operator must agree on a suitable location at the fireworks display site. The exclusion zone bounded by the separation distance must be a controlled area, with appropriate warning signs posted at its perimeters. Only authorised and trained people will be permitted in this area.

14.3.2 Clearance Distances for Preparation Site

Fireworks must be prepared with a clearance distance and other stated conditions as described in Section 15.4 of this Code. When the fireworks are prepared in an outdoor location, the clearance distance must be at least the minimum clearance distance for the fireworks. When the fireworks are prepared indoors in a workshop (or in a building performing an equivalent function to an indoors facility), the clearance distance of the fireworks must be a minimum of 30 metres.

14.4 Selecting the Fireworks Display Site

14.4.1 Suitability of Fireworks Display Site

Suitability of the fireworks display site will be dependent on assessing that there is an acceptable level of risk for the fireworks display planned and the circumstances that will be present during the display. The fireworks display site must have sufficient open space to meet the calculated minimum clearance distances to conduct the display. There should be no risk of harm to people or damage to property from an interaction with the firework. Nor should there be a risk of environmental harm or adverse environmental effects, such as nuisance noise.

(Refer to Section 14.9)

The following issues must be considered when assessing the risk for the suitability of the site for the fireworks display —

- vegetation (including excessive numbers of trees and shrubs, dead undergrowth and dry grass), where it presents a fire risk and also obstructs the identification, location and recovery of dud aerial shells and other fireworks articles;
- areas where people and vehicles (including dwellings, buildings, temporary accommodation, vehicles and parking areas) will congregate;
- overhead obstructions, with respect to the firing area. (Any overhead object or any part of an overhead object, e.g trees, branches, wires, football posts, structures, buildings must not be within 10 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 10 metres of any part of the firing area at any time as a result of swaying and blowing in the wind.);
- the locality, size and area of the site, taking into consideration the type,

- nature and size of fireworks to be used;
- the location of the actual display on the site taking into consideration spectator locations and secured areas;
- the weather conditions (such as winds) which will affect clearance distances required including consideration of potential wind shift and change;
- the time of the display (refer Environmental Guidelines Section 14.9 and Appendix 6);
- the types of fireworks to be used, e.g. salutes which are banned in certain locations (Refer to Section 14.2.1 of this Code.);
- sensitive sites adjacent to the display site (such as rural or urban residences, health care facilities, aged care facilities, detention correctional facilities, nature reserves, livestock properties and dangerous goods stores);
- the ability for the fireworks operator and fireworks operator's assistant(s) to have full sight of the fireworks display site area and, in particular, the fireworks firing zone; and
- the number of displays already held at that location (Refer to Appendix 6 for environmental guidelines).

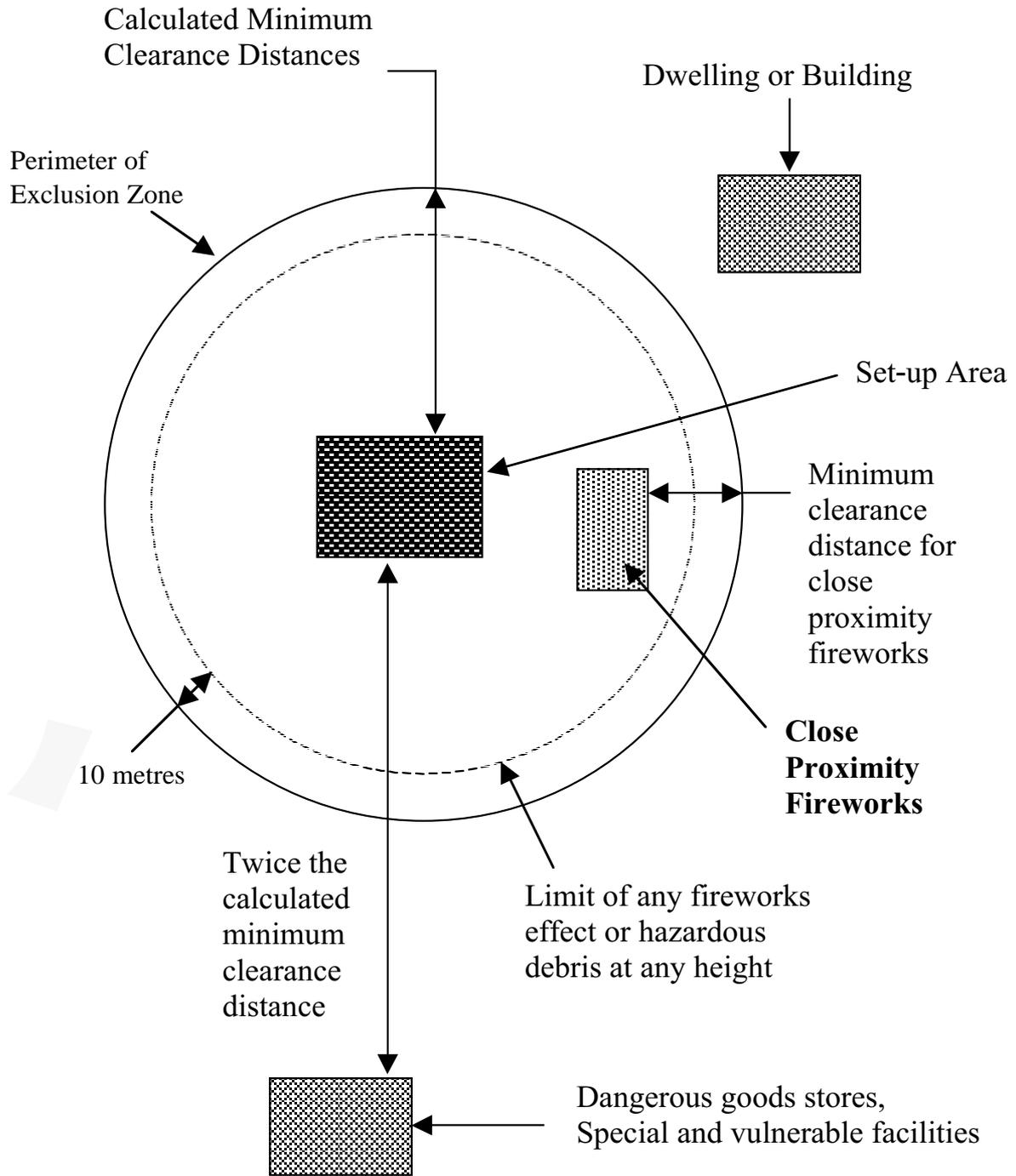
14.4.2 Protection of Public and Property from the Discharge of Fireworks

The fireworks operator must ensure that the point of launch of aerial shells ensures the safety and protection of the public and property including dangerous goods stores, special and vulnerable facilities from the discharge of fireworks (including aerial shells, fallout from hazardous debris, malfunctions and other associated hazards). Fireworks and mortars must be positioned so that any fireworks effect and hazardous debris (including an aerial shell which has not exploded in the air, as intended) falls within the fireworks display site area, as calculated for the minimum clearance distance for the fireworks display site area (Refer to Section 14.5).

The minimum clearance distances must be based upon the fireworks effects and hazardous debris at any height coming within the 10 metres buffer distance of the perimeter of the exclusion zone.

Fireworks devices, units or effects must not cross over or burst above any area occupied by spectators. A typical fireworks display site area is shown in Figure 14.1 Page 57.

Figure 14.1 Typical Fireworks Display Site Area



14.5 Minimum Clearance Distances

The minimum clearance distance is the distance from any firework to the perimeter of the fireworks display area referred to as the exclusion zone. It is calculated to establish an exclusion zone around the firework at the display from the fireworks requiring the largest clearance distance. Each firework will have its own clearance distance. For the purposes of simplicity, the overall clearance distances are estimated from the fireworks requiring the largest clearance distances. The minimum clearance distance calculated should not be considered to be the optimum clearance distance. It is simply the minimum requirement based upon known conditions, estimations and assumptions to achieve acceptable risk. The fireworks contractor in the safety management system and the fireworks operator at the display site should aim to significantly exceed the calculated minimum clearance distance to reduce the level of risk of harm to people and property as much as reasonably practicable. They should also allow for changes of conditions and incorrect estimations and assumptions leading up to and during the firing of the display. Information to estimate the calculated minimum clearance distance should be provided by the fireworks manufacturer or supplier in the Technical Data Sheet and incorporated into the fireworks contractor's safety management system.

14.5.1 Considerations

To calculate the minimum clearance distance for a fireworks display, various factors must be assessed, including —

- the default minimum clearance distance (i.e. the minimum clearance distance for the fireworks in ideal conditions) and the manufacturer's recommended minimum clearance distance;
- the effects of wind;
- the effects of angled fireworks (i.e. aerial shells, candles) or angled (sloping) land at the display site;

- the effects of fall-out from hazardous debris;
- the potential impact on special and vulnerable facilities; and
- the known effects and performance of the fireworks and any influences from equipment.

The minimum clearance distances calculated apply to any person not directly involved in the fireworks display (i.e. other than fireworks operators, fireworks operators' assistant(s) and security personnel). No other person is permitted to be within those distances. The numbers of authorised personnel within the exclusion zone must be kept to a minimum to minimise the exposure to the risk and thereby minimise the risk of personnel within the exclusion zone.

This prohibition applies to all other persons, including persons involved with the event with which the fireworks display is associated, such as —

- stage performers (e.g. musicians at concerts) and stage crew;
- sports person (e.g. racing vehicle drivers, rodeo contestants, equestrian event contestants) and associated crew or officials;
- camera crew photographers; and
- emergency services personnel.

Under certain circumstances people involved with the event may be permitted within the exclusion zone for difficult sites (refer Section 15.5 of this Code). They may also be permitted when a risk assessment with effective risk control measures has been implemented.

14.5.2 Calculation of Minimum Clearance Distances for Exclusion Zone

The person calculating the minimum clearance distance for the exclusion zone must take into account all the factors discussed in Section 14.5.1. The distance

calculated applies to all types of fireworks in the display. In practice, the calculation of this distance is based on those fireworks having the maximum effect on the clearance distance. For example, for 75 mm and 100 mm aerial shells to be fired from an area, the calculation would be based on the 100 mm aerial shells closest to the perimeter of the exclusion zone. The calculations for 75 mm shells may be redundant unless their angle was significantly different or there was some other factor that gave much wider spread of the fireworks effect or hazardous debris.

The clearance distance for close proximity fireworks to be fired closer to the perimeter of the exclusion zone can be calculated separately. Appendix 18 provides an example of a calculation to determine minimum clearance distances.

14.5.2.1 Default Minimum Clearance Distances

The default minimum clearance distances under ideal conditions for all fireworks are presented in Table 14.1. These distances are based on the consequences of a malfunctioning firework, not extending beyond the exclusion zone. These distances are based on zero wind speed and on the true vertical firing of all fireworks. Because of factors such as variations and tolerances, all fireworks effects fired and propelled will have a randomness or scatter effect and will not have a truly vertical trajectory.

The ‘manufacturer’ must also recommend a default minimum clearance distance in the Technical Data Sheet for the firework supplied. The ‘manufacturer’s’ recommended minimum default distance must provide for a minimum buffer distance of 10 metres from the extent of the hazard to the people and property to be protected by the minimum clearance distance. The estimated extent of the

hazard should be based on the worst case of all the modes of failure from the firework, e.g. blowout in the tube of a candle, a low burst of starshell, the functioning of a star shell on ground from long delay, etc. The ‘manufacturer’s’ default minimum clearance must be based on performance results.

If the ‘manufacturer’s’ recommended minimum clearance distance differs from the default minimum clearance distance in Table 14.1, the greater of the two minimum clearance distances must be used.

Table 14.1 provides for the doubling of minimum clearance distances for fireworks that are chain-fused. This applies to all chain fused-fireworks, regardless of who does the chain-fusing (e.g. the manufacturer, supplier, fireworks contractor or the fireworks operator).

14.5.2.2 Close Proximity Fireworks

For close proximity fireworks used at outdoor fireworks displays, the minimum clearance distance will depend on —

- the default minimum clearance distance of the close proximity firework; and
- the category of authority of the fireworks operator.

If the fireworks operator is authorised for close proximity fireworks displays, the minimum clearance distance for the close proximity fireworks will apply only to the close proximity fireworks.

If the fireworks operator is not authorised for close proximity fireworks displays, the minimum clearance distance for the outdoor fireworks will apply to those close proximity fireworks using Table 14.1. The calculation of minimum clearance distances for close proximity fireworks used outdoors will be subjected to the adjustment of clearance distances due to wind, angling, etc as applied to outdoor fireworks.

14.5.2.3 Effects of Wind

The supplier of the fireworks should provide information or recommendations on the effects of wind drift on fireworks performance. In windy conditions, the clearance distances used with aerial shells must be increased by at least the distances given below on the downwind side of the display area. If the clearance distances cannot be increased or the wind is stronger than 40 km/h (22knots), the display must not proceed. The fireworks event organiser must be advised in advance of a possible increase in wind speed to provide for such contingencies.

The minimum clearance distance for all fireworks firing effects higher than 15 metres vertically must be taken into account for the final calculation of clearance distance. Table 14.2 provides an illustration of the effects of wind on the drift of aerial shell performance. Appendix 23 also demonstrates a combined effect of wind speed, angle from vertical of firing and range of unexpended (dud) aerial shells of different sizes.

The practice of angling fireworks into the wind to negate the effects of the wind is discussed in Section 14.5.2.4. Fireworks should not be angled towards the crowd on the basis of adjusting the calculated minimum clearance distance to an acceptable distance to negate the effects of the wind.

The contribution of the effect of wind on the calculated clearance distance must be calculated separately in addition to the estimations for the exclusion zone from the fall-out of hazardous debris. The fireworks operator must have accurate estimates of wind speed, wind direction and wind rotation or wind veering to ensure the effectiveness of the calculated minimum clearance distance and that the

display will be conducted at a level of acceptable risk. The effect that wind may have on the exclusion zone is illustrated in Figure 14.2.

14.5.2.4 Effects of Angled Fireworks

From a safety point of view, it is preferable to keep all fireworks vertical, but, for aesthetic reasons, many operators do set-up fireworks at an angle to produce, for example, cross-over effects. When angling occurs, the minimum clearance distance becomes ineffective because a malfunctioning firework will land closer to spectators than if it was fired vertically. Accordingly, if any types of fireworks are angled, the angle must be determined and the minimum clearance distance re-calculated. Appendix 23 provides data on the necessary increase to the minimum clearance distance that must be applied for given product types and angles and at different wind speeds. The point of launch of the fireworks may be a trade-off between the angling of the fireworks and the effects of the wind where one is used to balance the effect of the other.

However, fireworks operators must be cautious in this regard as a wind shift may amplify the flight distance of any firework if the wind blows in the same direction as the firework is angled. The clearance distance cannot be reduced should the firework be angled away from crowd because the clearance distance will be calculated from the point of launch of the firework. Fireworks should not be angled towards the crowd in order to get a calculated minimum clearance distance that will overcome circumstances, constraints and features for that difficult site for the fireworks proposed to be fired.

Table 14.1 Default Minimum Clearance Distances – Outdoor Display Fireworks

DEFAULT MINIMUM CLEARANCE DISTANCES	
Display Fireworks	Default Minimum Clearance Distance (metres)
Lances and strings of firecrackers	10
Fountains - up to 25 mm max inside diameter	20
- greater than 25 mm inside diameter,	35
All other fireworks not listed above including ground level and aerial fireworks	a) 1 metre per millimetre of internal diameter of ground display firework and 1 metre per millimetre diameter of aerial firework. (For example, a 75 mm aerial shell will have a minimum clearance distance of 75 metres and a 50 mm Roman candle will have a minimum clearance distance of 50 m). However, this distance must not be less than 35 metres.
	b) The minimum clearance distance must be doubled when items of ground level fireworks or aerial shells* are delay chain-fused by the manufacturer, the fireworks contractor or the fireworks operator, e.g. a large multishot boxed item or a preloaded aerial barrage.
	c) For multi-break aerial shells, the minimum clearance distance for aerial shells under 200 mm diameter must be based on treating the shell as the next largest diameter shell. For example, a 100 mm diameter multi-break shell must have the minimum clearance distance for a 125 mm diameter single break aerial shell. For multi-break aerials shells 200 mm diameter and greater, the minimum clearance distance must be based on calculating the minimum clearance for a shell using the rule 1 metre per millimetre diameter of aerial firework and adding 50 per cent or half the distance to the calculated minimum clearance distance. For example, a 200 mm diameter multi-break shell must have a minimum clearance distance of 300 metres and a 400 mm (16 inch) diameter multi-break shell must have a minimum clearance distance of 600 metres.

* Note: Fireworks including aerial shells instantaneous chain-fused are not subjected to doubling of the default minimum clearance distances.

Table 14.2 Typical Aerial Shell Drift in Windy Conditions

AERIAL SHELL DRIFT IN WINDY CONDITIONS				
Wind Speed	Description	Shell Drift (Shell Diameter)		
		75 mm	150 mm	300 mm
Light breeze 8 km/h (5 mph)	<ul style="list-style-type: none"> • wind felt on face; • leaves rustle; • ordinary vane moved by wind. 	15m	16m	17m
Gentle breeze 16 km/h (10 mph)	<ul style="list-style-type: none"> • leaves in constant motion; • wind extends light flags. 	30m	32m	34m
Moderate breeze 24 km/h (15 mph)	<ul style="list-style-type: none"> • raises dust and paper; • small branches move. 	45m	48m	52m
Fresh breeze 32 km/h (20 mph)	<ul style="list-style-type: none"> • small leafy trees sway; • crested waves form on inland waters. 	60m	65m	69m
Strong breeze 40 km/h (25 mph)	<ul style="list-style-type: none"> • large branches move; • wires whistle; • umbrellas difficult to use. 	75m	81m	87m

Table 14.3 Wind Speed Equivalents.

WIND SPEED EQUIVALENTS						
Beaufort No	Category	Wind speed equivalent at a standard height of 10 metres above open flat ground				Specifications for estimating speed over land
		Knots per hour (kn)	Metres per second (m/s)	km/h	Miles per hour (mph)	
0	Calm	<1	0- 0.2	<1	<1	Calm, smoke rises vertically.
1	Light air	1- 3	0.3- 1.5	1- 5	1- 3	Direction of wind shown by smoke drift, but not by wind vanes.
2	Light breeze	4- 6	1.6- 3.3	6- 11	4- 7	Wind felt on face; leaves rustle; ordinary vane moved by wind.
3	Gentle breeze	7-10	3.4- 5.4	12- 19	8- 12	Leaves and small twigs in constant motion; wind extends light flag.
4	Moderate breeze	11- 16	5.5- 7.9	20- 28	13-18	Raises dust and loose paper; small branches moved.
5	Fresh breeze	17-21	8.0-10.7	29- 38	19-24	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	Strong breeze	22-27	10.8-13.8	39- 49	25-31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	Near gale	28-33	13.9-17.1	50- 61	32-38	Whole trees in motion; inconvenience felt when walking against wind.
8	Gale	34-40	17.2-20.7	62- 74	39-46	Breaks twigs off trees; generally impedes progress.
9	Strong gale	41-47	20.8-24.4	75- 88	47-54	Slight structural damage occurs (chimney-pots and slates removed).
10	Storm	48-55	24.5-28.4	89-102	55-63	Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	Violent storm	56-63	28.5-32.6	103-117	64-72	Very rarely experienced; accompanied by widespread damage.
12	Hurricane	> 64	> 32.7	> 118	> 73	Severe and extensive damage.

(Source: Bureau of Meteorology, Manual of Meteorology, Part 1 - General Meteorology - AGPS 1993.)

Mortars which are not aligned exactly vertically will also have significant effects on shell drift and the clearance distances necessary to ensure a safe display. For example, a 2 degree tilt (which represents a tilt of approximately 10 mm at the top of a 300 mm long mortar) can send a 75 mm shell about 13 metres down-range. It is not uncommon for a mortar rack to allow this level of movement of the mortars. It is also very difficult to secure a rack to this degree of accuracy without using a measuring instrument. A 5 degree tilt will send a 75 mm shell about 30 metres downrange, effectively using up a significant proportion of the required 75 metre minimum clearance distance. A small tilt, therefore, may require clearance distances to be at least doubled in the direction of the tilt.

In many situations the land at the display site may not be level. Operators must determine the angle of the secured firework from the vertical. The clearance distance will also be affected by the slope of the land and may need to be adjusted. Mortars may be angled intentionally during a display to allow for the effects of wind and to carry shells away from the main spectator viewing areas or where spectator viewing areas are on all sides, to keep the shells predominantly above the point of firing.

The mortars may be angled so that any dud shells fall at a point approximately equal to the offset of the mortars from the centre of the display site, but in the opposite direction.

Many boxed items are supplied with the tubes fanned, viz fanned box items. The clearance distances must consider the angle of the angled tubes in this firework for the calculation of minimum clearance distance.

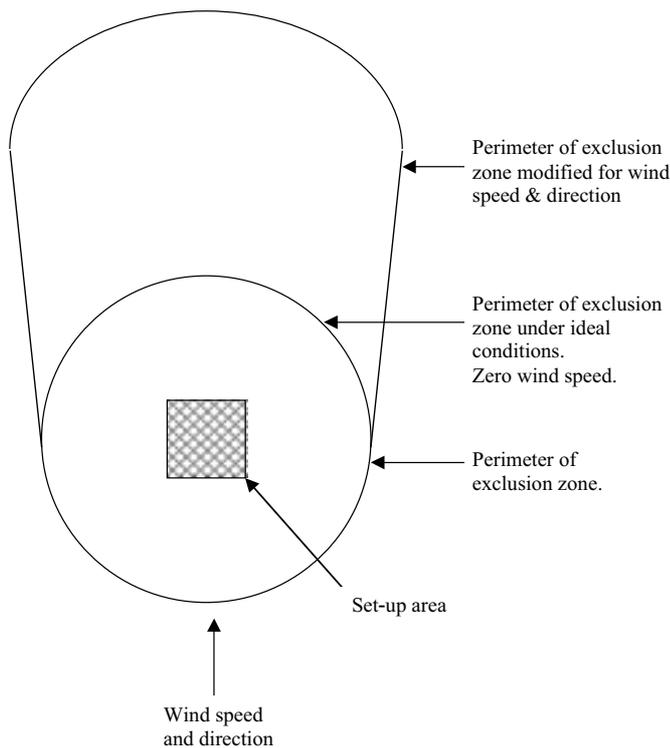
14.5.2.5 Effects of Fall-Out from Hazardous Debris on Exclusion Zone

The fall-out area for hazardous debris (any debris produced or expelled by the functioning of a firework that is capable of causing personal injury or property damage, including hot sparks, burning fireworks effects, heavy casing fragments, components of fireworks effects and unignited components) must be a large open area within the exclusion zone bounded by the calculated minimum clearance distance. Hazardous debris including debris from the small components and the casings must not land outside the exclusion zone. Spectators, parking areas, unauthorised vehicles including watercraft, premises, sensitive and vulnerable facilities and readily combustible materials must not be located within the fall-out area for hazardous debris during the display.

The minimum clearance distance for the fall-out area from hazardous debris must account for wind speed, wind direction and changes in wind direction and the type and performance of fireworks being fired. For stronger winds, the clearance distances downwind should be relatively much larger than the clearance distances across wind and upwind. The crowd and other significant exposures should not be located downwind unless there are large areas available for the exclusion zone.

Consideration must be taken for wind speed at the height of functioning of fireworks, e.g. aerial shells, as opposed to ground level wind speeds. Exposures downwind are always a major concern. The effect of wind speed and direction on the perimeter of the exclusion zone is demonstrated in Figure 14.2.

Figure 14.2 Effect of Wind on Exclusion Zone



14.5.2.6 Potential Impact on Sensitive and Vulnerable Facilities

14.5.2.6.1 General

The minimum clearance distance from sensitive and vulnerable facilities and the point of launch of the firework must be at least double the calculated minimum clearance.

14.5.2.6.2 Dangerous Goods Locations

Dangerous goods present a risk of explosion, flammability or toxicity. The nine classes of dangerous goods are —

- Class 1 – explosives;
- Class 2 – gases;
- Class 3 – flammable liquids;
- Class 4 – flammable solids, substances liable to spontaneous combustion, and substances that in contact with water emit flammable gases;
- Class 5 – oxidising substances and organic peroxides;
- Class 6 – toxic and infectious substances;
- Class 7 – radioactive substances;
- Class 8 – corrosive substances;
- Class 9 – miscellaneous dangerous goods and articles

Dangerous goods locations include premises that are placarded for dangerous goods, including service stations. The minimum clearance distance between dangerous goods locations and the point of launch of the firework must be at least double the calculated minimum clearance distances.

The fuel tanks on vehicles or other motorised equipment located in the display site are not taken into the calculation of minimum clearance distance, provided that they have been fully protected from the effects of a malfunctioning firework as determined from a risk assessment.

