



Special Effects Hazard Guide

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Disclaimer

In legislative terms, the requirements of the *Work Health and Safety Act 2011* (the WHS Act) and Work Health and Safety Regulations (the WHS Regulations) are mandatory. In contrast, a guide is designed to assist obligation holders to comply with the requirements of an act or regulation. The information contained in the LPA guides is not mandatory, has no legal status and may not apply in all work situations.

Obligation holders still have a duty to assess the risks in each work situation and take all reasonable steps to eliminate or minimise the risks that are specific to each work activity.

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1. Overview

This guide provides information to assist in managing risks associated with working with **special effects** in live entertainment and events. Information in this guide is based on the Work Health and Safety Act 2011 (WHS Act) and Work Health and Safety Regulations 2011 (WHS Regulations), which are operational in all states except Victoria and WA, where adoption of the legislation is not yet enacted (as at Jan 2018).

It is recommended that this information is referenced during the planning and delivery of events to assist in identifying hazards, assessing risks and determining appropriate control measures to eliminate and or minimise these risks, so far as reasonably practicable. This guide does not replace the need to implement risk management strategies, undertake research or seek specialist advice.

Each worker and person conducting a business or undertaking (PCBU) has a responsibility to understand their obligations under WHS legislation. Codes of practice and Australian and international standards provide approved guidance on how to meet work health and safety obligations.

Special effects hazards can cause many types of injuries and in extreme cases, death. Types of injuries can include burns, slips and falls, flash/eye injuries, hearing issues. Special effects hazards can also result in fire, water damage, explosions, hazardous leaks and spills. The risk of injury from special effects is strongly linked to where and how they are used. The risks are greater when working with portable equipment, custom made equipment/props, or with fragile equipment that can be damaged through repeated use and movement.

There will always be something new, something bigger, brighter and more 'special' to thrill and excite audiences. The desire to create a spectacular special effect that has never been seen before is both understandable and inevitable. This continual innovation and invention brings a special responsibility to the process of managing hazards associated with special effects. The sometimes unknown consequences of a newly-designed special effect require that extensive testing is undertaken within a controlled environment. This should occur before the introduction of all other elements, whether they are scenic elements, performers, technicians or audiences.

This Special Effects Hazard Guide provides practical information and suggested control measures for items such as:

- Naked Flame – flame effects
- Pyrotechnics
- Projectiles – air propelled projectiles, drop effects, confetti, petals, balloons



- Atmospheric – smoke, hazers, dry ice
- Noise
- Water
- Hazardous Props – breakaways, breakables, exploding, sharps
- Firearms – weapons, replicas
- Lighting – lasers, strobes, strobe like effects, UV lighting
- Cooking – on set/stage
- Practical household appliances – toasters, irons
- Wind – fans

Part 1, Safety Guidelines for Live Entertainment and Events provides general information on duties, obligations and risk management.



2. Key Considerations – Special Effects

The following questions must be considered during event design, planning and delivery. Use them to identify hazards and plan how risks will be managed.	Yes	No	Comments/Action
2.1 Design and planning			
<i>Has the scope of work been clearly defined (duration, equipment, scheduling, location)?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have other PCBUs and workers who will be affected by this activity been identified?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have arrangements been made to consult with and coordinate activities with other PCBUs?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have site/venue specific safety requirements or procedures been considered?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Has appropriate planning been undertaken for the transport of the special effects?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Has appropriate planning been undertaken for the storage of the special effects?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have Safe Work Method Statements (SWMS) been sought from the manufacturer/supplier of the special effects?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Does the venue need to sign off/approve the special effect prior to use?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Has this special effect been used before?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have all pieces of electrical equipment relating to the special effect been visually inspected, tested and tagged?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Will there be a requirement for an ongoing special effects equipment maintenance program?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have appropriate Safety Data Sheets (SDS) been obtained?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Where required, have appropriate approvals been sought and granted?</i>	<input type="checkbox"/>	<input type="checkbox"/>	



2.2 Event delivery			
<i>Have the people working with the special effects been given information, instruction and training?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have all people within proximity of the special effect during its operation been briefed and rehearsed?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Are appropriate emergency procedures in place?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have all safety checks and risk management procedures been undertaken?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have there been visual and other inspections of special effect sites, including those remote to the operator?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Are safety officers, crowd controllers, ushers, spotters briefed and in place?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Are appropriate audience warnings in place?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Have all pieces of electrical equipment relating to the special effect been visually inspected, tested and tagged?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Has the possibility that additional hazards may be introduced by a combination or sequence of effects been considered? (Have the various special effects been risk-assessed in a holistic as well as individual effect manner?)</i>	<input type="checkbox"/>	<input type="checkbox"/>	