14.5.2.6.3 High Fire Risk Substances

High fire risk substances include combustible liquids and combustible solids. The minimum clearance distance between premises containing such substances and the point of launch of the firework must be at least double the calculated minimum clearance.

14.5.3 Other Effects

Any other known effects not described above which might affect the health and safety of the public should be taken into consideration for the calculated minimum clearance distance. Examples of features from fireworks to be considered include —

- fireworks producing a large volume of smoke, toxic product, asphyxiants or irritants which unacceptably affects members of the public who may or not have sensitised respiratory systems or respiratory disorders; and
- effects of noise from strings of crackers or maroons.

14.5.4 Reduction of Calculated Minimum Clearance Distance

Engineering solutions, such as the adoption of effective barriers and shields, may mitigate the impacts, effects and consequences of malfunctioning fireworks. The largest, potentially most dangerous fireworks would benefit from the application of engineering solutions. If the effectiveness of the engineering solution can be demonstrated to the satisfaction of the Chief Inspector of Explosives to reduce the minimum clearance distance for their fireworks, the calculation of minimum clearance distance may be modified.

14.6 Insurance

The fireworks contractor must hold an appropriate and adequate public liability insurance policy for a fireworks display. While the minimum public liability insurance cover required for a display is \$5 million, large fireworks displays may require higher levels of insurance cover.

The fireworks contractor's insurance policy must cover all fireworks personnel, including the fireworks operator, and firework operator's assistants. The insurance policy normally covers people who are employees (covered by Workcover) and other nominated people.

Generally, the insurance provisions will be valid only when notification of the fireworks display has been provided and the fireworks operator fully complies with the legislation (including the *Explosives Act 1999* and the *Explosives Regulation 2003*), the conditions of any relevant authorities, and Australian Standards and codes of practice.

Most public liability insurance policies for fireworks displays will cover the majority of activities relating to a fireworks display, such as storage, handling, preparing, setting up, and conducting the display and post-display activities. They may not cover transport activities. Fireworks contractors are advised to check with relevant insurers

for adequate insurance cover. Refer to Section 11.10 of this Code.

14.7 Notifications and Permits

Government agencies, and the local community must be given prior notice of any proposed fireworks display and may require notifications and permits.

14.7.1 Notification to Agencies

The fireworks contractor must provide notification of the proposed fireworks display to the Explosives Inspectorate and the local fire authority at least seven (7) days in advance of the display. The fireworks contractor may also need to notify (or seek a permit from) other agencies listed in Section 4 of this Code, including —

- Civil Aviation Safety Authority;
- Queensland Transport;
- the local government authority;
- Police including water police;
- harbour master;
- air sea rescue or coast guard;
- port authority;
- Great Barrier Reef Marine Park Authority, etc.

The notification form to the Explosives Inspectorate (as outlined in Appendix 8) includes —

- the date, time and duration of the display;
- the location of the display (in sufficient detail to enable identification of the site);
- the type of fireworks to be used (ground level, aerial) including shell sizes;
- the name of the supplier of the fireworks for the display;
- the name and authority number of the fireworks operator carrying out the display;
- the names of assistants helping the operator in handling the fireworks at the display;
- details of the insurance cover held for the display; and
- a fireworks display site plan which must include —
 - the dimensions of the fireworks display

-
- site,
- the spectator viewing area,
 - the parking areas,
 - the fall-out area,
 - the associated clearance distances, and
 - distances to special and vulnerable facilities.

The notification form must provide reasonable estimates of proposed exclusion zones based on calculated minimum clearance distances. The notification form also contains a post-display notification section which must be submitted to the Explosives Inspectorate within seven (7) days after the fireworks display. After the fireworks display site plan has been reviewed, the Explosives Inspectorate may inspect the area depicted on the site plan.

14.7.2 Permission of Property Owner and Occupier

The fireworks event organiser must obtain permission from the occupier of a suitable site before a display can be held at that site. If the property (such as a park or vacant land) is not occupied by a responsible person, the fireworks event organiser still must seek the permission of the property owner. For example, the local authority will need to approve the use of a local park, reserve or beach.

The fireworks contractor must ensure from the fireworks event organiser that permission has been obtained from the occupier before the fireworks display may proceed.

14.7.3 Notification to Local Community

The fireworks contractor is responsible for providing an effective notification of the fireworks display to those people who might be affected by the display within a reasonable time before the display. The number of people who may be affected will depend on the nature and size of the display, the noise levels generated from salutes, reports, aerial shells of various sizes, barrages, cakes etc. Particular care must be taken for areas where noise may

create a major problem with people and animals such as livestock, horses, pets, small children, etc.

The fireworks contractor must determine the size of the area for notifying the community (known as the “community notification area”) on the basis of noise and its effect on all people, domestic animals and wildlife in the neighbourhood. The fireworks contractor must consider the following when determining the size of the community notification area —

- the size and type of fireworks to be used at the display;
- the day, date, time and location of venue;
- the locality (e.g. commercial, industrial, residential, rural-residential);
- special and vulnerable facilities;
- community facilities (including health care, aged care and places of assembly);
- domestic animals and wildlife (in shelters, refuges, sanctuaries, studs and domestic areas including stables, kennels, veterinary hospitals);
- terrain; and
- likely weather conditions.

As a minimum requirement for any proposed fireworks display, all neighbours up to 200 metres away must be notified. For larger displays, the notification area will be larger. In certain circumstances, neighbours up to 800 metres away from the planned display may need to be notified. The fireworks event organiser must be satisfied that appropriate notification has been effected.

For established fireworks precincts, such as South Bank and the City Reach of the Brisbane River, individual notification of neighbouring community is not mandatory provided there has been prior broad effective public advertising of the fireworks event.

The notification process must be effective. The most common practice is to include a written notice delivered to each property in the determined notification area at least four (4) days before the display.

Notifications are normally undertaken by a letterbox drop. Notification may also include advertisements in the local paper, billboard posters and community radio. The notice must include the following particulars for the display —

- the date and time;
- the location;
- the duration;
- a brief description of the display and the effects;
- the name of the fireworks contractor and the fireworks event organiser; and
- the name of a contact person(s) (including phone contact details for the fireworks contractor and fireworks event organiser) for immediate provision of information and discussion.

In addition to formal notification of the local community, the fireworks event organiser and fireworks contractor must be available for consultation and discussion with the local community at reasonable times before and after the fireworks display.

14.8 Record-keeping

A fireworks contractor and fireworks operator are required to maintain records of all fireworks displays as detailed in the fireworks contractor's safety management system. The records kept should include the completed notification form at Appendix 8 and other records such as the completed fireworks industry worksheet form also at Appendix 8. The completed notification form and the fireworks industry worksheet are regarded as being adequate records of the event. The fireworks contractor must also maintain stock keeping records of fireworks. These records will enable identification of any shortfall or theft. These records should be maintained for at least five (5) years.

Alternatively, the fireworks contractor and fireworks operator may keep a logbook as an alternative to the fireworks industry worksheet listed above which should contain the following information —

- the location, date and time of the fireworks display;
- the quantities and types of fireworks to be used;
- details of misfires and malfunctions and the method of disposal of faulty fireworks;
- the fireworks operator's signature;
- the names of the fireworks operator's assistant(s);
- the weather conditions;
- any unusual incidents (including people trespassing in the display area);
- any complaints received; and
- any other relevant details.

The records must be made available to an Explosives Inspector on demand. These records may be subjected to periodic inspection and audit. A copy of these records may be requested by the Explosives Inspectorate for evidence of experience for upgrades to authorities.

14.9 Environmental Protection Agency Noise Guidelines

The level of noise at the boundary of the community notification area must be less than that for the environmental values to be protected under the Environmental Protection (Noise) Policy of the Environmental Protection Agency. Following complaints about fireworks displays, the Explosives Inspectorate and the Environmental Protection Authority prepared guidelines, Abatement of Nuisance Noise from Fireworks. (See Appendix 6). All persons involved in the conduct of outdoor fireworks displays should read and become familiar with the information contained in this document.

Compliance with these guidelines will demonstrate a fireworks contractor's and fireworks operator's attitude to observing their obligations.

15. Setting Up the Fireworks Display

15.1 Location of the Fireworks Display

The location of a fireworks display influences any special requirements that apply. Special requirements apply for fireworks fired —

- from elevated positions (e.g. the tops of buildings);
- from floating vessels and floating platforms;
- from moving platforms;
- from aircraft; and
- near sensitive and vulnerable facilities.

15.1.1 Elevated Positions

An Inspector of Explosives should be consulted during the setting-up stage for a fireworks display from an elevated position. The calculated clearance distance for such a fireworks display must be contained within the roof area for the building or the elevated site. The possibility of smoke entering the air conditioning system and other hazards (such as unpredictable, strong and erratic winds around buildings and fall-out) must be considered in the setting up of the display.

Aerial shells and other fireworks must not be fired from buildings, unless the roof area is large enough to accommodate the entire calculated clearance distance.

15.1.2 Floating Vessels and Floating Platforms

Many fireworks displays on rivers and near the coast are fired from floating vessels (such as barges) or floating platforms. These vessels or platforms must be —

- set-up in compliance with the requirements detailed in Appendix 20; and
- 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.

15.1.3 Moving Platforms and Aircraft

The firing of fireworks from a moving vehicle or platform (including any land-based or water-based vehicle, regardless of its form of propulsion) or an aircraft requires the approval of the Chief Inspector of Explosives. The request for approval must be accompanied by a documented risk assessment. Other agencies, such as the Civil Aviation Safety Authority, local authorities and the Queensland Fire and Rescue Service, may also require approval to be granted. This requirement does not apply to a barge able to remain under tow and capable of moving during the fireworks display.

15.1.4 Sensitive and Vulnerable Facilities

The fireworks operator must identify and validate sensitive and vulnerable facilities before commencing setting up the fireworks display.

15.2 Documentation

The fireworks operator must ensure that all the documentation required by the fireworks contractor under the safety management system is present. This may include —

- the completed notification form;
- certificates of compliance for fireworks to be used;
- checklists;
- safety information (including Material Safety Data Sheets and Technical Data Sheets);
- work instructions and procedures from the fireworks contractor's safety management system; and
- plans such as emergency plans.

These records may be required for inspection by an official including an Inspector of Explosives or the fireworks event organiser.

15.3 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 eg. testing and tagging of fire extinguishers by competent persons.

The fireworks operator must check all equipment, including safety equipment, to verify that it is present, fully serviceable and suitable for the display.

15.3.1 Firefighting Equipment

The fireworks operator must locate at least one 9-litre water fire extinguisher to meet the requirements of AS1841.2 or equivalent, and one 20-litre container of water at each point of launch at the fireworks display.

15.3.2 Personal Protective Equipment

Personal Protective Equipment (PPE) is essential for all fireworks operators, fireworks operators' assistants and other personnel who are exposed to hazards from fireworks, should they malfunction during setting-up activities.
(Refer also to Section 5.4.1.6 of this Code.)

15.3.3 First Aid

The fireworks contractor and the fireworks operator must ensure that a fully serviceable, operational and appropriate first aid kit is provided at the fireworks display site and that a person trained in first aid, in addition to the fireworks operator, is present during the display.
(Refer to Section 16.7 of this Code.)

15.4 Minimum Clearance Distance for Setting up a Display and Sleeping of a Display

The preservation of the minimum clearance distance may be a problem when setting up a fireworks display or

when a fireworks display has to “sleep”, waiting to be fired, until the site is available for firing of the display. For example, sporting events, large agricultural shows, waterways and speedways often involve competition for the display site.

While setting up a display and the “sleeping” of a display waiting to be fired are lower risk activities than conducting the fireworks display, they still present a risk of harm to people and property should any fireworks inadvertently fire or malfunction. The minimum clearance distance for setting up a display is either 30 metres or 50 per cent of the calculated minimum clearance distance for conducting the display, whichever is the greater.

The minimum clearance distance for sleeping a prepared display is either 30 metres or 30 per cent of the minimum clearance distance for conducting the display, whichever is the greater. For example, if it is calculated that the minimum clearance distance for the display is 70 metres, the minimum clearance for setting up the display would be 35 metres and the minimum clearance distance for sleeping the prepared display would be 30 metres.

The following control measures must be in place for setting up and sleeping the display as appropriate —

- unauthorised persons are not permitted to enter the reduced minimum clearance distance for sleeping (The fireworks operator must provide training to any authorised personnel permitted within this area on the hazards present and emergency procedures to be followed.);
- the fireworks display set-up has a person present dedicated to security duties until the fireworks display commences;
- the area with the reduced minimum clearance distance has a barrier which is not easily traversed;

- the immediate area is posted with appropriate hazard and warning signs;
- the fireworks and fireworks personnel are fully protected from the external hazards (e.g. ignition sources and sources of high energy, such as high speed vehicles); and
- the fireworks are shielded.

15.5 Minimum Clearance Distances at Difficult Sites

For difficult sites such as showgrounds or football stadiums (with an exclusion zone that has permanent and effective restrictions from public access and an effective inner exclusion zone or semi controlled zone for people only under the direct control of the event organiser or fireworks operator), the minimum clearance distances for setting-up the display and sleeping the display for the inner exclusion zone may be set at a minimum of 15 metres. Activities where there is a limited number of people exposed from these activities (such as performances and equestrian events) are permitted in the inner exclusion zone. Activities in the inner exclusion zone should not be capable of impacting on the fireworks. For example, speedway cars are not permitted in the exclusion zone. The duration of the exposure of people in the inner exclusion zone should be kept to a minimum.

All people in the inner exclusion zone must be trained in the hazards from the fireworks and in emergency procedures in case of emergency.

15.6 Exclusion Zone for Moving Preloaded Displays

Fireworks prepared on a trailer away from the display site and moved manually or by vehicle into position at the set-up site before the display, may have to be moved through the crowds and even adjacent to grandstands. The fireworks operator must

ensure that the safety and security of the fireworks is preserved in the exclusion zone for the moving preloaded display during this activity.

An exclusion zone of 2 metres minimum in all directions from the nearest part of the vehicle and fireworks must be provided. Under these circumstances, the following minimum control measures for hazards must be provided for moving the fireworks into position —

- isolation of the fireworks by fixing barriers such as tarpaulins over the trailer and fireworks;
- provision of a security escort maintaining the exclusion zone;
- exclusion of ignition sources from the exclusion zone; and
- provision of suitable fire extinguishers.

15.7 Security

The fireworks event organiser, fireworks contractor and fireworks operator must ensure that security is provided for the fireworks from the time the fireworks arrive at the fireworks display site until the display is completed and the site is cleared. If the operator considers that the event organiser or the fireworks contractor has not instigated appropriate measures to safeguard the fireworks display site, the operator may refuse to set-up the display or start the display, or may halt it at any time.

15.7.1 Control of Public Access to Fireworks and the Exclusion Zone

The fireworks operator must liaise with the fireworks event organizer regarding the security requirements for the exclusion zone, including appropriate measures to prevent access to the fireworks, fireworks equipment and the fireworks display site by spectators and other unauthorised persons. These access control measures must apply —

- prior to the display, following the initial delivery of the fireworks;

- during the display (i.e. the firing of the fireworks); and
- after the display until the removal of —
 - all fireworks from the point of launch;
 - any unfired or misfired fireworks from the display site;
 - and all fireworks equipment.

Once the fireworks have been delivered to the fireworks display site, the fireworks may be kept in locked boxes on the site or in the vehicle used to transport the fireworks. The fireworks must not be left unattended or unprotected.

The fireworks event organiser, fireworks contractor and the fireworks operator 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 fireworks display exclusion zones for setting up, sleeping the display, conducting the display and post display activities and signs.

In addition to the use of barricades, signs and security personnel to effectively prevent the access of the public to the exclusion zone, the fireworks event organiser or fireworks operator may instruct the public not to enter the site by announcements over a public address system. The control of public access at the display site may be assisted by advertising in advance the best vantage points from which to view the fireworks display.

15.7.2 Signs

The exclusion zone must be designated. The fireworks operator must post signs around the perimeter of the fireworks display site area prior to the commencement of setting up the display to communicate the hazards associated with the display. The signs should —

- be a minimum of 600 x 300 mm in size;

- have a white background; and
- contain the words: “DANGER – FIREWORKS - RESTRICTED AREA – AUTHORISED ENTRY ONLY” or in words of equivalent warning in red letters of a minimum size of 50 mm.

The signs must remain in place until the display site area is returned to the control of the fireworks event organiser. The number and size of signs used will be determined by the following criteria —

- that they serve as a warning sign; and
- they must be easily seen and read at all parts of the perimeter of the exclusion zone.

15.8 Preparing the Fireworks

The fireworks must be prepared using safe work practices in accordance with the contractors safety management system.

15.8.1 Determining Clarity of Supplier’s Instructions

Before preparing fireworks for a fireworks display, the fireworks contractor should have incorporated the supplier’s operating and safety instructions that relate to the installation and operation of the fireworks and fireworks equipment to be used on the display into the safety management system. If the method of operation of any firework item is unclear, the fireworks contractor must contact the supplier and obtain further advice and instructions.

15.8.2 Setting Aside Poor Performance and/or Poor Quality Fireworks

The fireworks must be unpacked, inspected and prepared in accordance with the fireworks contractor’s instructions prior to setting up the display. The fireworks must be set aside when the inspection reveals the fireworks to be of dubious performance or quality (e.g. fireworks with tears, leaks, broken fuses, or showing signs of having been wet). After the display, any such fireworks must be either returned to the

supplier or destroyed according to the instructions in the safety management system.

15.8.3 Limiting Quantities of Fireworks Exposed

The exposure to risk from inadvertent functioning of fireworks is minimised by working with minimum quantities of exposed fireworks. When working with fireworks, the risk is minimised by only having those fireworks exposed which need to be exposed. To enable minimum quantities of fireworks to be exposed and prepared at any one time, the fireworks to be prepared and the prepared fireworks should not be kept exposed. Self-closing boxes and ready boxes provide an effective method of isolating fireworks from each other and minimise the exposure to other hazards and minimise the consequences should an incident occur.

15.8.4 Protecting Fireworks from Adverse Weather Conditions

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

15.8.5 Protecting Mortars and Witness Devices

The fireworks operator must ensure that loaded mortars have protection for the aerial shells from rain, burning debris, flash over etc. The provision of a witness device on each individual mortar, such as aluminium foil or plastic wrap, will also provide a witness for personnel after the display to see whether the aerial shell has functioned so that appropriate procedures will be undertaken.

15.8.6 Securing Fireworks and Fireworks Equipment

For general requirements for securing fireworks and fireworks equipment, refer to Section 13.2 of this Code and Appendix 22.

15.8.6.1 Aerial and Ground Fireworks

The fireworks operator must ensure that all aerial and ground fireworks and associated equipment are positioned securely in accordance with the fireworks contractor's instructions, so that they will remain in position when the fireworks are fired or malfunction. Poles for ground fireworks must be securely placed and firmly braced so that they will not fall over when the fireworks function. The fireworks operator must ensure that all secured fireworks and equipment have been checked for adequate securing.

The nature of the display site surface where the fireworks will be secured will determine the methods of securing. Methods of securing at one site (e.g. sports oval) may not be adequate for another location (e.g. soft sand at the beach).

15.8.6.2 Mortars for Aerial Shells

Except for display sites that are fully surrounded by the viewing area, mortars may be located and angled so that the aerial shells are carried away from the viewing area to the fallout area. Where a display site is fully surrounded by the viewing area, the mortars may be located and slightly angled to compensate for wind and the configuration of the display site.

15.8.6.3 Mortars on Barges

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. Refer to Section 13.3 and Appendix 22.

15.8.6.4 *Strings of Celebration Crackers*

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

If a T-shaped light tubular stand is used to suspend the string of celebration crackers, the string of crackers must be at least 300 mm away from the metal stand at all times. Because a string of cracker in excess of two (2) metres long will be heavy, the fireworks operator should ensure that the stand used is adequately secured to prevent it from falling over or toppling.

A protective shroud manufactured from suitable materials may be used around the string of celebration crackers to —

- reduce the likelihood of the explosion of projected firecrackers in close proximity to the crowd;
- reduce the chance of access by unauthorised persons to unexploded firecrackers; and
- assist cleaning up after the display.

15.8.7 Loading Aerial Shells into 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 premarked loading rod.

Once the aerial shell is loaded in the mortar, no person (including a fireworks operator and a fireworks operator's assistant) must pass any part of their body directly over the mouth of the mortar. A mirror may be used to inspect the interior of the mortar. The aerial shell must have the correct clearance in the mortar tube specified in Section 7.1.3.

15.9 Setting Up an Electrical Firing Display

15.9.1 General Steps Involved

In setting up an electrical firing display, a fireworks operator (or the fireworks operator's assistant) will —

- ensure that potential ignition sources are isolated e.g. mobile phones, pagers, radios, etc;
- reduce the chance of access by unauthorised persons to unexploded firecrackers; and
- assist cleaning up after the display.

15.9.2 Set-up of Electrical Firing Units

Prior to the fireworks display, the fireworks operator or the fireworks operator's assistant must inspect the electrical 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 fireworks primed with electric fuseheads.

Repairs may be permitted, provided that the system can be returned to full, safe operating condition prior to the display.

The electrical firing unit must be set up to permit a clear line of sight from the fireworks operator to the fireworks and

other parts of the discharge site. However, this is not necessary when a fireworks operator's assistant (acting as a spotter) is in direct communication with the fireworks operator controlling the operation of the electrical firing unit.

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

- disconnecting the cables from the electrical firing unit;
- if the circuit is shunted, inserting fuse wires into the system;
- if a computer firing system is used, programming a protection system into the computer system.

15.9.2.1 Testing of Firing Unit Electrical Circuits

Once the fireworks 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 - 0.05 amp or 20 per cent of no fire current). During this test, no persons are permitted in the immediate vicinity of any fireworks that have been attached to the electrical firing unit or in the set-up area.

If the circuit testing indicates a problem, the fireworks operator or the fireworks operator's assistant 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 fireworks operator.

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. Where the test indicates a fault of discontinuity, defective electric fuseheads or wires must be replaced.

15.9.3 Electric Fusing Operations

This section provides information on electric fusing operations. Refer also to Section 13.4 of this Code for more information.

15.9.3.1 General

Fireworks are fused by inserting the electric fusehead into the quickmatch fuse and securing it in this position with tape or twine. 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 fireworks display site or off-site in the fireworks contractor's or fireworks operator's workshop); and
- remote from people, protected works, storages of fireworks (including magazines) and other features which represent an unacceptable risk, should the fireworks accidentally ignite.

Fuseheads are easily ignited and are sensitive to many stimuli such as friction. Great care must be taken when fitting and removing fuseheads from fireworks. Fuseheads must not be crushed when cutting the fuse to remove them.

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

15.9.3.2 Fusing of Aerial Shells

Direct fusing into the lift charge of aerial shells is prohibited.

If mortars secured by rack systems (refer to Section 13.3.5.5 of this Code) are being used to support aerial shell mortars, the shells should be fused in such a way that shells are fired progressively from the outside to the inside of the array of mortars. This will reduce the overall consequences if a shell malfunctions in an individual mortar.

15.9.4 Repairing Fuses

A competent person may perform minor repairs to fuses (e.g. repairing torn paper and fitting replacement fuseheads) provided that the fireworks composition has not been lost and the performance and safety of the firework will not be compromised.

15.9.5 Cutting Fuses

Cutting tools, such as scissors, pliers, and side-cutters, must not be used to cut fuses. Such tools have been known to ignite quickmatch, probably because of the pinching and/or shearing action on powder grains. Instead, fuse may be safely cut by using —

- a sharp knife on a wooden or other non-sparking surface;
- 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).

15.9.6 Manual Firing of Aerial Shells

The safety cap protecting the fuse must not be removed by the person responsible for igniting the fuse until immediately before the aerial shell is to be fired.

16. Managing the Fireworks Display

16.1 Commencing the Fireworks Display

16.1.1 General Conditions

The fireworks operator may commence the fireworks display only when —

- the requirements of this Code have been observed;
- the risk of harm to people and property is at an acceptable level;
- it is safe to commence the display;
- all notifications, permits and approvals from all agencies have been undertaken and are in order, such as a clearance from the Queensland Fire and Rescue Service in an area where there is a fire ban;
- all personnel with duties for the display are ready and in position; and
- the advertised time for the display has arrived.

The fireworks operator 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 the Fireworks Display Worksheet (Appendix 8), logbook or equivalent. This will permit the fireworks operator to assess whether the above criteria have been met. Activities undertaken by the fireworks operator to confirm that the criteria have been met will include ensuring —

- 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 fireworks and fireworks equipment;
- readiness/preparedness of the fireworks operator's assistant(s) and fireworks event organiser; and
- documentation of the time of commencement.

16.1.2 Obligations of Fireworks Event Organiser

The fireworks event organiser must be satisfied that the organiser's obligations for the conduct of the fireworks display have been met before the fireworks operator starts the fireworks display. (Appendix 13 provides an illustrative checklist and list of questions to assist a fireworks event organiser in confirming that these duty of care obligations have been met.)

The fireworks event organiser must not direct, or knowingly permit, the fireworks contractor or the fireworks operator to undertake activities that are in contravention of the *Explosives Act 1999*, the *Explosives Regulation 2003* or this Code. This includes all activities involved with the display, including planning the display, setting up the display, managing the display and post display activities. The fireworks event organiser must not direct or pressure the fireworks operator to proceed with the outdoor fireworks display when it is unsafe or inappropriate to conduct the display at the site designated. Under such circumstances, the fireworks event organiser is also in breach of the *Explosives Act 2003*.

16.1.3 Weather Conditions

On the day of the outdoor fireworks display, the fireworks operator must determine the anticipated weather conditions at the time of the display from Bureau of Meteorology forecasts or other sources. The display must be set up, taking into account the anticipated weather conditions.

16.2 Suspending, Postponing or Cancelling the Fireworks Display

The fireworks operator must respond to conditions prior to commencement of the fireworks display and changing hazards during the conduct of the fireworks display.

16.2.1 Unfavourable or Changing Conditions

If conditions are unfavourable, the fireworks operator must either —

- modify the fireworks display (e.g. firing the smaller calibre fireworks only) to ensure that the exclusion zone is appropriate for the actual conditions; or
- delay, postpone or cancel the fireworks display.

If adverse conditions or a change in conditions (such as a significant change in wind speed or wind direction) significantly affect compliance with this Code or present a risk to safety, the fireworks operator must stop the fireworks display. The operator may recommence the display when the operator is satisfied that this Code has been observed and it is safe to resume the fireworks display. The fireworks operator must advise the fireworks event organiser accordingly.

16.2.1.1 Adverse Weather Conditions

If the fireworks operator considers that adverse weather condition (such as high winds or precipitation) presents a new increased and significant hazard and hence unacceptable risk, the fireworks display must be postponed until the weather conditions suitably improve.

If, during the fireworks display, a change in wind direction or speed increases the clearance distance required for the fireworks display such that it is greater than the clearance distance provided for the display, the fireworks operator must reassess the situation for safety and compliance with this Code.

The fireworks operator may adopt risk control measures to address such a situation, including —

- firing only those fireworks which meet the clearance distance requirements for the set-up; or

- at the planning stage, providing a margin to exceed the minimum clearance distances for a particular prevailing wind direction to avoid problems of this nature.

If the weather conditions cause fallout and discharge to extend beyond the fireworks display site area, the fireworks operator must stop the display. The display may resume when the fallout and discharge for the remaining fireworks to be fired will not extend beyond the fireworks display area.

This may mean not firing selected fireworks that cannot meet the fallout and discharge requirements. Alternatively, changes may be made to the exclusion zone to permit recommencement of the display at a level of acceptable risk.

16.2.1.2 Access by Spectator Crowd to the Exclusion Zone

If the spectator crowd enters the exclusion zone during the fireworks display through ineffective security or barriers in controlling the crowd, the fireworks operator must stop the display. The display may resume only when the fireworks operator is satisfied that the exclusion zone will not be entered and the spectator crowd is under control and the requirements of this Code will be observed.

16.2.1.3 Malfunctioning Fireworks

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

16.2.1.4 Incident During Fireworks Display

If an incident occurs during the fireworks display, the emergency plan should be implemented. The fireworks display must be immediately stopped until the fireworks operator has confirmed that it is safe and appropriate to resume the display. For more information on emergency planning requirements and management of an incident, refer to Sections 6.1.5 and 6.1.6, respectively, of this Code.

16.3 Authorised Personnel

16.3.1 Personnel in Exclusion Zone

The fireworks operator 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 where it is necessary to issue instructions to unauthorised personnel (e.g. for security personnel).

The fireworks operator 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.

16.3.2 Crowd Control Personnel

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

16.4 Spotters

16.4.1 General Functions

The fireworks operator must appoint one or more spotters to observe the flight and behaviour of aerial shells and other fireworks to confirm that they are functioning as intended. If an unsafe condition is detected, such as hazardous

debris falling into the audience, the spotter must immediately notify the fireworks operator to cease firing until the unsafe condition is corrected. The spotter must be in direct communication with the fireworks operator during the conduct of the display, with an effective means of informing the fireworks operator of any hazardous condition or situation.

16.4.2 Observing Trajectory of Fireworks Including Aerial Shells

In particular, the trajectory of the first firework including aerial shells fired must be observed carefully to confirm that the fireworks including aerial shell functions over 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.

16.5 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 fireworks operator must halt the display until the situation is resolved and the exclusion zone is once again clear.

16.6 Safety Equipment

Fire fighting equipment must be provided and be fully serviceable.

All personnel within the defined clearance distances of the fireworks display site must wear PPE during the display. The PPE must suit the identified hazards and the person's location during the fireworks display, and must be based on a risk assessment.

(Refer to Sections 5.4.1.6 of this Code for details of suitable PPE.)

Personnel exposed to flash and flame, unacceptable noise levels and smoke from the fireworks during the display must also wear suitable and appropriately rated safety equipment —

- face protection;
- respiratory protection equipment (e.g. respirator); and
- ear protection.

Fireworks operators who hand-light fireworks are at greatest risk. Operators who electrically ignite the fireworks from outside the defined clearance distances of the display site do not necessarily require PPE during the firing of the display as determined by the risk assessment and documented by the fireworks contractor in the safety management system.

If a fireworks operator considers that various items of PPE are not necessary to protect personnel within the defined clearance distances of the display site from harm, the operator should undertake a documented risk assessment to confirm that such equipment is not required. The fireworks contractor should make this risk assessment available to the fireworks operator, fireworks operator's assistants and personnel involved as appropriate.

16.7 First Aid

At least two qualified first aiders must be present at the display. A dedicated first aider, other than the fireworks operator, must be on duty at the display outside the exclusion zone 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.

16.8 Firing of Fireworks

16.8.1 Instructions for Firing

Individual display fireworks must be set off strictly in accordance with the fireworks contractor's documented procedures in the safety management system and the fireworks operator's instructions.

16.8.2 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. As soon as the fuse is ignited, the firer must withdraw from the mortar area.

16.8.3 Electrical Firing

Electrically fired displays do not require safety caps except that the fireworks 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 electrical firing unit during the display.

16.8.4 Ignition Sources

Ignition sources not approved by the fireworks contractor in the safety management system are not permitted in the exclusion zone. Permitted ignition sources may include port fires, flashlights,

electric lighting, or other non-incendiary illumination, such as chemilluminant devices, for illuminating the firing area. Unapproved ignition sources may include smoking materials, matches, lighters or open flame devices.

16.8.5 Malfunctioning Aerial Fireworks

16.8.5.1 Failure of Manually Fired

Aerial Shells to Leave Mortar

The mortar of a manually fired aerial shell which has failed to leave the mortar must be marked to indicate the presence of an unfired aerial shell. When the fireworks operator or the fireworks operator's assistant detects such a failure, they must warn other persons in the area and must mark the mortar appropriately as soon as practicable. The mortar must be isolated as long as the misfired aerial shell remains.

16.8.5.2 Failure of Electrically Fired

Aerial Shells to Leave Mortar

The mortar of an electrically fired aerial shell which has failed to leave the mortar does not require immediate marking. However, personnel entering the area after the fireworks display must be warned that an unfired aerial shell remains. At the end of the display, the mortar must be marked to identify the presence of a malfunctioning shell. A method to assist in identifying an unfired aerial shell is to use a witness device or cover. Refer to Section 15.8.5 of this Code.

16.8.6 Refuge for Fireworks Operator and Fireworks Operator's Assistant(s)

The fireworks operator and the fireworks operator's assistant(s) located within the exclusion zone during the display may take refuge in a shelter.

17. Post-display Activities

This section includes all activities that should be undertaken after the fireworks display has concluded to establish that the exclusion zone and surrounding areas are safe before the fireworks operator returns control of the display site to the fireworks event organiser. Personnel must not enter the set up area and post-display activities must not commence on the display site until the fireworks operator has deemed that it is safe to enter the site and surrounding areas.

17.1 Use of Personal Protective Equipment

Personnel involved in post-display activities must wear PPE as instructed by the fireworks contractor in standard operating procedures of the safety management system. Personnel handling fireworks equipment must wear covered footwear. Those people who may be harmed, should a firework 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 fireworks.

17.2 Inspecting Fireworks and Equipment

The fireworks operator should not return control of the exclusion zone to the fireworks event organiser until —

- an effective search of the exclusion zone and surrounding areas has been conducted; and
- the fireworks operator has declared that the zone has been properly cleaned and presents no hazards arising from the fireworks display.

17.2.1 Inspecting Electrical Firing Equipment

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

17.2.2 Searching For and Inspecting Unexploded Fireworks and Fireworks Components

The fireworks operator and the fireworks operator's assistant(s) must inspect the exclusion zone to locate any unexploded fireworks and fireworks components, such as the insert from a cake and unburnt stars. While debris fallout and erratic or malfunctioning fireworks are normally contained within the exclusion zone, they may extend to surrounding areas, on occasions.

Fireworks remnants should be checked for any malfunction, including blinds, duds and explosions. Hang-fires which can last for up to 30 minutes must be identified and accounted for.

17.2.3 Inspecting Fireworks Equipment

The fireworks operator should inspect all equipment (including methods of securing the fireworks 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.

17.3 Dealing with Unfired or Misfired Fireworks

Misfires must be dealt with in accordance with the operating procedures of the fireworks contractor's safety management system.

The procedures must be based on the following requirements or equivalent safety performance. Where practicable, the area surrounding an unfired or misfired firework (including an aerial shell found during the search) must be isolated to an area at least equivalent to its bursting diameter. The firework must not be handled until at least 30 minutes after the firework was fired. The procedures must provide equivalent performance

17.3.1 Unfired or Misfired Aerial Shells

An aerial shell must be doused with water and then must stand for a minimum of five (5) minutes before being placed in a suitable container.

Fireworks which cannot be dealt with properly for circumstances when they are required to be cleared away quickly for the next event (leaving no time to deal with a misfire properly) should not be selected and used.

17.3.2 Salvaging Fireworks

When electrical ignition is used and the firing failure is electrical in nature, the fireworks (including aerial shells) may be appropriately marked and may be salvaged by the fireworks operator. 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.

Fireworks 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 fireworks may be returned to the fireworks contractor for return to the supplier or stored at an authorised store in the interim. Records of any unused fireworks at any display must be kept by the fireworks contractor and the fireworks operator indicating the actions taken with those fireworks. The storage and transport of these fireworks must be undertaken in accordance with Sections 10 and 11 on storage and transport, respectively, in this Code.

17.3.3 Disposing of Fireworks Containing Residual Fireworks Composition

The supplier of the fireworks is responsible for providing disposal instructions with the supply of the fireworks. This information will be provided in the Material Safety Data Sheet, Technical Data Sheet and other safety information and incorporated into the fireworks contractor's safety management system. (Refer to Sections 7.1 and 9 of this Code)

All fireworks used in the fireworks display, which contain residual fireworks composition, must be rendered safe and destroyed. They may be disposed of on site or prepared for transport from the site for destruction at a suitable location. Where conditions allow, the fireworks operator may be permitted to fire safely any unfired fireworks or components after the display, provided that —

- the operator has undertaken a risk assessment to confirm that it is safe to do so; and
- the clearance distances are suitable.

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

Fireworks and any components of fireworks containing explosive composition must be rendered safe for transport away from the display site. They should be placed in water to ensure that the fireworks composition cannot be ignited, and then transported away from the fireworks display site in a superior package.

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

In addition to complying with the requirements of the *Explosives Act 1999* and this Code, the fireworks operator should dispose of/destroy fireworks and other materials associated with disposal activities (such as water used to douse fireworks) in accordance with the requirements of the Environmental Protection Authority and the local authority.

17.4 Cleaning Up the Fireworks Display Site

The fireworks operator and fireworks operator's assistant(s) must clear the exclusion zone and surrounding areas of all debris, plant, equipment and rubbish associated with the fireworks display.

17.5 Notifications

17.5.1 Notifying the Explosives Inspectorate

Following the fireworks display, the fireworks contractor must notify the Explosives Inspectorate of —

- explosives incidents as soon as reasonably as practicable;
- malfunctioning fireworks or equipment affecting safety within seven (7) days (other than an explosive incident); and
- routine fireworks displays not involving an explosives incident within seven calendar days of the display. (The contractor must submit a completed Fireworks Post-Display Notification Form.)

17.5.2 Notifying the Fireworks Supplier

The fireworks operator must notify the fireworks contractor who in turn must advise the fireworks supplier of —

- safety issues associated with the fireworks as soon as practicable; and
- general quality issues regarding the fireworks as soon as practicable, but no later than seven days from the date of the fireworks display.

17.6 Documentation and Records

The fireworks contractor and the fireworks operator must keep documentation and records associated with each display, including —

- the fireworks display notification;
- the fireworks post-display notification; and
- conditions, circumstances and details of the display e.g. a fireworks industry worksheet or equivalent.

The fireworks operator or the fireworks contractor must retain these records and documents for a minimum of five years. (Sections 14.8 and 15.2 of this Code provides more details on the types of records required).

Appendix 1

Dictionary of Terms

“**acceptable risk**” is a risk accepted on the basis of an informed decision to accept the consequences and the likelihood of a particular risk. To decide whether risk is within acceptable limits and as low as reasonably achievable, regard must be given to the likelihood of injury or illness to a person arising from the risk and the severity of the injury or illness.

“**aerial display**” is a fireworks display using aerial shells.

“**aerial shell**” is a firework which is designed to burst high in the air and is projected from a mortar by a lifting charge. Aerial shells are typically cylindrical or spherical canisters containing pyrotechnic or novelty effects with an internal explosive charge intended to break the shell. Attached to the base of each shell is a lift charge consisting of a propellant primed with a length of quickmatch fuse, an electric igniter or green safety fuse. Aerial shells may contain stars, comets, serpents, flashpowder, gunpowder, crackers, streamers or other effects.

An *aerial shell* is a cylindrical or spherical cartridge containing chemical composition, and a black powder propelling charge (lift charge). Shells are most commonly 50 mm to 150 mm diameter and are fired from high-density polyethylene (HDPE), fibreglass or heavy cardboard tubes. Upon firing, the lift charge is consumed and the shell is projected into the air. The pyrotechnic effect is produced near the highest point of flight when a bursting charge within the shell explodes, dispersing effects such as stars or whistles.

“**angled firework**” is a firework where the firework article or the mortar tube are deliberately set up other than in a vertical position, usually to achieve an artistic effect.

This may be done by the operator in the case of setting up mortars or ‘cross over effects’ with roman candles, or by the manufacturer in the case of boxed items containing fanned tubes.

“**appropriate person**” is a person whom the Chief Inspector of Explosives considers is appropriate. Matters to be considered include:

- the person’s physical and mental health;
- whether the person has been convicted in Queensland or elsewhere of certain offences;
- whether a domestic violence order has been made against the person;
- whether the person has adequate facilities for the use and handling of fireworks; and
- whether the person displays adequate knowledge of safety practices for the use and handling of fireworks.

“**associated works**” are other magazines, process buildings and storages of energetic materials, e.g. ammonium nitrate or Class 5 dangerous goods.

“**chain-fusing**” is used to ignite two or more fireworks items from a single ignition source. The two ways in which this can be achieved are:

“**instantaneous chain-fused**” fireworks items have their fuses linked by a length of quickmatch, so that once the quickmatch is lit, all fireworks items are ignited virtually instantaneously. The normal clearance distances apply to this method of chain-fusing.

“**delay chain-fused**” fireworks items 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 firework items in the chain.

Accordingly, there is greater potential for a malfunctioning item to dislodge an adjacent fireworks item before it functions. The minimum clearance distances, calculated based on maximum internal diameter of the largest fireworks item in the chain, are therefore doubled for delay chain-fusing.

“**close proximity firework**” is a firework where the minimum clearance distances are less than distances for an outdoor display firework as permitted in Section 14.5.2.2 of this Code of Practice. A close proximity firework may be used indoors or outdoors.

“**close proximity fireworks display**” is a fireworks display where close proximity fireworks are used by an operator licensed to use close proximity fireworks. A close proximity fireworks display may be held outdoors or indoors. Close proximity fireworks displays are typically held at rock concerts, theatres, stages, motorcross and sporting events, and any other events requiring pyrotechnic effects in close near the audience.

“**division**” (or **hazard division or subclass**) is one of the six divisions into which explosives are subdivided in accordance with the following criteria established by the United Nations:

Division 1.1 Substances and articles which have a mass explosion hazard.

Division 1.2 Substances and articles which have a projection hazard but not a mass explosion hazard.

Division 1.3 Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.

Division 1.4 Substances and articles which present no significant hazard.

Division 1.5 Very insensitive substances which have a mass explosion hazard.

Division 1.6 Articles containing extremely insensitive explosives.

***NOTE:** For a complete evaluation of these divisions, see Appendix 4 of this Code of Practice.*

“**exothermic reaction**” is a chemical reaction which is accompanied by liberation of heat.

“**explosive**” includes—

- a substance or a thing containing a substance, manufactured or used with a view to produce —
 - a practical effect by explosion; or
 - a pyrotechnic effect; and
 - a substance or thing declared under a regulation to be an explosive.

Examples of explosives—

Ammunition, detonators, gunpowder, nitroglycerine, pyrotechnics (including fireworks).

“**explosive substance**” is 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 do not produce large volumes of gases.

“**explosives incident**” means any of the following events involving an explosive —

- an explosive is, or appears to have been, lost or stolen;
- an accidental explosion, fire or spillage;
- the death of or an injury to a person;
- unexpected damage to property;
- potential to cause any of the events mentioned in four dot points above, other than an event that normally happens when handling or using an explosive.

“**extraneous electricity**” is an unintended electrical current from a source other than the firing device which could initiate an electric fusehead, including stray currents, induced currents, static electricity and radio frequency energy.

“**fire risk substance**” means any readily ignitable solid substance including waste paper, hay, sawdust and wood chips.

“**firework**” is a pyrotechnic article containing explosive composition which, upon functioning, will burn or explode, or both, to produce a visual effect or aural effect, or both, and which is intended as a form of entertainment. Loose firework compositions, e.g stars and powders are not included in this definition.

“**fireworks event organiser**” is the display host as defined in the *Explosives Regulation 2003* as the person who employs or otherwise engages a fireworks contractor to organise the fireworks display for the person.

“**fireworks operator**” is the person physically on the site who is responsible for managing all activities associated with —

- safe handling of fireworks
- setting up the display;
- managing the display;
- firing the display;
- post-display procedures; and
- emergency plans and procedures.

“**flash powder**” is a pyrotechnic substance contained in salutes and other pyrotechnic sound devices, which explodes with a brilliant flash of light and loud sound and includes photoflash powder (UN0094 Division 1.1G and UN0305 Division 1.3G), but excludes gunpowder.

“**flash powder type composition**” is a composition that is predominantly a mixture of perchlorates and metal powders.

The composition may contain other substances such as binders and colour agents. The composition may have an application either in loose powder or consolidated form.

“**ground display**” is a display of fireworks which primarily function on the ground and which may project stars, novelty and other effects above the ground. Ground fireworks include mines, Roman candles, lances, fountains and wheels. It does not include aerial shells.

“**gunpowder**” is a dry explosive consisting generally of potassium nitrate or sodium nitrate, charcoal and sulfur, which, under normal conditions, deflagrates rather than detonates. NOTE: It has a relatively low energy output and is classified as a low explosive (UN0027 and 0028, Division 1.1D).

“**hazard**” is a source of potential harm or a situation with a potential to cause loss.

“**hazardous debris**” is any debris produced or expelled by the functioning of a firework 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.

The “**manufacture**” of an explosive, including fireworks, includes —

- taking a step or process for producing an explosive, including fireworks; and
 - remaking or reconditioning an explosive, including fireworks; and
 - altering the chemical or physical nature of an explosive, including fireworks; and
 - breaking up or sorting out explosives, including fireworks,
- but does not include preparing for use.

“**may**”, or a similar word or expression used in relation to a power, indicates that the power may be exercised or not exercised, at discretion.

“**mass**” is the gross mass of a firework. (Any mass referred to in this Code of Practice is the gross mass unless otherwise stated.)

“**must**”, or a similar word or expression used in relation to a power, indicates that the power is required to be exercised.

NEQ is “**net explosive quantity**” and for an explosive article is the mass of the explosive components only and is exclusive of any non-explosive components.

“**no fire current**” is a current below which the electric fuseheads will not fire.

“**official**” is an authorised officer under any legislation or by-laws regarding public safety, health, safety and the environment, e.g. Inspector of Explosives, Fire Officer, Police Officer.

“**outdoor display firework**” is any firework intended for use only in outdoor fireworks displays.

“**outdoor fireworks display**” is a fireworks display that is held outdoors where the calculated minimum clearance distances for outdoor display fireworks are calculated in accordance with Section 14 of this Code of Practice.

“**PPE**” is personal protection equipment

“**personal injury**” includes an injury to any person where that person requires at least any form of first-aid treatment or medical treatment.

“**prepare for use**” means operations preparing a firework for a display and involves the fitting of igniters and priming devices such as attaching fuses, quickmatch and electric fuseheads and repairs to broken leaders..

“**pyrotechnic device**” is any packaged pyrotechnic substance or substances, or pyrotechnic unit, e.g. aerial shell.

“**pyrotechnic substance**” is a substance or mixture of substances designed to produce an effect by heat, light, sound, gas or smoke or a combination of these, as a result of non-detonative self-sustaining exothermic chemical reactions. Pyrotechnic substances do not rely on oxygen from external sources to sustain the reaction and include flash powder, gunpowder and coloured fire compositions.

“**pyrotechnic unit**” is a discrete unit containing a pyrotechnic substance which is assembled into a fireworks case and which, upon functioning, will burn or explode to produce a visual effect or aural effect, or both.

“**person**” includes an individual and a corporation. A reference to a person generally includes a reference to a corporation, as well as an individual, and is not displaced merely because there is an express reference to either an individual or a corporation elsewhere.

Examples of references to a person generally —

- ‘another’
- ‘anyone’
- ‘no-one’
- ‘one’
- ‘party’
- ‘person’
- ‘someone’
- ‘whoever’.

Examples of express references to a corporation —

- ‘body corporate’
- ‘company’
- ‘corporation sole’.

Examples of express references to an individual —

- ‘adult’
- ‘child’
- ‘spouse’.

To “**possess**” an explosive, including a firework, includes—

- having custody or control of the explosive, including a firework; and
- having an ability or right to obtain custody or control of the explosive, including a firework.

“**process building**” is a building on premises licensed for the manufacture or storage of explosives, other than for immediate use, in which any explosive is manufactured or any ingredient of an explosive is used in a manufacturing process.

“**protected works**” are of the following classes:
Class A: a public street, road or thoroughfare, railway, navigable waterway, dock, wharf, pier or jetty, marketplace, public recreation and sports ground or other open place where the public is accustomed to assemble, open place of work in another occupancy, river-wall, seawall, reservoir, water main (above ground), radio or television transmitter, main electrical substation, private road which is the principal means of access to a church, chapel, college, school, hospital or factory.

Class B: a dwelling house, public building, church, chapel, college, school, hospital, theatre, cinema (or other building or structure where the public is accustomed to assemble), shop, factory, warehouse, store, building in which any person is employed in any trade or business, depot for the keeping of flammable or dangerous goods, major dam.

A “**ready box**” is a portable, weather resistant container that protects the contents from burning debris with a self-closing cover or equivalent means of closure required.

A “**report**” is a loud noise intended for the main effect from a pyrotechnic unit or a firework. The effect from the report is usually achieved by confining flashpowder. Reports are effects from fireworks such as multishot boxed items, aerial shells, crackers, and maroons.

“**risk**” is the chance of something happening that will have an impact upon objectives. It is measured in terms of consequence and likelihood.

“**safety management system**” means a system for managing safety which sets out—

- the safety objectives;
- the systems and procedures to achieve the safety objectives;
- the performance standards to be met, and
- the means to maintain these standards.

“**salute**” is a special type of aerial shell containing a flashpowder type composition, intended only to produce a report or noise and flash.

“**seller**” is the person licensed under the *Explosives Act 1999* to sell fireworks. Sell includes the definition in the *Explosives Act 1999*.

“**self-closing**” box is 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.

“**separation distance**” see also “**clearance distance**” is the recommended distance intended to —

- prevent the immediate direct propagation of an explosion or fire from one magazine to another by missile, flame or blast; and
- minimise the risk of an explosion which has the potential to cause damage to protected works or injury to persons.