3. General Guide – Special Effects

3.1 Responsibilities

The Model Work Health and Safety Regulations impose specific requirements on PCBUs concerning work that involves noise and hazardous chemicals both a part of the special effects industry, including:

- Exposure of workers to noise at the workplace requiring PCBUs to carry out audiometric testing where a worker is frequently required to use PPE to guard against excessive noise
- Health monitoring in respect of workers carrying out specific work for the business in relation to hazardous chemicals

Duty holders may also have additional responsibilities under state regulations.

3.2 Training and competence

Different licensing and competency requirements apply across Australian states and territories. Across the myriad special effects utilised in the entertainment industry there are regulated, non-regulated and legislated requirements for many of the effects. Responsible persons should check with their state authorities to clarify what type of licence/s is/are required in the relevant jurisdiction.

The rehearsal of special effects under show conditions is imperative to the ongoing and repeated safe delivery of special effects. In circumstances where multiple special effects are designed to run sequentially or concurrently, it is important to structure rehearsals in a manner that progressively builds to the full effect. For example – start under work light with limited other distractions. Once competence and familiarity builds, introduce other elements, effects and hazards such as stage lighting, sound, pyrotechnics, hazers, methodically and systematically, until the full array of effects is operating safely and predictably within the performance environment.

3.3 Consultation, co-operation and co-ordination

The WHS Act makes consultation with workers a legal requirement. Consultation, cooperation and coordination between PCBUs is a requirement where they share a duty for the safety of a worker or for work to be done.

PCBUs should use the information in this guide to consult with workers including event staff, to determine the hazards and risks associated with planned special effects and how to best eliminate or minimise these risks using the hierarchy of controls.

Consultation should start as early as possible, before decisions are made, and continue through the duration of the event.



Consider the other parties who will need to be involved in the consultation process in the planning stages of the event and determine what information needs to be shared and discussed as part of your risk assessment.

During an event, PCBUs are required to consult, co-operate and co-ordinate with other parties such as the venue or site management, unions, production companies, designers*, event organisers or promoters, catering providers, security, subject matter experts such as licensed pyro technicians or safety officers, local authorities or governments, rigging companies, performers, suppliers of plant or equipment.

If employees are represented by health and safety representatives the consultation must involve those representatives.

Areas to address during consultation may include induction, schedules, floor plans, set elements, lighting and sound designs, site specific requirements, risk assessments, SWMS, SDS, hazards and control measures, legislative requirements, licences, plant movement, traffic management, exclusion zones, key contacts, emergency procedures, permits to work. Opportunities for consultation include toolbox talks, event briefings, site inspections, stakeholder meetings, post event reviews, working groups or forums.

*NOTE – Designers have an additional responsibility to prepare a risk assessment on how items they have designed can be used safely. PCBUs have a responsibility to request this risk assessment from designers to ensure they are fully informed as to all aspects of the design.

3.4 Design and planning

In the early stages of design and planning for an event, the following criteria should be addressed when planning to work with special effects:

- Consultation with relevant PCBUs and workers
- Consultation with all departments that will be affected by the use of the special effect
- Determining whether a specialist is required for the realisation of the special effect
- Development of separate risk assessments and SWMS, including controls agreed to during consultation, for each individual special effect
- Selection of equipment needed to realise the special effect
- Agreed scheduling and allocation of resources to minimise impact on others
- Access to site and delivery logistics
- Appropriate storage facilities for special effects equipment and consumables
- Specific maintenance programs for special effects equipment



- Emergency procedures in the event the special effect fails at cue time or occurs adversely pre or post cue
- Identification of any residual hazards that may exist after special effect has finished, e.g. unexploded pyrotechnics
- Development and documentation of a clear hierarchy of command, that is, a series of 'go' or 'no go' protocols that is followed prior to each special effect or series of special effects being cued to 'go'

3.5 Event delivery

In the delivery stages of an event (bump-in, rehearsal, show, performance, bump-out) the following criteria should be addressed when undertaking work with special effects:

- Consultation with relevant PCBUs and workers
- Site-specific inductions
- Equipment inspections and/or maintenance
- Work permits or engineering certificate requirements
- Equipment and environment checks – daily, weekly and pre and post show
- Post show analysis and checks for residual unexpected risks
- Implementation and monitoring of controls identified in risk assessments or SWMS
- Compliance to legislative requirements
- Review, consultation and adjustment control measures as required on site
- Incident reporting, management and communication procedures
- Sign-off and handover procedures

3.6 Review

After an event, the following criteria should be reviewed in consultation with relevant parties:

- Incident reports and outcomes including near-misses.
- Effectiveness of the control measures
- Scheduling
- Areas for improvement
- Incidents of non-compliance
- Any new hazards or risks identified



3.7 Documentation and records

The following documents and records should be created, maintained and kept on site when working with special effects during an event:

- Risk assessments and SWMS
- Training records, certificates of competency and licences
- Induction records
- Toolbox talk topics and attendance
- Evidence of consultation
- Incident reports, including near-misses
- Maintenance records
- Engineering certification, work permits and sign-off records.

Any of the above documents could be requested to be sighted by other PCBUs for verification or clarification and should be available at all times.

Some WHS documents and records need to be retained for a specific period of time – see relevant WHS legislation for details.

4. Suggested Control Measures

4.1 General special effects

Events/Performances often contain one or more special effect/s. Each special effect is often unique in its effect, it is therefore important that each special effect is carefully and systematically risk assessed and managed due to the serious consequences that may result from an uncontrolled effect going wrong. In addition, once each effect is individually risk assessed, a combination or sequence of effects should also be risk assessed as a whole.

All equipment must be well maintained and must not be used if it appears faulty. Workers must be trained in conducting routine inspections and clearly understand how to report worn, faulty or damaged equipment.

Unsafe equipment must be disconnected or isolated and 'out of service' ('lockout') tagging procedures must be understood. 'Return to service' procedures should be understood and include testing of equipment prior to use.



4.2 Naked flame – flame effects

Often inspection and approval of a proposed naked flame and naked flame special effect must be carried out by a suitably qualified person – someone who has acquired the knowledge and skills to carry out the task through training, a qualification or experience.

In some jurisdictions only the local fire brigade can carry out this inspection. In some states there is a requirement that a qualified person is present for the entire performance where a naked flame or flame effect is being used.

In addition to any special firefighting staff, equipment and procedures identified by the risk assessment, control measures could include:

- Removing combustible materials from the proximity of the flame
- Ensuring that all scenic elements and costumes are appropriately fireproofed

4.3 Pyrotechnics

These are high-risk special effects and in most circumstances their setting and use is restricted to a Licensed Pyrotechnic Technician.

Each pyrotechnic special effect requires a rigorous risk assessment with a range of controls introduced.

There are mandated record keeping requirements for pyrotechnics and pyro-technicians. Each state and territory has its own legislation and regulations governing the use of pyrotechnics.

4.4 Projectiles – air propelled projectiles, drop effects, confetti, petal drops, balloons

Ensure that the discharge of projectiles is not toward performers, technicians or audience members. Contents of effects such as confetti cannons need to be made of soft materials with the aim of eliminating the chance of strike injuries.

Any pressure settings have to be rigorously checked and refined for each deployment of the effect, especially in touring situations where the size of the effect may need to change when the venue size varies.

Effects such as confetti and petal drops require setting and operating procedures that eliminate the introduction of foreign and potentially dangerous particles into the drop. Dust and other particulates or projectiles could lead to injury or health problems.

4.5 Atmospheric – smoke, hazers, dry ice

Only approved substances are to be used in the production of atmospheric effects such as smoke, haze and dry ice. Safe Work Method Statements (SWMS), Safety Data Sheets (SDS) and risk assessments are all essential to assist in eliminating risks associated with atmospheric effects such as slips, falls, asphyxia, disorientation.



Control measures could include:

- Ensuring appropriate ventilation to guard against oxygen depletion
- Monitoring CO² and O² levels
- Placing smoke machines and hazers in trays or containers to capture excess residue or spills
- Safe storage of fluids
- Using the correct fluid

4.6 Noise

Part 4.1 of the Work Health and Safety Regulations impose specific duties and obligations on PCBUs regarding the exposure of workers to noise at the workplace and should be consulted.