“**string of firecrackers**” is a number of firecrackers chain fused by the manufacturer. The firecrackers are not designed to be fired individually and may be in strings containing 10,000, 20,000, 50,000, etc firecrackers.

“**superior package**” means a package which affords extra protection against damage, external stimuli, and extra protection to adjacent packages from inadvertent functioning of the contents of the package.

“**supplier**” is the person who sells, provides, imports or exports explosives, including fireworks.

“**transit storage**” is the storage of fireworks for at least one hour and less than three normal days at a location. This may include a licensed storage area, an unlicensed storage area or venue for the fireworks display. Transit storage may be undertaken in a building, magazine or in a vehicle including a trailer.

“**unrestricted fireworks**” are fireworks not requiring a licence for purchase, possession or use. Unrestricted fireworks include amorces, toy pistol caps, indoor table bombs, starting pistol caps, sparklers, snaps for bon-bon crackers, streamer cones, indoor decorative fountains and model rocket motors with a maximum weight of 62.5 grams.

“**vulnerable facility**” is a category of facility that includes, but is not restricted to, the following: —

- multistorey buildings, e.g. above 4 storeys.
- large glass fronted buildings of high-population.
- health care facilities, childcare facilities, schools.
- public buildings or structures of major historical value.
- major traffic terminals, e.g. railway stations, airports.
- major public utilities, e.g. gas, water, electricity works.

Appendix 2

Prohibited Items – Fireworks and Fireworks Equipment

A2.1 Fireworks

The following is a list of fireworks, which are prohibited because they present an unacceptable risk of harm to the fireworks industry personnel and the public. The fireworks are not listed by a manufacturer product name but are listed by function, properties or generic name (e.g. skyrocket) —

- a firework from which firework composition may escape;
- a firework, all or part of which explodes, containing aluminium or magnesium mixed with potassium chlorate or another chlorate, whether or not the firework contains another substance
- a firework (other than an unrestricted firework or a distress signal) containing a chlorate mixed with sulphur, a sulphide or phosphorus, whether or not the firework contains another substance;
- a firework (other than an unrestricted firework or a distress signal) containing its own means of ignition;
- a firework all or part of which is projected through the air on initiation and has the potential to injure a person outside the recommended spectator distances of this Code. Includes skyrockets;
- crackers, bangers, bungers, firecrackers including matchcrackers or similar exploding fireworks other than in strings;
- Strings of firecrackers where the individual crackers exceed 45 mm in length or 10 mm external diameter; or which contain headrolls;
- fireworks containing a chlorate in admixture with an ammonium salt;

- salute shells, greater than 75 mm diameter and/or length;
- candles, greater than 50 mm internal diameter;
- fountains, greater than 125 mm internal diameter;
- all candles greater than 25 mm internal diameter of the tube containing flash powder type compositions (i.e. perchlorates and metal powders), whether powdered or in pellet form, as the primary pyrotechnic unit. This does not apply to the small amount of flash powder present in the internal cavity of crossettes in a crossette candle;
- multishot boxed items with tubes in excess of 50 mm internal diameter.
- multishot boxed items not meeting the specification outlined in the Table A2.1

A2.2 Fireworks Activities

Certain activities in fireworks manufacture and refurbishment are prohibited because they present an unacceptable risk of harm to the fireworks industry personnel and the public. These activities include —

- the reloading of spent fireworks casings from used fireworks such as cakes and barrages;
- the reloading of mortars during a fireworks display; and
- the manufacture of fireworks, alteration etc as per Section 7.1 of this Code.

A2.3 Fireworks Equipment

The following is a list of equipment which are prohibited because they present an unacceptable risk of harm to the fireworks industry personnel and the public —

- metal mortars or fireworks holders; and
- mortars made of PVC, glass, ceramics and other brittle materials.

Table A2.1 Prohibited Multishot Box Items

Internal Diameter of Tube (mm)	Number of Tubes (max)	Number of Shots (max)	Comments
38 < ID ≤ 50	52	52	Pyrotechnic unit composed wholly or predominantly of flashpowder type compositions prohibited (crossette effect permitted)
25 < ID ≤ 38	100	100	Pyrotechnic unit composed wholly or predominantly of flashpowder type compositions prohibited (crossette effect permitted)
10 < ID ≤ 25	200	200	-
ID ≤ 10	1000	1000	-

Appendix 3

Chemistry and Properties of Fireworks

A3.1 Background

Fireworks effects are the earliest types of explosives known to man. The use of chemicals to produce heat, light, gas, smoke or noise originated several thousand years ago, probably in China or India. "Greek fire", the best-known ancient fireworks, was reported to have been used during the Arab naval siege of Constantinople in 673 AD. It contained a blend of sulphur, organic fuels and saltpetre that generated flames and dense smoke when ignited. Around the 10th century, adventurous people discovered that with the help of fire, an intimate mixture of potassium nitrate, charcoal and sulphur could produce a very impressive effect. In 1627, Kasper Weindl, at the Royal Mines in Hungary, fired the first commercial blast of black powder, thus introducing the modern high-energy composition.

A3.2 Fireworks Compositions

Fireworks are made up of compositions that burn energetically and, if confined, may explode. They are classed as low explosives, in contrast to the much more powerful high explosives such as dynamites. Fireworks burn or deflagrate; high explosives detonate. Fireworks compositions contain all the oxygen necessary for a chemical reaction (and are therefore very difficult to extinguish in a firefighting situation). Principal reactants are nitrates, chlorates or perchlorates, along with a combustible material. The nature of the composition and the state of the ingredients, such as particle size, determine the reaction rate, the appearance of the flame, smoke or other fireworks effect, and the noise and flash of the explosion. Black powder is a versatile mixture. It is used in various granulations as a propelling charge, a source of noise, and a constituent of other compositions or as part of ignition fuses and timing systems.

Other compositions produce coloured flames, twinkles, and smoke, and may be either loose or compacted. When compacted (by being pressed into cubes and pellets, or rolled into spheres) they are called stars and burn over their exposed surfaces to produce a brilliant ball of fire. Other formulations that contain powdered aluminium or magnesium react violently, resulting in explosions accompanied by a flash and are known as flash or concussion powders.

All fireworks compositions are energetic materials. They are therefore dangerous. In general, fireworks compositions are sensitive to flame, spark, friction, impact and heat. All abhor water in any form and most are rendered completely inert by it. It is worth noting, however, that water may cause spontaneous reactions in a few compositions (e.g., magnesium powders).

A3.3 Finished Products

In contrast, finished products are much less dangerous unless the case is ruptured and the composition leaks out. Fireworks casings are comprised of rolled paper, plastics or paper mâché. Do not tamper with manufactured articles.

A3.4 Basic Chemistry of Fireworks

A3.4.1 Constituents

Mixtures used in fireworks contain:

- An oxygen donor (oxidiser)
- One or more fuels that burn with the released oxygen when the oxidiser is heated
- Other chemicals that serve as binders and create colour, spark or other visual or audible effects.

A3.4.2 The Reaction

- The heat generated by the reaction between the oxidiser and the fuel causes the other effects to occur
- All compositions contain their own source of oxygen. Ambient air is not necessary for combustion.

A3.5 Fireworks vs High Explosives

- In general, fireworks deflagrate at a velocity of less than 350 m/s
- High explosives, in contrast, detonate at velocities ranging from 2000 to 7000 m/s
- Other comparative velocities:
 - Light: 299,792,500 m/s
 - Expansion of a nuclear fission bomb: 1,000,000 m/s
 - .30-06 rifle projectile: 825 m/s
 - Sound: 342 m/s
 - Commercial aircraft: 135 m/s
 - Cricket ball delivered by fast bowler: 40 m/s
 - Vehicles on highway: 30 m/s.

A3.6 Fireworks: Science and Art

While the chemistry of fireworks is a science, the development and manufacture of effects is an art.

OXYGEN + FUEL → HEAT + reaction products (solid, liquid or gas)

HEAT → Light, colour, sparks, whistle, report, smoke and propulsion.

3.6.1 Ignition

Ignition occurs when sufficient external energy interacts with the fireworks composition. This energy can be in the form of flame, sparks, high temperature (hot wire), impact, friction, laser beam or plasma shock.

Typical means of igniting fireworks include:

- Flame/sparks (fuse)
- Electric current (electric match)
- Impact (percussion primer)
- Friction (safety match)

A3.6.2 Propagation

Propagation of the reaction occurs when the heat generated by the initial ignition continues in the composition itself (an exothermic reaction).

Energy input to fireworks mixture →

Broken chemical bonds

New chemical bonds form →

Energy is released

Released energy:

- Lost to surroundings
- Transferred to composition in sufficient quantity to yield a self-propagating reaction.

A3.6.3 Requirements

Fireworks must:

- Produce the desired effect
- Be safe to manufacture
- Be chemically stable (in transportation and storage)
- Have a low hygroscopicity (tendency to absorb moisture from the air) and toxicity
- Have a moderate production cost

A3.7 Basic Fireworks Principles

Several key factors affect the performance of fireworks compositions. Even if two identical formulas are used to manufacture a fireworks mixture, the effects produced can be quite varied. The Reasons for this include:—

- Water/moisture. One of the oldest sayings in this field of fireworks is “Keep your powder dry”. Water absorbs heat when it vaporises. Powder with a high moisture content can be difficult to ignite and may produce a dangerous dud. In some cases, water can sensitise certain compositions such as magnesium powder.

- *Extent of Mixing.* A poorly mixed blend of oxidiser and fuel may burn quite slowly (if at all), while the same mixture blended to a high degree of homogeneity will tend to be quite reactive when ignited.
- *Particle Size.* Fireworks mixtures made from oxidisers and fuels of small particle size (high surface area) will tend to be considerably more reactive than compositions made from coarser chemicals, even if the same percentages and mixing methods are used.
- *Confinement. (through packaging or fireworks mass)* Unlike high explosives, fireworks mixtures show a sharp increase in burn rate when they are confined and ignited. Also, the burn rate of a mixture tends to increase as the surface area of the burning material increases. On ignition, gases and heat are produced; if the gases are held sufficiently long in the vicinity of the burning front, the heat will act on the gases and, if they cannot escape, the pressure increases. This elevates the reaction rate and establishes a vicious circle, whether it is in a paper tube, steel pipe or a quantity of fireworks composition approaching the critical mass.

A3.8 Commonly Used Chemicals

A3.8.1 Oxidisers

Ammonium perchlorate, barium nitrate, potassium chlorate, potassium nitrate, potassium perchlorate and strontium nitrate

A3.8.2 Fuels

Elemental: boron, carbon, phosphorus, silicon and sulphur

Organic compounds: natural gum, plastics, polymers and starch

Metals: aluminium, magnalium, magnesium and titanium

A3.9 Special Effects

A3.9.1 Noise Effects

Report or noise

Effects and Concussion powders:

These effects typically contain potassium perchlorate or nitrate oxidisers and aluminium.

A3.9.2 Whistle Effects

These are usually made up of potassium perchlorate, sodium salicylate or sodium benzoate.

A3.9.3 Coloured Flames and Sparks

The show-related applications of fireworks mixtures are infinite but usually involve the production of coloured flames or sparks. The common colour-and-spark producing chemical groups for fireworks-type reactions are —

- Red Strontium salts
- Green Barium salts
- Yellow Sodium salts
- Blue salts
- White Antimony salts or aluminium powder
- Amber sparks Charcoal or iron particles
- Gold sparks Iron or iron-titanium alloy
- Silver sparks Titanium, aluminium or magnesium

Appendix 4.

United Nations Classification System of Explosives

A4.1 Introduction

In 1968, a United Nations group of experts presented recommendations on the transport of dangerous goods. The body 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. The Australian Dangerous Goods Code and the Australian Explosives Code are based on the UN system.

A4.2 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. The classes are —

- Class 1 Explosives
- Class 2 Gases
- Class 3 Flammable liquids
- Class 4 Flammable solids
- Class 5 Oxidising substances
- Class 6 Poisonous and infectious diseases
- Class 7 Radioactive substances
- Class 8 Corrosives
- Class 9 Miscellaneous (substances not covered by the other classes).

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:—

A4.2.1 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.

A4.2.2 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.

A4.2.3 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.

A4.2.4 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) formerly called the "Safety Class". 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.

A4.2.4 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.

A4.2.5 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

A4.3 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.

A4.3.1 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.

A4.3.2 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.

A4.4 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 functioned.

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.

A4.5 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.

A4.6 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.

Table A4.1 Hazard Classification Codes

Compatibility Group ⇒	A	B	C	D	E	F	G	H	J	K	L	N	
Hazard Division ↓													
1.1	1.1A	1.1B	1.1C	1.1D	1.1E	1.1F	1.1G		1.1J		1.1L		
1.2		1.2B	1.2C	1.2D	1.2E	1.2F	1.2G	1.2H		1.2K	1.2L		
1.3			1.3C			1.3F	1.3G	1.3H	1.3J	1.3K	1.3L		
1.4		1.4B	1.4C	1.4D		1.4F	1.4G						1.4S
1.5				1.5D									
1.6												1.6N	

Mixed Class Divisions

Explosives of different divisions may be stored together provided that the whole is treated as belonging to the division having the smallest number (except for combinations of 1.5/1.1, 1.5/1.2 & 1.5/1.3 the resultant division is 1.1; and for 1.1/1.5 the resultant is 1.5).

Table A4.2 Permitted Combinations of Different Compatibility Groups

	A	B	C(a)	C(s)	D(a)	D(s)	E	F	G(a)	G(s)	H	J	K	L	N	S
A	✓	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
B	×	✓	×	×	✓*	×	✓*	✓*	×	×	×	×	×	×	×	✓
C(a)	×	×	✓	✓	✓	✓	✓	✓	✓	×	×	×	×	×	×	×
C(s)	×	×	✓	✓	✓	✓	✓	×	×	×	×	×	×	×	✓	✓
D(a)	×	✓*	✓	✓	✓	✓	✓	✓	✓	×	×	×	×	×	✓	✓
D(s)	×	×	✓	✓	✓	✓	✓	✓	×	×	×	×	×	×	×	×
E	×	✓*	✓	✓	✓	✓	✓	✓	✓	×	×	×	×	×	✓	✓
F	×	✓*	✓	×	✓	×	✓	✓	×	×	×	×	×	×	×	✓
G(a)	×	×	✓	×	✓	×	✓	×	✓	×	×	×	×	×	×	✓
G(s)	×	×	×	×	×	×	×	×	×	✓	×	×	×	×	×	✓
H	×	×	×	×	×	×	×	×	×	×	✓	×	×	×	×	✓
J	×	×	×	×	×	×	×	×	×	×	×	✓	×	×	×	✓
K	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×	✓
L	×	×	×	×	×	×	×	×	×	×	×	×	×	✓#	×	×
N	×	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	✓
S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓

✓ permitted combinations

✓# permitted only if explosives are of the same type

✓* permitted only for detonating fuses of compatibility group B

(a) explosive article

(s) explosive substance

Appendix 5 Common Fireworks Malfunctions

Table A.5.1 Common Fireworks Malfunctions

<i>Malfunction</i>	<i>Common Causes</i>	<i>Action</i>
Aerial shells and comets		
Premature ignition – Shell fires from mortar before it is intentionally lit	Burning debris in the mortar or sparks from neighbouring articles	Clean mortars before refiring (cover exposed fireworks with aluminium foil for prevention)
Hangfire – shell fuse suddenly starts burning slower than it is supposed to. Just as suddenly, it may resume burning at its normal rate	Fuse wet or damaged	Wait at least 30 minutes before you attempt to remove the shell from the mortar
Misfire – Shell does not fire	Article wet or damaged	<ul style="list-style-type: none"> ▪ Warn the shell loader not to use the mortar in which the misfire occurred for the duration of the display ▪ When the display is over, with the permission of the Fireworks Supervisor, clear the mortar and dispose of the shell ▪ Place tape on mortar to indicate presence of unfired shell
Mortar burst – Shell explodes inside the mortar	<ul style="list-style-type: none"> ▪ Fire leak into the shell ▪ Weak or damaged casing ▪ Stars reacting to loading impact ▪ Time fuse damaged or missing 	Discontinue display until inspection of immediate area in which malfunction occurred proves conditions to be safe
Muzzle break – Shell bursts just as it leaves the mortar, scattering stars and burning material in all directions near ground level	<ul style="list-style-type: none"> ▪ Faulty manufacture ▪ Time fuse damaged or missing 	Discontinue display until inspection of immediate area in which malfunction occurred proves conditions to be safe

Appendix 5

Table A.5.1 Common Fireworks Malfunctions

<i>Malfunction</i>	<i>Common Causes</i>	<i>Action</i>
Low (ground) break – Shell explodes on or near the ground, either on the way up or coming down	<ul style="list-style-type: none"> ▪ Shell misloaded into oversized mortar ▪ Insufficient lifting charge ▪ Damaged or missing plug ▪ Damaged time fuse 	Discontinue display until inspection of immediate area in which malfunction occurred proves conditions to be safe
Dud Shell – Shell rises but fails to burst at the proper height and falls to the ground, sometimes igniting or exploding on landing	<ul style="list-style-type: none"> ▪ Faulty manufacture ▪ Damaged time fuse or primer 	Recover and dispose of dud shell
Burning Debris/dud components – Shell burst at right altitude but shell components fall to the ground as burning or live pieces	<ul style="list-style-type: none"> ▪ Damp stars or components ▪ Shell break too powerful ▪ Burst ignites non-fireworks material 	Recover and dispose of components
Roman Candles		
Low Burst – Burning projectiles fall to the ground	Article wet or damaged	Discontinue display until inspection of immediate area in which malfunction occurred proved conditions to be safe

Appendix 6 Environmental Guidelines

For most recent version see: www.epa.qld.gov.au

or via link on the NR&M Explosives Inspectorate webpage. www.nrm.qld.gov.au/mines/explosives

 **Queensland Government**
Environmental Protection Agency
Queensland Parks and Wildlife Service

GUIDELINE
Noise

Abatement of nuisance noise from fireworks

Content:

Background	page 1
Procedures	page 1
Related processes	page 2
Other issues to consider	page 2

Purpose and Scope

To outline the parameters for the use of fireworks so that noise impacts are not excessive and unreasonable.

To determine the EPA's approach on how best to minimise excessive noise from fireworks displays.

Background

The Department of Natural Resources and Mines is responsible for controlling safety aspects of outdoor fireworks displays. It administers the *Explosives Act 1999* under which a fireworks operator is required to obtain a pyrotechnician's licence or a shotfirer's licence endorsed by the Explosives Inspectorate of the Department.

Complaints regarding safety aspects of fireworks displays should be directed to the Explosives Inspectorate of Department of Natural Resources and Mines on (07) 3224 7512.

Section 6ZC of the *Environmental Protection Regulation 1998* (EP Reg) provides for the control of noise from open-air events. However, this section was not intended to deal with the control of noise from fireworks displays, which generally occur infrequently and enjoy considerable community support.

Complaints of excessive noise from fireworks displays should be directed to the EPA Pollution Hotline: 1300 130 372.

Procedures

Persons responsible for operating a fireworks display must adopt all reasonable and practicable measures available to minimise noise impacting on noise-sensitive places. Such measures include, but are not limited to:

- The firing of fireworks shall only occur between the following hours:

Monday to Thursday	7 am to 9 pm
Friday & Saturday	7 am to 10 pm
Sunday & Public Holidays	1 pm to 9 pm
New Years Eve	7 am to 12.30 am (New Years Day)

Note: For events proposed outside the above timeframes, written approval must be obtained from the Department of Natural Resources and Mines.

- The positioning and selection of fireworks for use in a display should minimise its effect on noise-sensitive places. This may be achieved by:
 - using the shielding effects of natural/man-made features to reduce noise level at sensitive places.

- placing the display as far away as practicable from any noise-sensitive place.
 - excluding the use of "salute" or other high noise fireworks from an event.
3. Frequency of events - the firing of fireworks outside the frequencies contained in the table below must not be undertaken without written approval from Department of Natural Resources and Mines.

Venue	Minimum Interval Between Events ¹	Events per Calendar Year
commercial (theme parks, shopping centres)	5 days	not more than 6
sporting events (football clubs)	5 days	not more than 6
community organisations (shows, religious festivals)	24 hours	not more than 6
educational institutions	24 hours	not more than 6
residential, rural areas and private functions	3 months	not more than 4

Related processes

Fireworks operators and event organisers are encouraged to consider the impact of noise on neighbouring properties. If complaints arise, the complainants are encouraged to engage in dispute resolution. The Department of Justice and Attorney General provides dispute resolution services via its Alternative Dispute Resolution Branches throughout Queensland. Dispute resolution services have the potential to allow negotiation between the parties and may result in flexibility in relation to the frequency of use, start and finish times, positioning of launch sites and other measures to minimise noise while maximising general community enjoyment. Dispute resolution is an effective, confidential and voluntary means of settling a dispute.

Other issues to consider

- Under section 6Q of the EP Reg, the administering authority may issue a nuisance abatement notice to a responsible person to control noise from fireworks if:
 - a relevant nuisance complaint has been made for the emission, and
 - the administering authority believes the emission is or has been causing unlawful environmental nuisance², after considering whether the noise is or has been excessive and therefore an unlawful environmental nuisance.
- The operator of the fireworks, has an obligation under Section 319 of the Environmental Protection Act 1994, to comply with their General Environmental Duty - a person must not carry out an activity that causes or is likely to cause environmental harm (under section 436 of the EP Act, an environmental nuisance is classified as environmental harm) unless the person takes all reasonable and practical measures to prevent or minimise the harm.
- Failure to comply with an abatement notice, without a reasonable excuse, is an offence under section 6V of the EP Reg and carries a maximum penalty of \$3000 (40 penalty units³) for an individual and \$6000 (80 penalty units) for a corporation.

¹ Definition of an event: A fireworks event would last a maximum of 30 minutes.

² When investigating claims of excessive noise from fireworks, which are being operated outside the parameters of this guideline, Agency Officers will consider section 6S (General emission criteria) and section 6T (Noise emission criteria) of the EP Reg when deciding whether the fireworks noise under investigation is causing excessive noise and therefore unlawful environmental nuisance.

³ A "penalty unit" is defined under the Penalties and Sentences Act 1992. A penalty unit is \$75 as at 1 February 2002 but rises periodically.

Appendix 7

Extraneous Electricity

A7.1 Scope

This Appendix provides guidance on the source of various forms of extraneous electricity and sets out recommendations on preventive measures, paying particular attention to stray currents and static electricity.

A7.2 Sources of Extraneous Electricity

Extraneous electricity may result from both natural and man-made situations, as follows:—

- A7.2.1 Lightning. Lightning is a potential high-energy source capable of initiating fireworks. The situation may be aggravated if there are conductors in the vicinity of the point of the lightning discharge that lead to the loading site, e.g. conductive ore body, water pipes or other services, rail tracks, fencing wires.
- A7.2.2 Induced Currents, Capacitive Discharge. Induced currents may be present in areas such as around power stations and earth loop transport systems (rail, trams, trolley locomotives). Capacitive discharge may occur where high voltage transmission lines charge a suspended, aboveground electric circuit to a high voltage. This voltage may then be discharged to earth through an electric match thus causing a premature initiation of the fireworks.
- Accidental earthing. Should there be an accidental earthing of a power transmission line in the vicinity of an electric circuit, a premature initiation of fireworks could occur.
- Transmitters. When using electric initiation, there is a possibility of the electric circuit being energized by the electric field produced by radio transmitters, radar, television transmitters or the like. Table A7.1 provides recommendations for safe distances, based on information derived from BS 4992:1974.
- Static electricity. While electrostatic charges are among the most common phenomena in nature and the mechanism of the formation of the charges is controversial, the potential for an electrostatic charge to

initiate an electric match or black powder is very real. For a dangerous condition to exist, three criteria have to be met, as follows —

- A capacitor-like object needs to be charged to a potential (voltage) such that the electrical energy stored in this system is large enough to cause initiation when released as a discharge. For example, the capacitor can be a person or fireworks equipment.
- The capacitor has to lose its charge to cause ignition.
- The path of this discharge needs to be sufficiently close to the sensitive material to cause ignition or initiation. As it is difficult to control Items (ii) and (iii), Item (i) offers the best potential for introducing preventive measures and thus minimizing an electrostatic charge build-up.

A7.3 General Preventive Measures

The possibility of premature initiation from extraneous electricity is always a potential hazard. Where extraneous electricity is suspected or evident, detailed information should be sought from the manufacturers as to the suitability of their products and initiation systems in particular circumstances. Some preventive measures applicable to all initiation systems are as follows —

- Use a non-electric initiation system.
- Ensure all bare connectors in, or to be used in, a circuit are kept shorted out by twisting the ends together until final connection.
- Avoid situations which may generate and store static electricity.
- Take special care to ensure that bare lead wires do not come into contact with the ground and that connections are either insulated or kept clear of the ground.
- Cease all fireworks set-up operations if an electrical storm is imminent.
- Keep electric matches clear of the ground until firework set-up commences.

Specific recommendations on stray currents and static electricity are provided in Paragraphs A7.4 and A7.5.

A7.4 Stray Currents

A7.4.1 General

Under certain conditions there may be a possibility that stray electrical currents could initiate premature initiation of fireworks. As a guide to determining the possibility of such currents existing on a particular site, the following information is included —

- Where electrically operated equipment, including welding equipment, is used, it is possible for stray currents to be generated from faulty circuits and equipment. These currents may pass through the ground itself as well as continuous metal objects such as haulage rails, pipelines, ventilating ducts or wire ropes.
- As the minimum firing current for electric matches is 250 mA, tests for stray currents should be sensitive to at least 60 mA, a.c. or d.c.
- Tests for stray currents should be carried out in advance of electric firing, particularly in highly conductive ground or where continuous metal objects extend into the fireworks display area. A suitable test is given in Paragraph A7.4.2.

A7.4.2 Testing for Stray Currents

A high impedance (10 MW or more) voltmeter should be used to test for stray currents. Two probes made of identical material 25 mm in diameter and 200 mm long should be driven into the ground or placed between the locations in question being tested, e.g. damp spots, pipes, rails. Stainless steel is recommended for probes. As any source of potential can be dangerous (whether caused by stray currents or something else) it is advisable to try to locate the greater potential difference within a radius of 1 m to 2 m from the point where the electric match leads are likely to be placed. Once the highest potential difference has been found, a low-impedance ammeter (1 W or less) should be placed across the probes and the current recorded. If the current is less than or equal to 60 mA, the situation is reasonably safe. If the current is more than 60 mA, special

precautions should be taken to ensure the bare lead wires cannot come in contact with the ground. Where possible, all stray currents found should be eliminated. It is advisable to test for stray currents over a period of time in order to be aware of fluctuations which may become more pronounced when heavy equipment is started or operated in the vicinity of the test area.

A7.5 Extraneous Electricity

A7.5.1 General

Where electric matches are used to initiate fireworks charges, they must be used at such distances from sources of electromagnetic radiation that a substantial factor of safety is provided against the possibility of induced ignition of the matches from such sources.

NOTES:

- 1 Additional information and guidance on extraneous electricity is provided in Table A7.1, extracted from BS 4992:1974, which sets out recommendations for minimum distances from sources of extraneous electricity.*
- 2 Electric match leads should be shorted out by twisting together the bared ends, until immediately prior to use.*

A7.5.2 Atmospheric Electrical Activity

If there is evidence of any form of atmospheric electrical activity or disturbance, the fireworks set-up at the display site shall be suspended and such operations must not be resumed until the electrical disturbance has passed.

A7.5.3 Direct Contact with Electrical Conductors

Where firing cables or wires are used in the vicinity of power or lighting cables, adequate precautions must be taken to prevent any firing cables or wires from coming into contact with electrical conductors before, during, or after the display.

A7.5.4 Induced Currents and Stray Currents

Adequate precautions must be taken to prevent initiation of fireworks due to capacitive and inductive coupling from high voltage lines, and from stray currents.

NOTE: As a guide, electric firing should not be used within 100 m of power lines with voltages in excess of 20 000 V.

A7.5.5 Static Electricity

Adequate precautions must be taken to prevent initiation of fireworks due to the build-up of static electrical charges. The following situations can contribute to this phenomenon —

- Setting up fireworks in dust storms and snowstorms.
- Moving plastic sheeting.
- Loading of free-flowing sand into bins or trailers.
- Pouring free-flowing granular fireworks compositions, including black powder into paper or plastic cartridges or tubes.

A7.6 Static Electricity

A7.6.1 General

Dangerous levels of static electricity may be generated in a number of ways, for example by dust storms, snowstorms, moving plastic sheeting, the loading of free-flowing granular sand into bins and even the action of pouring free-flowing granular fireworks compositions from a plastic container into paper cartridges or plastic tubes.

A7.6.2 Dusty Conditions

In a dry, dusty atmosphere, for example over a desert, the accumulation of static charges may be substantial during dust storms. Although it is desirable to suspend all blasting operations during storms, these are often of such duration that practically no work would be possible for days on end. Certain precautions should be observed if work must be done under these conditions. The recommended procedure to be adopted is as follows —

- Lay out the electric firing cable.
- Short-circuit both ends and connect both to earth, say by driving a metal rod into the ground, and wetting the ground if it is very dry.
- Short the electric match leading wires and attach their ends to earth.
- Uncoil the leading wires carefully and lay them along the ground. The wires must not be thrown and, in uncoiling, the operator should handle the portion of the wire adjacent to the electric match, not the match itself.
- The operator should be earthed before handling the electric match prior to connection to the firework, to prevent possible sparking from fusehead to firework.
- Disconnect the leading wires from the earthed rod and connect them to the leads of the electric firing cable, which should also have been disconnected from earth.
- Do not disconnect the other end of the cable from earth until ready to fire.
- When operating near electric power lines, make sure that the leading wires and electric firing cable are securely anchored and placed so that they cannot be made to contact the power lines by the elevation of the fireworks.

A7.6.3 Other Static Electric Hazards

The following precautions should be taken to deal with other static electric hazards —

- All machinery near the fireworks display site should, where possible, be well earthed.
- The wiring of the electric firing circuit should be separated from large conductors such as rails or piping and be protected and isolated with good insulation.
- Care should be taken when covering fireworks, with plastic sheeting, e.g. to protect the fireworks, or with removing such sheeting. Persons should be clear of the fireworks when carrying out such activities.

Table A7.1 Safe Distances For Electric Igniters Subject To Radio Frequency Radiation

Table A7.1, which has been extracted from BS 4992—1974 and should be read in conjunction with that Standard, sets out recommendations for safe distances for blasting from electromagnetic radiation when electric igniters are being used to initiate the fireworks. For example, Clause 7.9 of BS 4992—1974 points out that ‘these distances may not apply under desert and marine conditions, where special firing methods adopted may give rise to worse hazard’ and Clause 7.10 states that if two or more significant field sources are superimposed at the firing site a safety assessment should be carried out.

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 50 kW continuous work	800
3	Radar	0.2 to 1 GHz	6 MW peak 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 8

Forms

A8.1 Fireworks Display and Post-display Notification

The Fireworks Display and Post-display Notification Form for notifications to the Explosives Inspectorate at least 7 calendar days prior to the fireworks display is presented following Section A8.2.

A8.2 Fireworks Display Worksheet

The Fireworks Display Worksheet for recording information, conditions and circumstances at the fireworks display is presented following the Fireworks Display and Post-display Notification Form.

Please refer to page 109-117 for forms.
For latest version of these forms please visit www.nrm.qld.gov.au/mines/explosives.

Appendix 8 Forms



Queensland Government
Natural Resources and Mines

Fireworks Display and Post-Display Notification

Part 1 — Fireworks Display Notification

Part 1 is to be completed by the fireworks contractor **prior to** conducting any fireworks display. One form is to be completed for **EACH** display

NOTE: It is a **legal requirement** to notify the Department of Natural Resources and Mines (NR&M), in writing, of any fireworks display at **least 7 calendar days** prior to the intended display. Failure to comply with this requirement may result in the display being cancelled and/or a review of the fireworks contractor's licence

Office Use Only

Date received: Notification Complete: Yes No

7 days notification requirement met: Yes No → 7 day fax sent Yes No

Acknowledgement sent: Yes No Entered in database: Yes No

Licence No: Licence conditions: _____

Notification sighted by Inspector:
 No Yes → Name: _____ Sign: _____ Date: _____

Display inspected by Inspector: Yes No

1 Details of Fireworks Contractor Conducting Display

Name of Contractor or Company Representative Company Conducting Display(if applicable) ABN (if applicable)

Licence No Contact Telephone No Current Insurer Insurance Policy No

- A copy of a current public liability **insurance policy** specifying fireworks relating to the fireworks contractor has been supplied to NR&M: Yes No → **If no, please attach a copy of the current policy to this notification**
- List details of all persons assisting in the **use** of fireworks (note that all unlicensed assistants must be under the **direct and personal** supervision of a licensed fireworks operator) (attach extra sheet if necessary):

Name	Licence No if fireworks operator

2 Notifications/Administration

- The following agencies/persons have been notified of the proposed display (**cross all those applicable**):

<input type="checkbox"/> Fire Brigade (mandatory)	<input type="checkbox"/> Neighbours (mandatory)	<input type="checkbox"/> Local Council
<input type="checkbox"/> Land Owner/Agent and Occupier	<input type="checkbox"/> Water Police	<input type="checkbox"/> Air Sea Rescue
<input type="checkbox"/> Port Authority	<input type="checkbox"/> Coast Guard	<input type="checkbox"/> Queensland Transport

CASA (displays where fireworks are launched within 5 km of an aerodrome, or could attain heights greater than 90 m, or where the display of lights could endanger the safety of aircraft)
- The land owner/agent and occupier has granted approval for the use of the land
 No Yes → If **yes**, name of land owner/agent and occupier: _____

3. **Event Organiser** details:

Name No: Organisation Contact Telephone

3 Display Details

Date Time Location (street address where possible)

Type (cross all applicable)

Aerial Ground Close Proximity (see note at end of this form) Other (specify): _____

For most recent version see:the NR&M Explosives Inspectorate webpage.www.nrm.qld.gov.au/mines/explosives

2. Fireworks will be angled towards spectators:
 No Yes → If **yes**, the minimum clearance distance will be increased by: _____ metres
- 3.* Wind conditions at the time and location of the display will be taken into consideration when calculating the minimum clearance distance:
 Yes No
- 4.* How many persons will assist the operator in the preparation, conduct and clean-up of the display? _____
- 5.* This display meets the requirements of the EPA *Guideline for the Abatement of Nuisance Noise from the use of fireworks*:
 Yes No → If **no**, documented risk assessment to be submitted to the Explosives Inspectorate
6. All operators and assistants will wear personal protective equipment required in Safety Requirements: Yes No
7. Name of first aid attendants for display: _____
8. Vehicle transporting fireworks to the display site complies with the Australian Explosives Code (including extinguishers):
 Yes No → If **no**, documented risk assessment to be submitted to the Chief Inspector of Explosives
9. Adequate fire fighting equipment is available at the site in the form of (describe):

- 10.* Metal equipment will be used in this display: No Yes → If **yes**, documented risk assessment to be submitted to the Chief Inspector of Explosives
11. All fireworks will be properly secured: No → If **no**, documented risk assessment to be submitted to the Chief Inspector of Explosives
 Yes → Describe how fireworks are to be secured (attach extra sheet if required):

12. Security of the display site to prevent unauthorised access will be achieved by (cross all applicable):
 Barriers Security Guards (Number of Guards: _____) Other (specify): _____
13. At the display site, fireworks will be stored at (state location of storage): _____

5 Declaration by Fireworks Contractor or Representative Conducting Display

NOTE TO OPERATOR: *The safety requirements as stated in the Explosives Act 1999, Queensland Code of Practice for the Control of Outdoor Fireworks Displays, and any other direction to fireworks contractors and fireworks operators issued by the Chief Inspector of Explosives from time to time (referred to in this form as "Safety Requirements") must be complied with as a condition of licence. Failure to comply with Safety Requirements applicable to the type of display conducted will result in the display being suspended or cancelled, and/or a review of the operator's licence.*

I certify that the information supplied in Sections 1 – 4 and all attachments are true and correct:

Signature	Name of Fireworks Contractor or Representative	Licence No or ABN	Date
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

- I wish to receive acknowledgement that the Department of Natural Resources and Mines has received this notification (please include fax number here if you wish to receive an acknowledgement by fax, otherwise an acknowledgement will be sent by mail).

Once completed, this document acts as the fireworks contractor's and fireworks operator's record. YOU ARE REQUIRED TO KEEP A COPY OF THIS DOCUMENT ON YOUR PERSON WHEN TRANSPORTING OR USING FIREWORKS IN RELATION TO THIS DISPLAY.

When completed, please fax this notification and any attachments to the applicable NR&M Office:

Fax Numbers:

Southern Region: 3405 5345

Central Region: 4938 4331

Northern Region: 4760 7400

* The completion of these questions is **optional** for close proximity fireworks **displays**

(page 3 of 9)

Part 2 — Fireworks Post-Display Notification

Part 2 is to be completed by the licensed fireworks contractor or representative who conducted a fireworks display after conducting that display. One form is to be completed for EACH display. This form must be completed and submitted to NR&M within 7 calendar days of the display, even if an incident did not occur at the display. In addition, it is a legal requirement to immediately notify the Chief Inspector of Explosives through an Inspector of Explosives of an explosives incident and details of any associated loss of life, personal injury or property damage (refer Explosives Act 1999 S.55).

1 Fireworks Contractor Details

Name	Licence No	Contact Telephone Number
<input type="text"/>	<input type="text"/>	<input type="text"/>

2 Display Details

Date	Time	Location
<input type="text"/>	<input type="text"/>	<input type="text"/>

The display was conducted using the fireworks and clearance distances described in Part 1 — Fireworks Display Notification:

Yes No → If no, please attach a list describing the changes

3 Explosives Incident Details

An "explosives incident" refers to any of the following events involving an explosive (refer Explosives Act 1999 Schedule 2):

- (a) an explosive is, or appears to have been, lost or stolen;
- (b) an accidental explosion, fire or spillage;
- (c) the death or injury to a person;
- (d) unexpected damage to property;
- (e) an event, including a misfire, **which has the potential to cause any of the events in (a) to (d), other than an event that normally happens when handling or using an explosive.**

1. An explosives incident was associated with the display described in "Display Details":

Yes No → If no, go to "Declaration by Display Operator"

2. The explosives incident involved the following event(s) (cross all applicable):

Fireworks malfunction Injury/death Property damage Other

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

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

4 Declaration by Fireworks Contractor or representative

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

Signature	Name	Licence No	Date
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Once completed, this document acts as the fireworks contractor's and fireworks operator's record. You are required to keep a copy of this document.

When completed, please fax this notification and any attachments to the applicable NR&M Office:

Fax Numbers:

- Southern Region: 3405 5345
- Central Region: 4938 4310
- Northern Region: 47607400

Office Use Only

Date received: Entered in database: Yes No

Notification sighted by Inspector:

No Yes → Name: _____ Sign: _____ Date: _____

(page 4 of 9)

For most recent version see: the NR&M Explosives Inspectorate webpage. www.nrm.qld.gov.au/mines/explosives

Fireworks Display Worksheet

Date of display:

Time of Display:

Firework Event Organiser

Name:

Contact Details:

Fireworks Contractor

Name:

Contact Details:

Fireworks Operator

Name:

Licence Number:

Fireworks Assistants including Security and First Aid

Name	Activity / Task	Trained for Task	Details of Training

Fireworks for Display

Type	Quantity	Method of Firing	Current Certificate of Compliance	MSDS	Tech Data Sheet

Additional Notes:

(page 5 of 9)

Setting Up the Display

- List of equipment used

- Procedures for setting up from fireworks contractor given? Yes No
- Contractors Procedures followed? Yes No
- Perimeter boundary for exclusion zone erected? Yes No
- Signs in exclusion zone erected? Yes No
- Fireworks event organiser advised of their duty of care obligations? Yes No
- Site secured
 - Perimeter boundary Yes No
 - Security

- Security provided by

Organiser	Contractor	Both
-----------	------------	------

- Who?
 - How many? Names?

Number	Security Officers Names
1	
2	
3	
4	

- **Fireworks and equipment secured**

Method Used	Tested?

- No unnecessary confinement of fireworks Yes No
- Testing of fireworks and equipment satisfactory Yes No
- No prohibited fireworks present Yes No
- Operator and Assistants wearing correct PPE
(Personal Protective Equipment) Yes No

(page 6 of 9)

For most recent version see: the NR&M Explosives Inspectorate webpage www.nrm.qld.gov.au/mines/explosives

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:

- Approximate clearance distances from perimeter boundary for exclusion zone to fireworks: _____
- Size of area : _____
- Estimated distances verified to be correct Yes | No
 - Equipment used: _____
- Operator and Assistants wearing appropriate PPE? Yes | No
(Personal Protective Equipment)

Post-display

Fireworks Equipment

Certified free from unconsumed fireworks	Yes	No
Certified free from Damage	Yes	No
Exclusion Zone certified free from fireworks	Yes	No
Area beyond exclusion zone free from fireworks	Yes	No

Details of searches:

Date:	Time:
Persons conducting search:	

Display Site returned to control of fireworks event organiser

Date:	Time:	
Name of Organiser:		
Nature of notification:	Verbal	Written

Explosives Incident	Yes	No
----------------------------	-----	----

Fireworks Malfunction	Yes	No
Name of Product		
Details of Malfunction		
Supplier of Product		
Supplier Notified		

Misfire	Yes	No
Details		
Disposal Details		

Injuries	Yes	No
Name of Person		
Status of Person	Display Staff Member	Member of Public
Describe Event:		

Complaints

Date:	Time:	Who:
Details:		
Outcome:		

Post-display

Operator and Assistants wearing appropriate equipment	Yes	No
---	-----	----

Site Cleaned Up	Yes	No
-----------------	-----	----

Other Comments

General Comments

Signed: _____ Date: _____
 Fireworks Operator

Signed: _____ Date: _____
 Fireworks Contractor

Appendix 9

Powers of Inspectors of Explosives

For the planning of a display, during setting up, the conduct of the fireworks display, the post-display activities, investigating complaints and investigating incidents and accidents, the following powers of Inspector under the *Explosives Act 1999* are relevant.

Section 56

Where an Inspector believes it is reasonably necessary to preserve evidence after an explosives incident, the Inspector may, either orally or in writing, require the authority holder whose explosives were involved in the explosives incident to isolate the site to prevent interference.

Note: Section 57 makes it an offence for any person to interfere with the site of an explosives incident without the permission of an Inspector (But note also 57(2) and (3)).

Section 58

When an explosives incident occurs, the Inspectorate may investigate or the Inspectorate can require, by written notice to the authority holder whose explosives were involved, the authority holder to investigate and provide a report to us by a reasonable time stated in the notice.

Section 59

An Inspector may ask any person questions about an explosives incident. The person must answer the questions unless he/she has a reasonable excuse e.g. self-incrimination.

Section 83

An Inspector may enter any place where such entry is necessary to investigate the circumstances of an explosives incident at the place.

Section 89

When an Inspector has entered any place, the Inspector may, for the purposes of monitoring or enforcing compliance with the Act; —

- search, examine, inspect, test, measure, photograph, film, sample,
- remove an explosive or an ingredient for examination or testing,

- copy a document,
- take persons, equipment and materials the Inspector reasonably requires to assist him/her,
- require the person in the place to give the Inspector reasonable help to carry out the above.

Section 90

An Inspector may seize a thing in the place if —

- entry was not made under a warrant;
- the Inspector reasonably believes the thing is evidence of an offence against this Act; and
- seizure of the thing is consistent with the purpose of entry as told to the occupier.

Where entry is made under a warrant, the Inspector may seize evidence for which the warrant was issued. An Inspector may seize anything else in a place if the Inspector reasonably believes:

- the thing is evidence of an offence against this Act, and,
- seizure is necessary to prevent the thing being hidden, lost, destroyed or used to continue or to repeat the offence.

Note:

1. An Inspector must allow the owner to inspect or copy a seized thing until such time as it is either forfeited or returned (Section 93),
2. An Inspector must return the seized thing after 6 months or after any proceeding or appeal unless, of course, it is forfeited to the State.
3. Despite the above, an Inspector must return the seized thing immediately the Inspector stops being convinced its retention as evidence is necessary.

Section 96

Where an Inspector finds a person committing an offence against this Act or the Inspector reasonably suspects the person has just committed an offence, the Inspector may

require the person to state name and address, and may require evidence to support the answer.

Note: *When making the requirement the Inspector must warn the person it is an offence to fail to answer without reasonable excuse.*

Section 97

The Chief Inspector can require any person to attend before an Inspector to answer questions concerning numerous subjects. The Chief Inspector must however warn the person it is an offence to fail to comply.

Note:

1. *Section 98 makes it an offence for any person to fail to comply with attendance or with answers to questions. Self-incrimination is an excuse from answering questions.*
2. *Section 99 makes it an offence to knowingly answer incorrectly or in a misleading manner.*

Section 100

An Inspector may require a person to produce any document this Act requires the person to hold or keep. The person must produce the document and must allow the Inspector to inspect it.

In this case, self-incrimination is not an excuse. The Inspector may keep the document to take an extract from it or to make a copy but must then return the document.

Note: *Section 101 makes it an offence to give a document to an Inspector that the person knows is false or misleading.*

Section 102

Where an Inspector reasonably suspects a person is contravening, or has contravened and is likely to continue to contravene, a provision of this Act, the Inspector may give a written notice requiring the person to remedy the situation. (Remedial Action Notice).

Note: *The notice —*

- *must* state the breach, the reasons for believing it is a breach and the time allowed to remedy the situation;
- *may* state the steps the Inspector

considers necessary to remedy the situation;

- *may* be given by attaching it to a thing e.g vehicle; and
- *must* be complied with.

Section 103

Where an Inspector reasonably believes a dangerous situation exists and a person is in a position to take steps to prevent, remove or minimise the danger, the Inspector may give a written notice requiring the person to take those steps (Dangerous Situation Notice).

Note: The notice —

- *must* state the situation the Inspector believes is causing the danger, the reasons for that belief and the time allowed to remedy the situation;
- *may* state the steps the Inspector believes are necessary to remedy the situation;
- *may* be given by attaching it to a thing e.g vehicle; and
- *must* be complied with.

Section 104

Where an Inspector reasonably believes a dangerous situation exists and a given notice is not being complied with or a notice is inappropriate, the Inspector may take direct action necessary to remedy the situation.

Note: *The Inspector must prepare reasons for taking action, as soon as practicable, and if asked by an affected person give those reasons. Action includes asking others to assist the Inspector as necessary.*

Section 105

It is an offence for any person to obstruct an Inspector, or an assistant, in the exercise of a power under this Act. Any person attempting to obstruct must be warned that it is an offence. To obstruct is to hinder, resist or attempt to obstruct.

Appendix 10

Assignment of Fireworks to Hazard Divisions

A10.1

Fireworks must normally be assigned to hazard divisions 1.1, 1.2, 1.3, and 1.4 on the basis of test data derived from Test Series 6. However, since the range of such articles is very extensive and the availability of test facilities may be limited, assignment to hazard divisions may also be made in accordance with the procedure in A10.2.

A10.2

Assignment of fireworks 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 the default table in Appendix 10 Table A10. Such assignment must be made with the agreement of the Chief Inspector of Explosives.

A10.3

Where fireworks of more than one Hazard Division are packaged 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.

A10.4

The addition of new types of fireworks to column 1 of the default list in Table A10 below must only be made on the basis of full test data submitted to the UN Sub-Committee on the Transport of Dangerous Goods for consideration.

A10.5

Test data derived by competent authorities which validates or contradicts the assignment of Hazard Division to firework types and/or subdivisions by calibre/weight in column 4 of Table A10 to hazard divisions in column 5 must be submitted to the UN Sub-Committee on the Transport of Dangerous Goods for information (see also note 3 in section 2.1.3.2.3 of the *United Nations Recommendations on the Transport of Dangerous Goods Model Regulations*)

Table A10 Default Table for Classification of Fireworks page (1 of 4)

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
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, star shell; report shell: maroon, salute, sound shell, thunderclap	with delay fuse and bursting charge, from a mortar	all salute shells colour shell: ≥ 200 mm colour shell: < 200 mm with > 25 per cent perchlorate/ metal composition, as loose powder and/or report effects colour shell: < 200 mm with ≤ 25 per cent perchlorate/ metal composition, as loose powder and/or report effects colour shell: ≤ 50 mm or ≤ 60 g pyrotechnic composition with > 2 per cent perchlorate/ metal composition as report effects	1.1G 1.1G 1.1G 1.3G 1.3G
	Cylindrical display shell: aerial shell, colour shell, dye shell, multi-break shell, multi-effect shell, nautical shell, parachute shell, smoke shell, star shell, report shell, maroon, salute, sound shell, thunderclap Aerial shell kit, preloaded mortar, shell in mortar	with delay fuse and bursting charge, from a mortar Assembly comprising a shell inside a be projected	colour shell: ≤ 50 mm or ≤ 60 g pyrotechnic composition with ≤ 2 per cent perchlorate/ metal composition as report effects As for spherical shells, longest dimension determines the classification	1.4G
	Shell of shells (spherical) (references to percentages for shell of shells are to the gross mass of the fireworks article)	report shells and inert materials and	all report shells colour shell: ≥ 200 mm colour shell: < 200 mm > 120 mm	1.1G 1.1G 1.3G 1.1G

Table A10 Default Table for Classification of Fireworks (page 2 of 4)

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
		report shells ≤ with ≤ 33 per cent perchlorate/metal pyrotechnic composition and ≥ inert materials and designed to be projected from a mortar	≤ 120 mm	1.3G
			> 300 mm	1.1G
		colour shells ≤ units, with ≤ pyrotechnic composition and ≤ be projected from a mortar Assembly including several elements	≤ 300 mm	1.3G
Combination/ batteries	Barrage, bombardos, cakes, finale box, flowerbed, hybrid, multiple tubes, shellcakes			the most hazardous firework type determines the classification
Roman candles	Exhibition candle, candle, bombettes	one or two points of ignition tube containing alternate propellant charge(s), pyrotechnic unit(s) and transmitting fuse(s)	< 25 mm ≥ 25 mm and < 50 mm ≥ 50 mm, containing no flash power type composition ≥ 50 mm containing flash power type composition	1.4G 1.3G 1.2G
Mine	pot-a-feu, ground mine	tube containing propellant charge and pyrotechnic units and designed to be round. The principal effect is ej	Containing > 3 per cent perchlorate/metal composition as report effects	1.1G

Table A10 Default Table for Classification of Fireworks (page 3 of 4)

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
		aural effect in the air.	> 90g pyrotechnic composition containing ≤ 3 per cent perchlorate/metal composition as report effects	1.3G
	bag mine, cylinder mine	cloth or paper bag or cloth or paper pyrotechnic units and designed to be mine	≤ 90 g pyrotechnic composition containing ≤ 3 per cent perchlorate/metal composition as report effects	1.4G
Fountain	Volcanoes, gerbs, showers, falls, rains, lances, Bengal fire, flame projectors, flutter sparkle, cylindrical fountains, cone fountains, illuminating torch, tourbillions, strobes, whistle	pyrotechnic composition	report as primary effect, limits to be determined	1.1G
Sparklers	Handheld sparklers, non-handheld sparklers, wire dipped sparklers, dipped sticks	(along one end) with slow burning an ignition tip	Other	1.3G
Low hazard fireworks and novelties	table bombs, throw downs, crackling granules, smokes, fog, chaser, snakes, glow worm, serpents	visible and/ or audible effect which and/ or explosive composition	[to be defined	1.4G
Spinners	Aerial spinners, helicopters, ground spinners	or spark-producing pyrotechnic composition, with or without noise aerofoil attached	≥ 1kg pyrotechnic composition	1.3G
			< 1kg pyrotechnic composition	1.4G
			pyrotechnic composition per item ≥ 10 g	1.3G
			Pyrotechnic composition per item < 10 g	1.4G
			Articles may contain up to 1.6 mg of silver fulminate, or up to 16 mg potassium chlorate/ red phosphorous mixture	1.4G
			pyrotechnic composition per item > 20 g, containing ≤ 3 per cent perchlorate/ metal composition as report effects	1.3G

Table A10 Default Table for Classification of Fireworks (page 4 of 4)

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
Wheels	Catherine wheels, Saxon	that it can rotate	pyrotechnic composition per item ≤ 20 g, containing ≤ 3 per cent perchlorate/ metal composition as report effects No report effect, each whistle (if any) ≤ 5 g, ≥ 1 kg total pyrotechnic composition	1.4G 1.3G
Aerial wheels	Flying Saxon, UFO's, rising crown	fixed to a supporting ring	No report effect, each whistle (if any) ≤ 5 g, < 1 kg total pyrotechnic composition No report effect, each whistle (if any) ≤ 5 g, > 60 g pyrotechnic composition per driver or > 200 g total pyrotechnic composition	1.4G 1.3G
Firecrackers	Strings of firecrackers, Tom thumbs, Po Ha's, Chinese celebration firecrackers	report	No report effect, each whistle (if any) ≤ 5 g, ≤ 60 g pyrotechnic composition per driver and ≤ 200 g total pyrotechnic composition Strings of tom thumbs and strings of Po Ha's	1.4G
Selection pack	Display selection box, display selection pack, garden selection box, indoor selection box	table	Strings of Chinese Celebration Firecrackers The most hazardous firework type determines the classification	1.3G

Note: References to percentages in the table, unless otherwise stated, are to the mass of the fireworks composition.

Appendix 11

Mortars and Racks

A11.1 Guidelines for Mortar Tube Design

The information regarding wall thickness and strength of mortars has been sourced from the National Fire and Protection Association document NFPA 1123 *Code for Fireworks Display 2000* Edition. 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.

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	—	—
300	—	—	—

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	—	—
300	—	—	—

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 fireworks display site and must be done before the mortar is used as a certified design at a fireworks 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.

A11.2 Methods of Protection for Mortars Firing Shells

In order to prevent any injury to people or damage to property from failure of a mortar tube, aerial shell misfire, premature explosion of an aerial shell, projection of debris or inadequate discharge of an aerial shell,

protection and support for mortars may be achieved by one of the following —

- Burial of mortars in the ground to an appropriate depth.
- Placement of sandbags around mortars to an appropriate height.
- Burial of mortars in the ground with additional sandbag protection.
- 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.
- 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.
- 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.
- Placement of mortars in wooden racks.
- Placement of mortars behind a barrier or wall, shown by witnessed tests to be resistant to fragments generated by explosion of the star shell and rupture of the mortar.
- Support for mortars or for mortar racks, troughs or drums to ensure that the mortars are not realigned.

Table A.11.4 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

Appendix 12

Responsible Persons Associated with Phases of Life Cycle of Fireworks:

Duty of Care Obligations

A12.1 Obligations of Responsible Persons

Sections 3.3.2 and 3.3.3 of this code identifies persons directly and otherwise associated with fireworks displays. Tables A12.1 to A12.3 identifies duty of care obligations for those persons for various phases of the life cycle.

Table A12.1 Fireworks Event Organiser

Fireworks Event Organiser	
Topic	Obligation
Notifications/Approvals	confirming that the fireworks contractor has properly notified all relevant authorities about the display (e.g. the Explosives Inspectorate and the Fire and Rescue Service) prior to the display.
	notifying the local community of the display as required.
	obtaining approval from the owner or agent for the land on which the fireworks display is to be held.
Site – Safety and Security	selecting a safe and suitable site for the fireworks display relevant to the types of fireworks to be included in the display.
	ensuring that the security measures (including crowd control measures) for the fireworks display are adequate and that spectators are aware of those requirements.
Safety Management System	ensuring that the fireworks contractor has met their duty of care obligations by having a health and safety management system in place (including personal protective equipment for the fireworks operator and the fireworks operator's assistant(s), such as head, ear, eye and face protection, cotton clothing and enclosed footwear).
	providing appropriate emergency planning (e.g. first aid, fire extinguishers, and ready access (entry to and exit from the site)).
Insurance	ensuring there is appropriate insurance coverage for the fireworks display.
Personnel – Authorisation	selecting a suitably authorised fireworks contractor who provides an appropriately authorised fireworks operator for the fireworks display.
Planning/Conduct of Display	providing sufficient time for the fireworks operator to safely set-up the fireworks display and clean up after the display.
	responding appropriately to changing conditions during the fireworks display (e.g. stopping the display if the fireworks operator demands it or if the conditions are unsafe, such as unsuitable weather conditions for clearance distances or the failure of the spectators to follow directions).

Table A12.2. Fireworks Contractor

Fireworks Contractor	
Topic	Obligation
General	working in accordance with this Code.
	taking any reasonable and necessary course of action to ensure that no-one is exposed to an unacceptable level of risk.
	ensuring that the fireworks event organiser has been advised of their duty of care obligations.
Notifications/Approvals	notifying the local community of the display.
	notifying relevant authorities prior to and after the display.
Site – Safety and Security	selecting a safe and suitable site for the fireworks display relevant to the types of fireworks to be included in the display.
	ensuring that the security measures (including crowd control measures) for the fireworks display are adequate and that spectators are aware of those requirements.
Safety Management System	providing details of procedures, practices and other documentation under the safety management system to the fireworks operator.
	ensuring that the fireworks operator and fireworks operator’s assistant(s) are competent and trained in the safety management system’s requirements.
	having a health and safety management system in place (including personal protective equipment for the fireworks operator and the fireworks operator’s assistant(s), such as head, ear, eye and face protection, long-sleeved cotton clothing and enclosed footwear).
	providing appropriate emergency planning (e.g. first aid, fire extinguishers, and ready access (entry to and exit from the site)).
Quality/Safety of Fireworks	ensuring that fireworks used in a fireworks display comply with the <i>Queensland Fireworks Product Safety Code</i>
	providing to the fireworks operator, who is conducting a display on the contractor’s behalf, a copy of a current certificate of compliance for the fireworks to be used (or a certification that the fireworks are covered by a current certificate of compliance).
Conduct of Display	responding appropriately to changing conditions during the fireworks display (e.g. stopping the display if the fireworks operator demands it or if the conditions are unsafe, such as unsuitable weather conditions for clearance distances or the failure of the spectators to follow directions).
Incidents	ensuring incidents associated with the display are reported on the post display notification form to the Explosives Inspectorate and serious incidents are immediately reported to the Explosives Inspectorate.

Table A12.3 Fireworks Operator

Fireworks Operator	
Topic	Obligation
General	working in accordance with this Code.
	taking any reasonable and necessary course of action to ensure that no-one is exposed to an unacceptable level of risk.
	reporting any noncompliance to the fireworks contractor.
Notifications/Approvals	ensuring that the local community has been notified of the display and reporting those findings to the fireworks contractor.
	Ensuring that the relevant authorities have been notified of the display.
Site – Safety and Security	selecting a safe and suitable site for the fireworks display relevant to the types of fireworks to be included in the display.
	ensuring the security of fireworks at site.
	ensuring that the security measures (including crowd control measures) for the fireworks display are adequate and that spectators are aware of those requirements.
Safety Management System	ensuring that the fireworks contractor has met their duty of care obligations by having a health and safety management system in place (including personal protective equipment for the fireworks operator and the fireworks operator’s assistant(s), such as head, ear, eye and face protection, long-sleeved cotton clothing and enclosed footwear).
	working in accordance with the fireworks contractor’s safety management system and other instructions.
	providing appropriate emergency planning (e.g. first aid, fire extinguishers, and ready access (entry to and exit from the site).
	providing safety equipment.
Personnel-Supervision/ Training	ensuring the fireworks operator’s assistant(s) and other personnel are trained and competent.
	effectively supervising all assistants.
Documentation/Records	providing appropriate documentation.
	keeping appropriate records.
Conduct of Display	responding appropriately to changing conditions during the fireworks display (e.g. stopping the display if the fireworks event organiser or fireworks contractor demands it or if the conditions are unsafe, such as unsuitable weather conditions for clearance distances or the failure of the spectators to follow directions).
Incidents	ensuring that incidents associated with the display are reported to the fireworks contractor and are reported on the post-display notification form to the Explosives Inspectorate and any serious incidents are immediately reported to the Explosives Inspectorate.

Table A12.4 Fireworks Operator’s Assistant

Fireworks Operator’s Assistant	
Topic	Obligation
General	taking any reasonable and necessary course of action to ensure that no-one is exposed to an unacceptable level of risk.
	undertaking only those activities which the fireworks operator’s assistant has been trained in and for which the assistant is competent.
Safety Management System	complying with the practices and procedures applying to the firework’s operator’s assistant that are part of the safety management system for the fireworks contractor under the direction of the fireworks operator.
	wearing suitable personal protective clothing and other safety equipment.
Incidents	reporting to the fireworks operator or other designated supervisor any incident and any other matters that may lead to an incident.

Table A12.5 Spectator Public

Spectator Public	
Topic	Obligation
Display Area	keeping well clear of the display area during the setting up of the display, after the display has been set-up and before the display is fired, during the firing of the display, and after the display until the area has been cleared by the fireworks operator.
Directions	following directions relating to the display, provided by the fireworks event organiser, the fireworks operator, security personnel and other authorised personnel.
Incidents	reporting incidents to the fireworks operator, the fireworks event organiser or their agents or the Explosives Inspectorate.

Table A12.6 Persons Responsible for Design and Construction of Fireworks

Persons Responsible for Design and Construction of Fireworks	
Topic	Obligation
General	ensuring that the fireworks are designed and constructed and are in a condition that is safe for storage, handling, transport and use.
Information	ensuring that appropriate information about the safe storage, handling, transport and use including disposal of the fireworks is provided for the fireworks. (Information is appropriate if it clearly and correctly identifies the fireworks and states the precautions to be taken for the safe storage, handling, transport, use and disposal of the fireworks and also the hazards associated with the storage, handling, transport, use and disposal of the fireworks).
Classification, Packaging, Marking and Labelling	ensuring that the fireworks are properly classified.
	ensuring that the fireworks are packed in approved packages and containers.
	ensuring that the fireworks are properly marked and labeled.

Table A12.7 Persons Responsible for Design, Construction and Manufacture of Fireworks Equipment

Persons Responsible for Design, Construction and Manufacture of Fireworks Equipment	
Topic	Obligation
General	ensuring that the fireworks equipment is designed, constructed and manufactured so that, when used properly, the risk of harm to people and property from the use of the equipment is at an acceptable level.
Information	ensuring that all reasonable steps are taken to ensure that appropriate information about the safe use of the fireworks equipment is available to the user of the equipment, including information about the maintenance necessary for the safe use of the fireworks equipment. (Information may be appropriate if it states the use for which the equipment was designed and tested and any conditions that must be complied with if the equipment is to be used safely so that the risk of harm to people and property is at an acceptable level, including ongoing inspection and testing requirements and acceptance criteria for continued serviceability).
Quality of Fireworks Equipment	ensuring that the quality of fireworks equipment is certified, including a certification from testing of the fireworks equipment as appropriate. (Testing must not be undertaken at any fireworks display).

Table A12.8 Persons Purchasing Fireworks

Persons Purchasing Fireworks	
Topic	Obligation
Authorisation	being authorised for the categories, types and sizes of the fireworks purchased.
Information	ensuring that all necessary current and appropriate safety and performance information is provided for all fireworks purchased.
Quality and Safety	ensuring that there is appropriate certification for all the fireworks being purchased for product safety and quality of the fireworks.
Security	ensuring the ongoing security of the fireworks purchased.

Table A12.9 Person Responsible for Sale/Supply of Fireworks

Persons Responsible for Sale/Supply of Fireworks	
Topic	Obligation
Authorisation	ensuring that all reasonable steps are taken to supply only fireworks of the type for which the purchaser is appropriately authorised.
Information/Communication	ensuring that all reasonable steps are taken to ensure that current and appropriate safety and performance information for the safe use of the fireworks is available to the fireworks contractor. (See Table 12A.6).
	providing current safety and technical information (including a Material Safety Data Sheet and a Technical Data Sheet).
	ensuring that all reasonable steps are taken to inform all purchasers of a firework, when the supplier becomes aware of a hazard or defect that may create an unacceptable level of risk to users, of the nature of the hazard or defect and its significance and any controls to manage the risk.
Quality Management System	operating a recognised quality management system.
	ensuring the safety, performance and quality of the fireworks supplied.
	providing a current certificate of compliance with the supply of the fireworks.
Classification, Packaging, Marking and Labelling	ensuring that fireworks offered or consigned for transport are fireworks are properly classified, identified, labelled, packaged and stowed prior to transport.
Incidents	reporting incidents involving the seller/supplier's fireworks to the Explosives Inspectorate.

Table A12.10 Persons Responsible for Sale/Supply of Fireworks Equipment

Persons Responsible for Sale/Supply of Fireworks Equipment	
Topic	Obligation
Information/Communication	ensuring that all reasonable steps are taken to ensure that appropriate information about the safe use of the fireworks equipment is available to the user of the equipment, including information about the maintenance necessary for the safe use of the fireworks equipment. Refer to Sections 7.2.1 and 9.2 for guidance on “appropriate information”.
	ensuring that all reasonable steps are taken to inform the purchaser when the seller or supplier becomes aware of a hazard or defect that may create an unacceptable level of risk to users of the equipment to inform the users of the equipment about the nature of the hazard or defect and its significance and any modifications or controls that have been developed to eliminate or correct the hazard or defect or manage the risk.
Tagging and Identification	ensuring that all equipment is properly tagged and identified.

Table A12.11 Persons Responsible for Storage of Fireworks

Persons Responsible for Storage of Fireworks	
Topic	Obligation
General	ensuring that the storage system is designed, constructed, installed and located, so that when used properly, risk is at an acceptable level and the risk to persons and property from a potential explosives incident is minimised.
Safety Management System	ensuring that a documented safety management system is implemented with documented procedures.
Security	ensuring that security measures are in place to reasonably prevent access to the fireworks by unauthorised persons.
Identification of Hazards	ensuring that hazards associated with the storage of fireworks are, to the extent of current state of knowledge about the hazard, identified and recorded.

Table A12.12 Persons Responsible for Transport of Fireworks

Persons Responsible for Transport of Fireworks	
Topic	Obligation
General	ensuring that the risk to persons and property from the transport of fireworks is at an acceptable level
	ensuring that fireworks are in a condition that is safe for transport.
Personnel – Authorisation and Competency	ensuring that the person transporting the fireworks is competent and authorised.

Table A12.13 Persons Responsible for Consignment of Fireworks for Transport

Persons Responsible for Consignment of Fireworks for Transport	
Topic	Obligation
General	ensuring that the fireworks are in a condition that is safe for transport.
Classification, Packaging, Marking and Labelling	ensuring that the fireworks are properly classified, identified, labelled, packaged and stowed prior to transport.

Appendix 13

Fireworks Event Organiser

A13.1 Planning the Fireworks Display

A checklist of questions and issues that the fireworks event organiser may ask a prospective fireworks contractor is detailed as follows:

Sighting the Fireworks Contractor's licence. Questions the fireworks event organiser may ask include:—

- Is the licence current?
- How long has the operator been licensed?
- Does the licence category cover the fireworks to be used?

Sight the fireworks contractor's fireworks display insurance. Questions the fireworks event organiser may ask include:—

- Is the policy current?
- Does the policy have a minimum indemnity of \$5 million
- Does the policy cover the fireworks operator the contractor proposes to use?
- Is the level of insurance adequate for the size of fireworks display?

Sight the fireworks contractor's and fireworks operator's records. This will provide information on how many displays have been conducted and a list of potential referees.

- Are they professionally kept?
- Does the operator have documented experience at displays?

Does the fireworks contractor have a copy of this Code and a safety management system including copies of their operating procedures and practices. Questions the fireworks event organiser may ask include:

- Have you seen it?
- If not, ask to see it.

How does the fireworks contractor plan to notify all appropriate persons of the display?

- Neighbours of the display site.
- Agencies listed in Section 4 of this Code of Practice, e.g Explosives Inspectorate and Queensland Fire and Rescue Services.

What crowd control does the fireworks contractor recommend? Questions the fireworks event organiser may ask include:

- Do you consider this adequate?
Other questions may include:
- Is the proposed site suitable for the fireworks proposed?
- Has adequate time been allowed to set-up the display?
- Will the fireworks display site be secure and fully controlled after set-up and before the display?
- Is there a suitable area for holding and preparing the fireworks on site before set-up?
- Are there any problems with the proposed display in complying with both the fireworks event organiser requirements, the fireworks contractor's requirements and the requirements of this code of practice?

A13.2 Firework Display Check by Fireworks Event Organiser

What should the event organiser check at the display?

1. Is the licensee present?

- Are there sufficient licensees to supervise the assistants at the display?

2. Ask to see the display plan.

- Is this what you planned?

3. Are there sufficient assistants to

- prepare the display, provide security and clean the site after the display?

4. Is crowd control adequate?

- Is the fireworks area properly defined and barricaded?
- Are the spectators aware of their responsibility to obey the operator, assistants and security personnel?

5. Are the operator and assistants appropriately attired?

- Do they have full-length clothing cover?
- Do they have head, ear and eye protection?
- Are they wearing appropriate footwear?

6. Is there appropriate safety equipment at the display site?

- Fire extinguishers.
- First aid equipment.

7. Has the operator notified all appropriate persons?

- Have neighbours been informed?
- Have the Explosives Inspectorate and fire services been notified?
Ask for a copy of the notification.

8. Are the weather conditions appropriate?

- High winds increase the risks at displays—are they too strong?

9. What is the operator's plan for cleaning up after the display?

- Will the area be searched for unfired fireworks?
- Will all equipment be removed from the site?
- Is it too dark for a proper search at night?

Further search in the morning may be necessary.

Appendix 14

Guideline for Container Modification for the Storage of Fireworks

A14.1 Purpose

This Appendix offers guidelines for the conversion of freight containers for use as magazines for the storage of fireworks. More detailed information may be found in Australian Standard AS2187.1–1998.

Where there is an inconsistency between these guidelines and AS2187.1 then either may be used or an equivalent design or method. These are minimum requirements. A higher standard is recommended.

A14.2 Requirements

A non-collapsible general purpose freight container that complies with requirements of AS/NZS37 11.4 may be converted for use as a magazine for the storage of fireworks. The following general requirements apply —

- Converted freight containers require no additional cladding where the steel case is at least 2 mm thick.
- Floors may be made from galvanised steel at least 2 mm thick or timber.
- Where floors are made from galvanised steel the floor must be covered by timber, rubber matting or a covering of equivalent performance.
- Where magazines are raised more than 300 m from the ground the floor must be of galvanised steel or the base cladded with galvanised steel at least 2 mm thick. All floors must 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.
- Where ventilation is desired then the requirements of AS 2187.1 section 2.3.3 must be met with the following exceptions. —
 - The weather shields for side openings may be not less than 2 mm thick.
 - The side openings may be straight through vents
 - Side opening must 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 3.00 mm in diameter or another method which delivers equal security.
- There must be two locking systems, one of which must be shrouded, on the doors. The locks must comply with AS4145.4: Locksets – Padlocks to a level 7 standard.
- The magazine must be fully lined to comply with AS2187.1 Section 2.3.2.3
- All interior surfaces must be free from exposed ferrous metallic substance.
- Where the external environmental conditions are likely to cause internal temperature fluctuations that may adversely affect the contents, a shade roof should be provided. Where a shade roof is provided, it must be self-draining away from doorways. Refer to AS2187.1 Section 2.1.7 for details.
- Lightning protection is required in accordance with the requirements of AS 1768 relating to the protection of structures with explosive contents.
- For modular steel magazines earthing terminals at diagonal corners are required. Refer to AS 2187.1 Section 2.1.5 for details.
- Lighting in magazines may be either natural or artificial. Electrical fittings and wiring must comply with AS3000 for electrical equipment in hazardous locations and satisfy the requirements of the Hazardous Zone Classification specified in Section 2 of OSC(E) 81/1.
 - Electrical installations inside magazines should be avoided.

-
- Outside lighting may be arranged to shine through the open door of a magazine.
 - On the lining of the door of the magazine the following sign must be permanently fixed. —
 - “THIS MAGAZINE IS SUITABLE ONLY FOR THE STORAGE OF FIREWORKS”
 - Explosives of compatibility groups C and G should not be stored in the same magazine. Refer AS2187.1 section 3.1.2 for greater definition.
 - A magazine must have signs displaying the words “EXPLOSIVE” in bold red letters at least 75 mm high on a white background and an orange diamond with the UN class. (Black powder may be stored in these magazines with fireworks to a limit of 30 kg.)
 - Fire fighting equipment must be located in such a position as to be able to fight fires external to the magazine.

Appendix 15 Requirements for Placards for Fireworks

The requirements for outer warning placard and store placard are detailed below.

A15.1 Outer Warning Placard

An Outer Warning Placard must comply with the following requirements:

- The placard must not be less than the dimensions shown in Figure A15.1
- The placard must be lettered 'HAZCHEM' as shown in Figure A15.1, in red letters of that style and not be less than 100 mm high, shown on a white or silver background.

A15.2 Placards for Storage

A placard for a fireworks and gunpowder stored must conform to the following requirements:

- Display the Class label or labels appropriate to the Class or Classes in respect of all the dangerous goods stored in the building, structure, room, compartment or outdoor storage areas to which the placard relates.
- Be of the form and colouring specified in the Australian Explosives Code and must have sides not less than 100 mm in length.

Figure A15.1 Form and Dimensions of an Outer Warning Placard

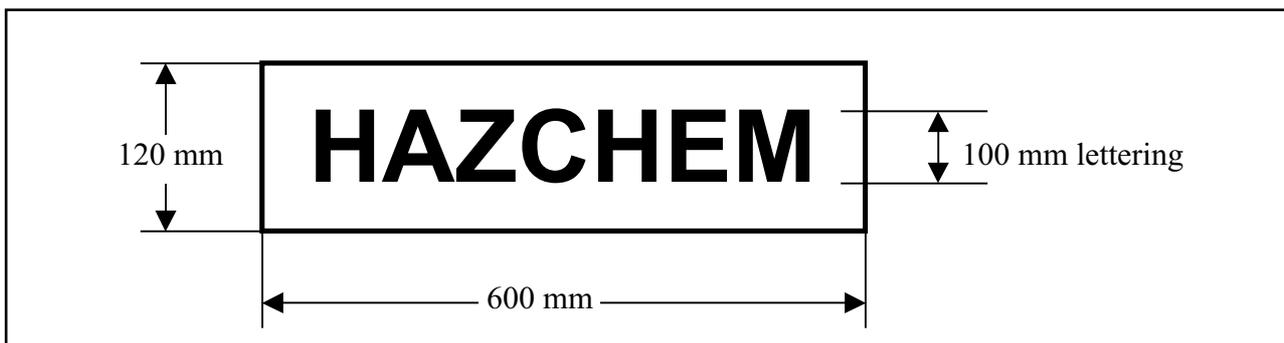
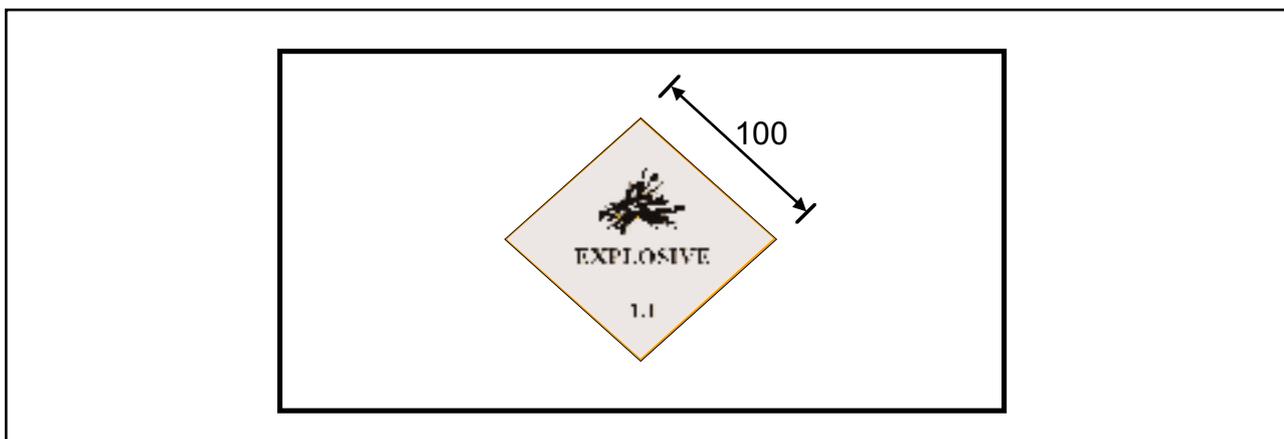


Figure A 15.2 Form and Dimensions of a Placard for Fireworks and Gunpowder Stored



Appendix 16

Fireworks Design, Construction and Testing

A16.1 General Requirements

Fireworks must be designed and constructed to be safe during handling, storage, transport and use. Only fireworks of known performance, product safety and demonstrated compliance with the published safety and performance information may be supplied. The fireworks must be properly identified, properly packaged, properly classified and have suitable safety information and performance data provided to the purchaser.

A16.2 General Design

The fireworks must function in a safe and predictable manner. The fireworks 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, salutes, reports and maroons, be designed and constructed so that, upon ignition, the firework case(s) does not rupture;
- not contain any mixture of an unstable, toxic or highly sensitive nature which may result in an unsafe firework.

Consideration must be given to —

- ignition method and fuse burning time;
- fireworks composition;
- explosive content;
- construction type and integrity;
- performance of the firework;
- debris characteristics;
- size of the area affected during the functioning of the firework; and
- the fire, safety and health risks posed by the firework or its components or effects.

A16.3 Construction

Fireworks must be constructed so that —

- no fireworks composition can escape during normal handling prior to use; and
- wrapping paper that encases a wick should be able to be easily removed without dislodging the wick from the firework proper.

A16.4 Fireworks Composition

The fireworks compositions in the firework must be a formulation such that the firework is stable and safe during use, transport, handling and storage.

The chemicals listed in Table A16.1 are chemicals that are normally used in compositions for the construction of fireworks. The fireworks supplier must list the ingredients in the firework composition in the Material Safety Data Sheet.

If the composition contains a substance not listed below in Table A16.1, a competent person must undertake an assessment to establish the suitability of the fireworks composition. The assessment must be documented in a formal report. This requirement does not apply to miscellaneous substances, which are compounds commonly used as binders. (These include organic compounds, such as lactose, shellac, red gum, chlorinated paraffin, and polyvinyl chloride, consisting of a combination of carbon with hydrogen, oxygen, or chlorine, or all three. Nitrogen can be present if it accounts for less than 10 per cent by weight of the composition.) However, the assessment should demonstrate the safety and performance of the composition from health and safety matters including —

- toxic products injurious to health of operators, e.g. arsenic;
- compositions that are unsafe during handling, storage, transport and use from properties such as sensitivity to ignition. (Some compositions may be too sensitive to ignition from stimuli such as friction, impact, static and heat.)

The firework composition must not contain any mixture of an unstable, toxic or highly sensitive nature which may result in an unsafe firework, for example —

- mixtures of chlorates with sulphur, sulphides, phosphorus, acids, metal powders or any ammonium salts;

- mixtures of chlorates with sulphur, 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 fireworks composition for lances or smokes.

Table A16.1 Standard Fireworks Chemicals

STANDARD FIREWORKS CHEMICALS	
Chemical	Typical Use
Aluminium	Fuel
Ammonium perchlorate	Oxygen donor
Antimony	Fuel
Antimony sulfide	Fuel
Asphaltium	Fuel
Barium carbonate	Neutralizer
Barium nitrate	Oxygen donor
Barium oxide	Oxygen donor
Barium perchlorate	Oxygen donor
Barium sulfate	Oxygen donor
Bismuth trioxide	Noise (crackling)
Boric acid	Neutralizer
Boron	Delay compositions
Calcium carbonate	Neutralizer
Calcium oxalate	Oxygen donor, colour producer
Calcium sulfate	Oxygen donor
Carbon or charcoal	Fuel
Chlorinated rubber	Fuel, colour enhancer
Copper acetoarsenite	Colour producer
Copper ammonium chloride	Colour producer, chlorine donor
Copper ammonium nitrate	Colour producer
Copper ammonium sulfate	Colour producer
Copper benzoate	Colour producer
Copper carbonate	Colour producer, neutraliser
Copper metal	Colour agent
Copper oxide	Oxygen donor, colour agent
Copper oxychloride	Colour producer
Copper salts (except copper chlorate)	Colour agent
Cryolite	Colour producer
Dechlorane	Chlorine donor
Dextrine	Fuel/binder
Gallic acid	whistles
Hexamine	fuel
Hexamethylenetetramine (hexamine)	Fuel
Iron and iron alloys (e.g., ferro/titanium)	Fuel
Iron oxide	Oxygen donor
Lead tetroxide	Noise (crackling)
Magnalium (magnesium/aluminium)	Fuel
Magnesium (in display fireworks and theatrical fireworks only)	Fuel
Magnesium carbonate	Neutralizer
Magnesium sulfate	Oxygen donor
Manganese dioxide	Primer compositions
Naphthalene	fuel
Nitrocellulose-based lacquers	Binder
Nitroguanidine	Sparkler compositions
Organic dyes	Coloured smokes

Table A16.1 Standard Fireworks Chemicals ... continued.

STANDARD FIREWORKS CHEMICALS	
Chemical	Typical Use
Parlon	Chlorine donor
Paulownia coal	Fuel
Potassium benzoate	Whistle
Potassium bichromate (potassium dichromate) (not to exceed 5 per cent of formulation)	Oxygen donor
Potassium carbonate	Neutraliser
Potassium hydrogen phthalate	Whistle
Potassium nitrate	Oxygen donor
Potassium perchlorate	Oxygen donor
Potassium permanganate	Oxygen donor
Potassium sulfate	Oxygen donor
Realgar	fuel
Saran	Chlorine donor
Silicon	Priming compositions
Silicon dioxide (silica)	Flow agent
Sodium benzoate	whistles
Sodium bicarbonate (sodium hydrogen carbonate)	Neutralizer
Sodium nitrate	Oxygen donor
Sodium oxalate	Colour producer, glitter
Sodium salicylate	Whistle
Sodium salts (except sodium chlorate)	Colour agent
Sodium sulfate	Oxygen donor
Stearic acid	neutraliser
Stearine	
Strontium carbonate	Colour agent
Strontium nitrate	Oxygen donor
Strontium salts (except strontium chlorate)	Colour agent
Strontium sulfate	Oxygen donor
Sulfur	Fuel
Titanium (particle size > 100 mesh if 1.4G or 1.4S Fireworks)	Fuel
Zinc	Fuel, colour producer
Zinc oxide	Oxygen donor
Zirconium	Fuel
Zirconium nickel alloy	Fuel
Zirconium hydride	
Zirconium silicate	Fuel

A16.5 Ignition Method

The ignition method must be readily identifiable and must be by an appropriate method 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 firework.

Note: *Methods of ignition requiring a flame should be suited to the use of ordinary matches.*

A16.5.1 Fireworks Designed to be Ignited by Hand

Fireworks 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 firework of five seconds.

A16.5.2 Other Fireworks

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

A16.6 Performance

The performance of fireworks must be such that persons following reasonable instructions for their use from the Material Safety Data Sheet and Technical Data Sheet and observing the fireworks are not, as far as practicable, exposed to unacceptable risk of harm to persons or damage to property.

This requirement imposes requirements on the provision of information on such aspects as to how far projectiles and burning debris are thrown and the size of the area affected during the functioning of the firework and, therefore, the minimum clearance distance for the exclusion zone from which it is safe to conduct or watch the display.

Fireworks must comply with the following —

- the area affected by the functioning of the firework at ground level must be specified. This must include the contributing effects from wind, angling, etc;
- a firework 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 10 metre buffer distance of the perimeter of the exclusion zone for the defined minimum clearance distances for the applicable conditions including weather conditions. Refer Section 14.5.2.1 of this Code; and
- No hazardous debris must be projected laterally beyond the 10 metres buffer distance of the perimeter of the exclusion zone for the defined minimum clearance distances set for the display from the point of initiation of the firework.

A16.7 User Information

Information must be provided for the safe handling, transport, storage and use of the firework. Sufficient information must be provided in documentation such as MSDSs and Technical Data Sheets to enable the safe management of the fireworks and the fireworks display. The way in which the firework functions must be described to enable fireworks contractors to select fireworks appropriate to their needs. All information must be easy to comprehend and must be legible. Information and instructions must be in English.

Information must be provided as to the most appropriate method of using and disposing the fireworks, 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 fireworks, effects of wind, hazardous debris fallout, etc;
- 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.

A16.7.1 Firecrackers – All Strings of Firecrackers

- no clay plugs that may be propelled on firing to harm spectators;
- maximum cracker size – 45 mm x 10 mm; and
- no head rolls.

A16.7.2 Additional Information

Additional information detailing safe methods of transportation, storage, usage and disposal must be provided to the purchaser with all fireworks.

A16.7.3 Transportation

Information must be provided as to the most appropriate method of transporting fireworks within a vehicle, including —

- location within the vehicle;
- securing the fireworks; and
- segregation and separation from incompatible substances.

A16.7.4 Storage

Information must be provided as to the most appropriate method of storing fireworks, including —

- segregation and separation from incompatible substances;
- separation from ignition sources;
- keeping in a locked receptacle;
- keeping away from children; and
- keeping away from foodstuff.

A16.8 Testing

The testing of fireworks in this section of this Code is complementary to the requirements of the Queensland Fireworks Product Safety Code (not released at the time of printing of this Code). In the interim, testing must be done in accordance with this Code. Suppliers must supply fireworks that have been tested and the product safety and performance of the fireworks are known to be acceptable and certified to validate that the fireworks product safety is acceptable. Testing must not be undertaken at a public display.

Testing should validate that the fireworks are safe and also comply with the acceptance criteria for safety, design, product specification and performance. Testing should be conducted under management plans including a safety management system.

A16.8.1 Chemical Tests

Qualitative chemical tests may be carried out to establish or confirm the composition of the product.

A16.8.2 Safety and Performance Tests

The importer or supplier on each different consignment and type of fireworks must undertake safety and performance testing not

more than 12 months prior to their supply. Additional performance testing may be carried out on stock held for more than 12 months or at other frequencies determined by the manufacturer.

A16.8.3 Additional Safety and Performance Tests

Additional safety and performance testing must be undertaken whenever circumstances occur which may affect the performance of the fireworks 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 fireworks —

- stored fireworks can suffer from moisture absorption or desiccation;
- climatic changes, caused by transporting fireworks from a temperate to a tropical climate, can adversely affect their performance;
- fireworks 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 firework; and
- reports, e.g. from the fireworks contractor, that the firework has malfunctioned.

A16.8.4 Testing Environment

The test must be conducted on level cleared ground. The set-up area should have a radius of at least 10 metres. The fireworks must be prepared in accordance with the instructions supplied. The area for testing must have an exclusion zone at least 25 per cent larger than the exclusion zone required for the conduct of a public display. A fireworks display site at a public display is not a test facility

A16.8.5 Testing Procedure

Testing will be a series of destructive and non-destructive tests on a batch or lot of fireworks. Sampling procedures and sample sizes should be based upon recognised standards, e.g. AS1199.

A16.8.5.1 Physical Examination and Test Firing

The person in charge of the testing must be competent in testing fireworks and in applying the requirements of 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. An example of a check list at testing is provided in Section A16.9. Examples of some tests to be conducted on sampled fireworks on the testing plan are as follows —

- examine the labelling of the firework to ensure that labelling meets requirements;
- examine the firework and its packaging for escaped fireworks composition;
- examine the structural type and integrity of the firework;
- measure and record the safety and performance features including effect of the firework functioning for assessment of compliance. Examples of features for measuring and recording may include —
 - the effects of the firework 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;
 - weight of any piece of paper, cardboard, fabric, plastic-foam or clay which falls outside the exclusion zone.

Some fireworks may perform in a dangerous manner and appropriate precautions should be taken. Appropriate risk control measures including appropriate PPE should be implemented.

A16.8.5.2 Explosive Content - Weight

The explosive content and expected range in weight for Hazard Division classification and NEQ calculations should be validated.

A16.8.5.3 Chemical Testing

A competent person or an accredited certification body should carry out any chemical testing.

A16.8.6 Acceptance Criteria

A16.8.6.1 Compliance with Design Criteria

Fireworks must comply with the general design criteria in Section A16.2. Failure to satisfy any one of the requirements in Section A16.2 constitutes a failure of the firework. Fireworks must also comply with the acceptance criteria for malfunctions of the fireworks. The malfunctions for fireworks should be categorised into a classification of defect. Defects can be categorised into critical, special, major and minor defects. The acceptance criteria should be based on the regime for selecting sample sizes and the categorisation of the defects.

A16.8.6.2 Compliance with Material Safety Data Sheet and Technical Data Sheets

Fireworks must comply with the acceptance criteria for the safety and performance features published in the Material Safety Data Sheet and the Technical Data Sheets. The tests for the samples should be a combination of destructive tests and non-destructive tests.

A16.8.6.3 Acceptance Procedure for Safety and Performance Testing

The results of the safety and performance testing on the batch or lot of fireworks should be presented so that an assessment can be undertaken against the acceptance criteria. The batch of fireworks must be ultimately accepted or rejected using the established criteria and sampling systems.

A16.8.6.4 Records of Testing

Results and methods of testing must be documented and kept for not less than 5 years after the last stock was sold. Records of testing by third party assessors must be provided to the relevant authorities for validation and confirmation prior to distribution of the fireworks to retailers for sale.

A16.9 Fireworks Performance Test – Check List

Firework tested (example)

Name of firework
.....

Manufacturer/Brand
.....

Description

Supplier Date of supply

Consignment identification.
Batch.....Sample Noof.....

Name of testerDate of test

Weather conditions
.....

Results of tests:
YES NO ('Yes' means that the fireworks passes the test. 'No' means that it fails.)

- label contains accurate description, warning and instructions
- fireworks composition not escaping from article
- easily lit with ignition source
- where applicable, fuse burning time
- delay to firing of next tube (of multi-tube firework) <5 seconds
- article functions without exploding (not applicable for crackers, salutes, reports and maroons)
- article or firework 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
- powder weight:

 single tube firework: composition weight
 single tube or cone fountain: composition weight
 multi-tube firework: composition weight
 crackers: composition weight <0.3 g per cracker (black powder) and <50 mg (flash powder)

Comments:
.....
.....
.....
.....

Signature of tester:

Appendix 17

Separation Distances – Storage of Explosives Including Fireworks and Other Activities

A17.1 Quantity Distances for the Stores of Divisions 1.1, 1.2 and 1.3 Explosives

Table A17.1 provides information on the quantity distances for the storage of Hazard Division 1.1 and Table A17.2 provides information on the quantity distances for the storage of Hazard Divisions 1.2 and 1.3

Table A17.1 Quantity Distances for the Storage of Division 1.1 Explosives

Qty stored (Q) kg		Separation distance (D), m					
		Protected works – Class A as defined in AS 2187.0	Protected works – Class B as defined in AS 2187.0		Vulnerable facilities	To other explosives storage	
Gross Mass	NEQ		Unmounded	Mounded		Unmounded	Mounded
100	50	25	180	30	180	18	9
200	100	25	180	38	210	23	12
400	200	35	180	52	260	29	15
600	300	45	180	68	300	33	17
800	400	55	180	82	330	36	18
1 000	500	63	180	95	360	39	20
2 000	1 000	100	180	150	450	48	24
3 000	1 500	135	200	200	510	55	28
4 000	2 000	160	240	240	560	61	31
5 000	2 500	185	280	280	610	66	33
6 000	3 000	205	305	305	650	70	35

Table A17.2 Quantity Distances for the Storage of Division 1.2 and 1.3 Explosives

Qty stored (Q) kg		Separation Distances to protected works (D), metres for Division 1.2				Separation distances to protected works (D), metres for Division 1.3		
		To protected works		To associated works		To protected works		To associated works
Gross Mass	NEQ	Class A	Class B	To other storage – mounded or unounded	To process buildings – mounded or unounded	Class A	Class B	To other storage
100	50	180	180	90	135	60	60	25
500	250	180	180	90	135	60	60	25

A17.2 Separation Distances for Division 1.4 Explosives

The separation distances for Division 1.4 explosives is not a function of the quantity stored up to 500 kg. Storage should be separated from each other and process buildings by —

- (a) 25 metres, if the explosives stored are vulnerable to ignition by radiant heat; or
- (b) 10 metres, for all other explosives.

Storage should generally be separated from Class A protected works by 25 metres, however consideration should be given in each case to the type of explosives (i.e. the hazard presented) and any exposed sites to determine the appropriate separation distance.

Classification Code 1.4S explosives should not require separation but should not hinder any firefighting or other emergency response within 5 metres.

Appendix 18

Sample Calculations of Minimum Clearance Distances

A18.1 Principles

This appendix illustrates the concepts, principles and process that must be used when determining the clearance distances for the exclusion zone for the safe conduct of a fireworks display. These calculations should be done at three different stages for the display. These stages are —

- the planning stage which includes assessing the suitability of the proposed site for the fireworks proposed in consultation with the fireworks event organiser and then for the Notification Form which must be provided at least 7 days before the display;
- setting up the display at the display site for the forecast conditions that are anticipated at the time of the display; and
- immediately before the commencement of the display should the existing conditions be at variance with the forecast conditions for the display and will affect the actual clearances distances required for the display.

Below are detailed worked examples showing how the calculation of minimum clearance distance for the exclusion zone may be undertaken.

A18.2 Example

An event organiser wants a display on a field 200 metres round (in diameter). It is proposed to fire 75 mm aerial shells with a delay chain-fused finale of 75 mm shells at the end. The fireworks event organiser has advised that there is normally a 8 km/h breeze blowing at the time of the display from the south east. A service station is located 350 metres away from the north fenced boundary of the oval.

A18.2.1 Planning Stage

The minimum default clearance distances

The minimum default clearance distances are determined using Section 14.5.2.1 and Table 14.1 of this Code.

- For 75 mm aerial shells 75 metres minimum is required
- For delay chain-fused 75 mm aerial shell finale: 150 metres minimum is required

(Note: These distances are calculated using the 1 millimetre per metre rule of Table 14.1 and doubling the distance for delay chain-fusing.)

Effect of wind

The effect of wind using Section 14.5.2.3 of this Code then needs to be calculated.

All fireworks have their effects reaching higher than 15 metres (reference supplier's Material Safety Data Sheet and Technical Data Sheet), therefore wind needs to be considered and the added risk assessed.

From Table 14.2, addition to minimum clearance distance for an 8 km/h breeze is 15 metres minimum. (In practice, manufacturer supplied-information would be used.)

Effect of angled fireworks

The fireworks will be fired vertically, therefore no correction for angle is planned.

Effects on fallout zones

Advice from manufacturer is that hazardous debris fallout will extend 50 metres downwind for a wind speed of 8 km/h. Therefore the firing site needs to be at least 60 metres minimum downwind from spectators (perimeter of the exclusion zone) – allowing 10 metres buffer (refer to Section 15.5.2.1).

Location of special and vulnerable facilities

The location of the nearest special and vulnerable facility is a service station 350 metres away from the north fenced boundary.

Calculation of minimum clearance distance

The minimum clearance distance required for the display is then calculated by using the

minimum default clearance distance for a particular firework and adding corrections for wind, angled fireworks, fallout of hazardous debris, location of special and vulnerable facilities, etc.

For 75 mm aerial shells

In this instance, the minimum clearance distance is calculated by summing the following —

Description	Distance (metres)
Minimum default clearance distance	75
Allowance for 8 km/h wind	15
Allowance for angled mortars	0
Total	90

The manufacturer of the fireworks has recommended that hazardous debris fallout will extend to 50 metres downwind at a wind speed of 8 kilometres per hour and hence these fireworks would require at least 60 metres distance from spectators (perimeter of the exclusion zone).

Hence the greater of these two calculations is used to determine the required minimum clearance distance – in this case 90 metres minimum, and hence such a display on a field having a 100 metre radius is possible.

For delay chain fusing of 75 mm aerial shells

In this instance, the minimum clearance distance is calculated by summing the following —

Description	Distance (metres)
Minimum default clearance distance	150
Allowance for 8 km/h wind	15
Allowance for angled mortars	0
Total	165

Hence in this instance, because the field only has a 100 metre radius, delay chain fusing is not possible.

As the service station is more than twice the minimum clearance distance, it should not be problem.

A18.2.2 Setting Up Display

When setting up the display, the forecast is for winds from a southerly direction at 15 kilometres per hour. Such a wind would suggest a 30 metre correction (using Table 14.2). The calculated minimum clearance distance would now be —

Description	Distance (metres)
Minimum default clearance distance	75
Allowance for 15 km/h wind	30
Allowance for angled mortars	0
Total	105

This would now suggest that the field with just 100 meters radius is insufficient for the display. However, this issue may be resolved by —

- clearing spectators from the area affected by the wind (adjusting the perimeter of the exclusion zone);
- moving the display site away from the centre of the field upwind by 5 metres, thereby making all minimum clearance distances satisfactory; or
- some other risk mitigation method which reduces the risk from the higher winds.

The service station is still at an acceptable distance.

A18.3 Time of Display

Before firing the display, the conditions must be revalidated and reassessed to ensure that the clearance distances for the display remain appropriate for an acceptably safe display.

Appendix 19

Strings of Crackers

A19.1 Strings of Crackers

This section applies to the use of strings of crackers at a display where only strings of crackers are used, such as Chinese New Year celebrations. For strings of crackers used as a part of outdoor fireworks displays, the general requirements for separation distances at outdoor display apply and any prohibitions applying to string of crackers where only strings of crackers are used do not apply.

A19.2 Prohibitions

The following prohibitions apply to strings of firecrackers where only strings of firecrackers are used in displays such as Chinese New Year celebrations —

- strings of crackers emitting hard projectiles (e.g clay plugs) must not be used;
- strings of crackers must not have the large bundle of crackers attached to the end of the string (report or head-roll); and
- the strings of crackers must not be of a larger internal diameter than Po-Ha's type firecrackers (e.g. 45 mm long by 10 mm outside diameter maximum).

A19.3 General

Prior to the display, permission must be obtained from the occupier and other relevant bodies e.g local council, and notification given to the Explosives Inspectorate, police, Fire Brigade and Department of Transport (where relevant). Neighbouring premises must also be advised of the intended display.

Strings of celebration crackers must only be supplied to licensed contractors and must be under the control of the licensed contractor at all times.

In accordance with the *Abatement of Nuisance Noise from the use of Fireworks Guideline* issued by the Environmental Protection Agency, displays should occur between the following hours:—

- Monday to Thursday 7am to 9pm
- Friday and Saturday 7am to 10pm
- Sunday and Public holidays 1pm to 9pm

For events proposed outside the above timeframes, written approval must be obtained from the Explosives Inspectorate.

A19.4 Security

At no time is the string of Chinese crackers to be left unattended. This applies from the time the firecrackers are brought on site before setting-up until the firecrackers are lit.

A19.5 Safety Considerations

The operator must supply at least one 9 litre water fire extinguisher to AS1841.2, or equivalent, and one 10 litre container of water. Fire extinguishers must be tested and tagged.

The area within a minimum 10 metres of the string of crackers must be cleared of all spectators. If there are potentially harmful effects, the clearance distance must be increased accordingly. Should other fireworks be used in a display where strings of crackers are used, the minimum clearance distances for those fireworks must comply with calculated minimum clearance distance in Section 14.5.2 of this Code. Only those persons lighting the fireworks and the Lion Dancers must be permitted in the cleared area from when the string of crackers is set up or prepared for firing, through to when the fireworks are lit and functioning. Effective crowd control measures such as physical barriers or security guards should be employed to ensure compliance with this requirement.

It is the obligation of the operator and the organiser to notify spectators of their responsibility to stay outside of the restricted area and to enforce this requirement.

Following a risk assessment, the fireworks contractor will document procedures in the safety management system, This will include requirements for protective clothing and equipment.

All fireworks operators, assistants and Lion Dancers within the restricted area must wear appropriate and suitable personal protective equipment (PPE) which as a minimum should include ear and eye protection.

A19.6 Display Set-up

The string of celebration crackers must be suspended in a manner that does not contribute or cause any damage to any building, vehicles, or other property likely to be damaged by exploding fireworks, or injury to persons.

If a T-shaped light tubular stand is used to suspend the string of celebration crackers, the string of crackers must be at least 300 mm away from the steel stand at all times. Strings of crackers in excess of 2 metres long will be heavy so ensure any stands used are adequately secured to prevent the stand from falling over or toppling.

A protective covering manufactured from suitable materials with a minimum clearance distance may be used around the string to reduce the incidence of projected firecrackers exploding in close proximity to the crowd. The shroud also reduces the chance of unexploded firecrackers being accessible to unauthorised people. The shroud also makes cleaning up after the display easier.

A19.7 Post-display Activities

The fireworks operator must search for unexploded firecrackers after the display. Unauthorised people are not permitted to enter the display area until the area is cleared by the operator after all post-display activities are concluded.

The debris must be immediately swept up and placed in a suitable receptacle so that control of the debris containing unfired firecrackers is maintained.

It is the responsibility of the fireworks contractor and fireworks operator to ensure proper disposal of this material and to ensure control of any unfired firecrackers.

All unfired firecrackers must be destroyed by the operator and unfired firecrackers must not be supplied to any person who does not hold a licence.

A service is provided at Government Explosives Reserves for the disposal of unwanted fireworks including firecrackers.

Appendix 20

Floating Vessels and Floating Platforms

A20.1 Introduction

In general, the duty of care obligations of responsible persons in Part B Section 3.3 and Appendix 12 of this Code apply. The requirements for fireworks, fireworks equipment, clearance distances and exclusion zones, securing of fireworks, setting up the display, managing the display and post-display activities etc. are similar to those requirements of this Code. This Appendix will clarify the specific requirements applying to floating vessels and floating platforms because of the special nature of this activity.

A20.2 General

A.20.2.1 Specific Hazards

Firing fireworks from a floating platform, such as a raft, pontoon or barge, presents a special hazard since this type of platform can be unstable from waves and currents. The floating platform can recoil from the fireworks 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 fireworks operator and fireworks operator's assistants cannot move about the platform as freely as on firm ground. Additional hazards and risks on vessels and platforms include —

- the closeness of the fireworks operator and the operator's assistant(s) to the fireworks;
- the increased potential for the fireworks operator or the operator's assistant to slip or trip; and
- the hazards associated with the water itself.

A20.2.2 Requirements for a Floating Vessel or Floating Platform.

A20.2.2.1 Construction

A floating vessel and or floating platform must be of sufficient strength and stability to enable all activities associated with the firing of the display to be conducted safely. The types of fireworks and the placement of the fireworks, fireworks equipment (including

mortars and securing equipment) must not jeopardise the stability of the site structures and seaworthiness of the floating vessel when the fireworks are fired.

A20.2.2.2 Identification

The floating vessel or floating platform must be identified as an explosives vessel or platform from the time that the fireworks are taken on board at initial set-up until the fireworks operator declares the vessel or platform free from fireworks.

The platform or vessel must be fitted with standard fireworks warning signs described in Section 15.7.2 of this Code. The number of signs used should be based on permitting the ready identification of the presence of fireworks 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.

A20.2.2.3 Staffing

A floating vessel or floating platform may be staffed or unstaffed, provided that —

- the fireworks 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.

A20.2.2.4 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 fireworks. Portable power-generation equipment and material-handling equipment deemed necessary for the performance of the display may be permitted.

A20.2.2.5 Safety Shelter

Floating vessels and floating platforms that are staffed during electrical firing must have a safety shelter which is located as far as practicable away from the fireworks. The safety shelter must be designed and constructed to withstand the impacts and effects from the fireworks to be fired (such as low bursting aerial shell, impact from a dud aerial shell, direct impact from a Roman candle, barage or cake). 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 fireworks display set-up and above, e.g. malfunctioning fireworks and dud aerals.

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 fireworks operator and the fireworks operator's assistants.

A20.2.3 Requirements for Fireworks

A20.2.3.1 Types

Small calibre fireworks, such as ground level fireworks, 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 firework firing up to an additional angle of 10 degrees to the horizontal.)

Aerial fireworks must be fired only from a vessel or platform of substantial size where stability is ensured.

A20.2.3.2 Storage

The storage of fireworks for a future display on board a floating vessel or platform when the floating vessel or platform is already set up for a display is prohibited.

A20.2.4 Requirements for Health and Safety Equipment

A20.2.4.1 PPE

In addition to the requirements for PPE identified in Sections 5.4.1.6 and 15.3.2 of this Code, the provision and wearing of PPE including flotation devices must be determined by undertaking a risk assessment for the activities to be undertaken.

Persons undertaking activities on a floating vessel or platform involving managing the display and post-display must wear a flotation device. All PPE including flotation devices when not required to be worn must be readily available.

A20.2.4.2 Fire Protection Equipment

The requirements for fire protection equipment are the same as in Section 15.3.1 of this Code.

A20.3 Setting Up 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 be slept in two locations:—

- the set-up location; and
- the display site.

The following requirements for setting up the display are in addition to the requirements in Section 15 of this Code.

A20.3.1 Electric Firing of Display

Only electric firing of displays on a floating vessel or platform is permitted. Hand firing is prohibited.

A20.3.2 Egress Paths

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.

A20.3.3 Overhead Obstructions

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.

A20.3.4 Minimum Clearance Distances

The requirements for calculating minimum clearance distances for the display and for setting-up are the same as those in Sections 14.5 and 15.4 of this Code. The vessel must be positioned to maintain the minimum clearance distance at all times during the display.

A20.3.5 Exclusion Zone for Setting Up and Transport

The exclusion zone for setting up the display and for transporting the display set-up on the vessel is the same as in Section 15.4 of this Code. The exclusion zone must be defined so that unauthorised persons and unauthorised vessels and vehicles are restricted from entry.

A20.3.6 Transport from Set-up Location to Display Site

The vessel transporting the fireworks set-up from the set-up location to the display site is not required to be licensed.

A20.3.7 Securing Fireworks and Fireworks Equipment

The methods for securing the fireworks and associated equipment must be directed by the fireworks contractor. Methods for securing may be different from land-based applications.

A20.4 Sleeping the Display

The minimum clearance distances requirements for sleeping a display remain the same as in Section 15.4 of this Code.

A20.5 Managing the Display

A20.5.1 Emergency Response

A watercraft ready and capable of providing rapid emergency response must be present during the display.

A20.5.2 Personnel

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.

All personnel aboard a floating vessel or floating platform during the display must wear a floatation device with a visual location device.

A20.5.3 Communication System

An effective communication system, such as mobile phones, or a two-way radio, must be available on the vessel to communicate with the emergency support team, the fireworks event organiser and other agencies.

Appendix 21 Segregation of Dangerous Goods

Table A21.1 Segregation of Dangerous Goods

CLASS	1	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6	7 ⁽⁵⁾	8	9	Food and Food Empties	Fire Risk Substances
1 (Explosives)	⁽¹⁾ N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	N
2 (Flammable Gas)	N	0	0	0	0 ⁽²⁾	N	N	N	N	N	0	N	0	0	0	0
2.2 (Non-flammable Non-Toxic gas)	N	0	0	0	0	0	N	0	0	N	0	0	0	0	0	0
2.3 (Toxic Gas)	N	0	0	0	N	0	N	0	N	N	0	0	0	0	N	0
3 (Flammable Liquid)	N	0 ⁽²⁾	0	N	0	0	N	0	N	N	0	N	0	0	0	0
4.1 (Flammable Solid)	N	N	0	0	0	0	N	0	N	N	0	N	0	0	0	0
4.2 (Spontaneously Combustible)	N	N	N	N	N	N	0	0	N	N	0	N	0	0	0	0
4.3 (Dangerous When Wet)	N	N	0	0	0	0	0	0	N	N	0	N	N	0	0	0
5.1 (Oxidizing Agent)	N	N	0	N	N	N	N	N	0	N	0 ⁽³⁾	N	N	0 ⁽⁴⁾	0	N
5.2 (Organic Peroxide)	N	N	N	N	N	N	N	N	N	0	0 ⁽³⁾	N	N	0 ⁽⁴⁾	0	N
6 (Toxic)	N	0	0	0	0	0	0	0	0 ⁽³⁾	0 ⁽³⁾	0	0	0	0	N	0
7 (Radioactive)	N	N	0	0	N	N	N	N	N	N	0	0	N	0	N	0
8 (Corrosive)	N	0	0	0	0	0	0	N	N	N	0	N	0	0	N	0
9 (Miscellaneous Dangerous Gds)	N	0	0	0	0	0	0	0	0 ⁽⁴⁾	0 ⁽⁴⁾	0	0	0	0	0	0

NOTES:

0 means compatible.

N means incompatible.

(1) see Table A4.2

(2) means incompatible when both classes are in bulk.

(3) means incompatible when Class 6 substance is a fire risk substance, and may therefore not be loaded into the same vehicle or freight container without appropriate segregation.

(4) means incompatible when Class 9 substance is a fire risk substance, and may therefore not be loaded into the same vehicle or freight container without appropriate segregation.

(5) for segregation of undeveloped photographic film, personnel and mail - see requirements of the Code of Practice for the Safe Transport of Radioactive Substances.

Appendix 22

Securing Fireworks and Equipment

A22.1 General Requirements

All fireworks and associated equipment must be properly secured so that the fireworks and equipment do not become disturbed, dislodged or knocked over, or having the orientation changed regardless of the nature of the surface during a display, through normal or abnormal functioning of the fireworks, adjacent fireworks or through any other activity. The methods used to secure the fireworks must be effective for all circumstances and conditions that may exist for the setting up, sleeping and conduct of the fireworks display.

The fireworks contractor may adopt the methods proposed by the fireworks supplier or fireworks equipment supplier or alternatively develop methods to properly secure fireworks and any associated equipment. The methods adopted by the fireworks contractor must be effective. The fireworks contractor must document all the methods, procedures, practices, equipment and materials for securing the fireworks permitted by the fireworks contractor in the safety management system. Performance criteria and testing procedures to ensure that securing is effective during the display should be documented in the safety management system.

A22.2 Methods of Securing Fireworks

Table A22.1 below provides information on recommended methods of securing fireworks that may be used by fireworks contractors for different surfaces and applications. These methods cover the different types of fireworks and applications where the fireworks must be secured. Table A22.2 below provides details on the methods of securing fireworks items which are presented in the columns in Table A22.1. These methods are described by a brief description and notes on the method of securing.

Table A22.3 provides notes for the applications and notes described in Table A22.1 and A22.2

Some illustrations in sketch form of methods of securing multishots, pre-loaded barrages, Roman candles and fountains are provided.

Further examples of methods of securing fireworks are shown in a series of photographs in Section A22.5. These sketches and photographs were supplied by representatives of the fireworks industry associations.

Table A22.1 Securing Fireworks 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 A22.1 Securing Fireworks 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

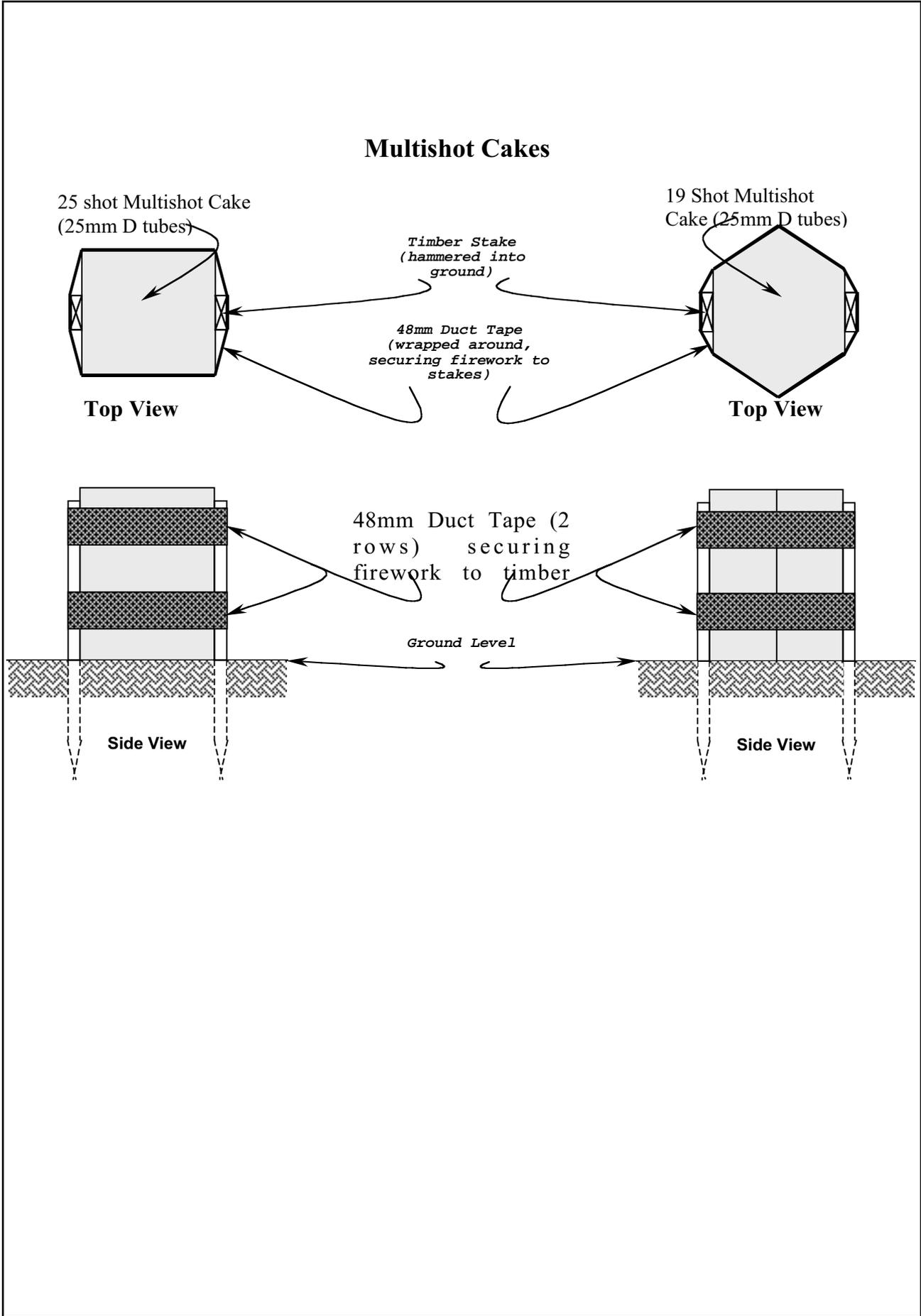
Table A22.2 Details of Methods of Securing Fireworks Items

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"x4" timber post, purpose designed attachment, post secured by star pickets
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 or sand bagging
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

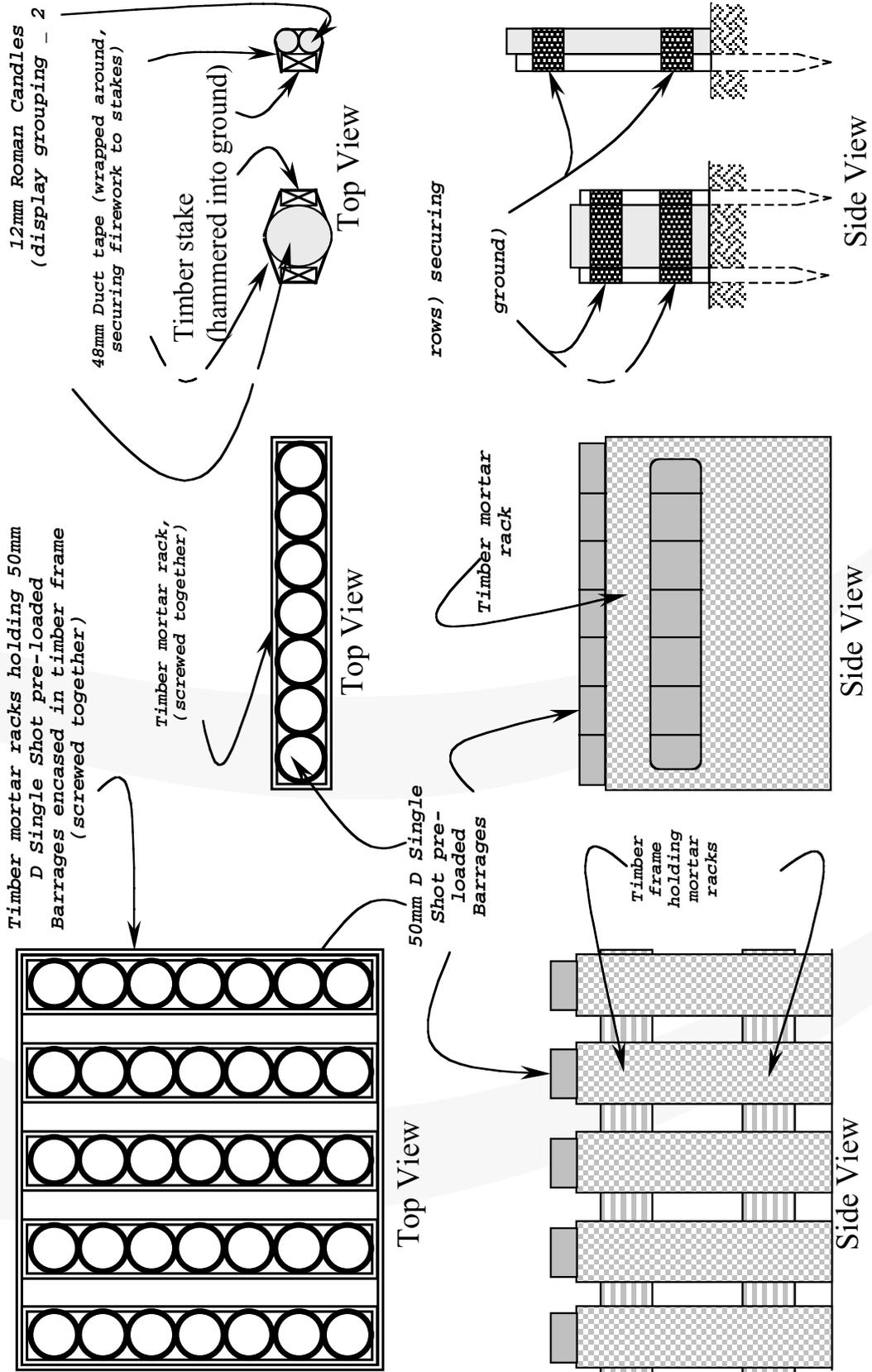
Table A22.3 Notes for Applications and Items in Tables A22.1 and A22.2

Barges	Floating launch vessels including pontoons
Barrier	A solid wall able to physically separate item and its effects in event of worst-case malfunction from audience
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
Sand bags	Unrestrained sand should not be used to secure items. Sand must be bagged or contained in box, tub, skip, trench, plywood panels etc.
Staking	Preferably 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, fibre reinforced tape. Not masking tape. Multiple turns required, item must be rigidly held.
Trailers	Towed wheeled vehicle holding racks of mortars
Unstable cakes	Multishot items with centre of gravity above one third item height
Zip ties	Plastic zip ties should not be used to secure any fireworks item
NB	The methods for securing fireworks described in this matrix are not meant to be comprehensive. Alternative methods of securing fireworks may be available, and if they offer better security they should be used.

A22.3 Illustrative – Firework Securing Methods



Single Shot pre-loaded Barrages, Roman Candles & Fountains



A22.5 General Photos of Secure Fireworks Device







Appendix 23

Aerial Shell Range Tables

A23.1 Drift of Shells from Angle and Wind

This appendix provides an illustration for information purposes only of the range in metres for the drift of aerial shells of various shell diameters for a range of angles from the vertical in a range of wind speeds. The tables presented below are based on a shell being a dud and the range being estimated for the shell returning to the ground unexploded. The tables demonstrate the effect of angle from the vertical only and also in combination for the distance various shells will move horizontally (range) for a selected wind speeds. The contribution from random shell drift is not illustrated in this Appendix. It must be noted that when shells are fired in ideal conditions, i.e. at wind speed 0 km/h

and 0 degrees from the vertical, they will not have a range of 0 metres. There will be a random scatter to a maximum distance from the point of firing.

Suppliers when providing performance data in their Technical Data Sheets should provide performance data based on contributions from wind speed, angle from the vertical, maximum dispersion of the shell under ideal conditions, etc for the calculation of minimum clearance distance and the random scatter of shell drift. The technical literature provides information on these issues to assist both suppliers and fireworks contractor's in complying with their duty of care obligations.

Table A23.1 Shell Drift (metres) Wind Speed 0 km/h

Shell diameter	<i>Angle from vertical [degrees]</i>						
	<i>0</i>	<i>5</i>	<i>10</i>	<i>15</i>	<i>20</i>	<i>30</i>	<i>45</i>
50mm	0	24	48	69	88	120	152
62mm	0	29	57	82	105	143	179
75mm	0	33	64	93	119	161	202
100mm	0	40	79	114	145	197	245
125mm	0	47	91	132	169	229	284
150mm	0	53	103	150	191	258	319
175mm	0	59	114	165	211	285	351
200mm	0	64	124	180	230	310	382
225mm	0	73	143	207	264	355	434
250mm	0	82	159	230	294	396	482

Table A23.2 Shell Drift (metres) Wind speed 5 km/h

Shell diameter	Angle from vertical [degrees]						
	0	5	10	15	20	30	45
50mm	13	38	61	83	102	134	163
62mm	14	43	71	96	119	157	191
75mm	15	48	79	108	134	176	215
100mm	15	56	94	130	162	213	259
125mm	16	63	108	149	186	246	299
150mm	16	70	120	167	209	275	334
175mm	16	75	131	183	229	302	366
200mm	17	81	142	198	248	329	397
225mm	17	90	160	225	282	374	451
250mm	16	98	177	249	313	415	500

Table A23.3 Shell Drift (metres) Wind speed 10 km/h

Shell diameter	Angle from vertical [degrees]						
	0	5	10	15	20	30	45
50mm	26	51	74	96	116	147	175
62mm	28	57	85	111	134	171	204
75mm	29	62	94	123	149	191	228
100mm	31	71	110	146	178	229	273
125mm	32	79	124	166	203	262	313
150mm	33	86	137	184	226	293	350
175mm	33	92	148	201	246	321	382
200mm	33	97	159	215	266	346	412
225mm	33	107	177	242	301	392	467
250mm	33	115	194	266	331	433	515

Table A23.4 Shell Drift (metres) Wind speed 20 km/h

Shell diameter	Angle from vertical [degrees]						
	0	5	10	15	20	30	45
50mm	53	77	102	123	142	173	198
62mm	56	85	113	140	162	199	227
75mm	59	92	123	154	179	221	254
100mm	62	102	141	177	210	261	301
125mm	64	111	157	199	236	296	343
150mm	65	119	170	218	261	327	380
175mm	66	124	182	235	282	356	414
200mm	66	130	192	250	302	382	444
225mm	67	140	211	278	336	428	499
250mm	66	147	228	301	367	470	548

Compiled using Shell Predictor v1.0
by John Harradine, Explosives Inspectorate, Department of Natural Resources and Mines, Queensland, Australia

Effective 19 August 2002

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