In the context of the entertainment and event industry, noise can be generated from a number of sources beyond plant and equipment. Sound systems and aural sound effects can be classified as a noise risk within the workplace and must be treated as a potential risk to the health and wellbeing of everyone exposed to loud and prolonged sound levels.

4.7 Water

Use of large quantities of water for a special effect can bring with it many types of hazards, including electrical shocks or electrocution, flooding (water damage), water borne contaminants, disease and parasites. Each of these risks needs to be assessed and appropriate control measures put in place.

Control measures include

- Use of appropriately designed and engineered holding tanks and transfer equipment that remove the potential for leaks or bursts
- Appropriate water filtration and treatment to ensure that the water used in the special effect remains free of contaminants, disease and parasites

4.8 Hazardous props – breakaways, breakables, exploding materials

Specialist props can be a source of risks particularly when they are breakaways, sugar glass, exploding or other breakable materials. Special care should be taken when designing and constructing these special effects, and the execution of them should be undertaken in a controlled manner. Extensive trials and rehearsals will be required in order to mitigate risks and unintended outcomes that could endanger the health and safety of crew, performers, audience members or the public.



4.9 Firearms – blank firing, replicas and imitations

All firearms, whether a replicas or an imitation, regardless of the construction or workings, is considered 'a real firearm' and therefore requires a special permit from the Australian Firearms Registry. This also includes realistic-looking plastic toys.

The use of any form of replica or imitation firearm in an event/performance environment will require the oversight of a specialist armourer. The armourer will train all performers and non-performers in the safe handling, use, care and storage use of the firearms. Each state and territory has prescriptive legislation that controls the supply and use of such items. This legislation should be consulted prior to any use of firearms within a production or event.

Repeated rehearsals in a safe and controlled environment are essential to the safe use of firearms in an event/performance environment. Special facilities such as appropriate lockable storage facilities and a rigorous key handling system will be required for all imitation and replica firearms.

4.10 Weapons – replicas and imitations

A weapon is characterised as anything that can be used, or usable for inflicting bodily harm. In an event/performance environment, a 'weapon' could be, for example, a phone book, walking stick, a necklace or a replica sword or imitation spear, anything which could be used, or usable to portray an act of harm.

It is advisable not to refer to these 'weapons/proxy weapons' as props, because props are usually static/ridged or remain in one place in a theatrical/event setting, and are not choreographed into physical movements of artists.

Repeated rehearsals in a safe and controlled environment are essential to the safe use of all weapons in an event/performance environment.

4.11 Prohibited weapons

Each state and territory has legislation that controls the supply, possession and use of 'prohibited weapons'. Prohibited weapons lists are available from each of the state and territory's police websites. These particular weapons fall into the same category as theatrical firearms and require the same protocols for securing permits for the supply, use, storage and handling of such weapons.

It is the PCBU's responsibility to ensure all permits and the correct paperwork are completed and filed with the relevant authorities before obtaining and using these types of weapons.



4.12 Specialist lighting – lasers, strobes, strobe like effects, UV lighting

NOTE – Some forms of specialist lighting, particularly strobe effects can have detrimental health implications for some individuals. A competent and suitably trained operator should supervise their use and appropriate audience warnings should be given.

Use of lasers in an event environment may require special permission and depending on the laser deployed, a licensed operator may also be required. Further information can be found within the AS/NZS 2211 and <http://www.arpana.gov.au/radiationprotection/basics/laser.cfm>

Lasers are classified according to the hazard associated with their emissions, as defined in the Australian/New Zealand Standard AS/NZS IEC 60825.1:2011 *Safety of Laser Products Part 1: Equipment classification and requirements*, AS/NZS IEC 60825.14:2011 *Safety of Laser Products Part 14: A User's guide*.

- Class 1 and 1M lasers are safe under reasonably foreseeable conditions of operation. Class 1M can be hazardous if the beam is viewed with magnifying optical instruments (hence the letter 'M' is added).
- Class 2 and 2M lasers emit visible light at higher levels than Class 1, but eye protection is provided by aversion responses such as the human blink reflex. Class 2M lasers can be hazardous if the beam is viewed directly with magnifying optical instruments.
- Class 3R lasers produce visible and invisible light that is hazardous under direct viewing conditions. There is low risk for eye injury provided the exposure time is short. There is no risk for skin injury.
- Class 3B lasers produce visible or invisible light that is hazardous under direct viewing conditions; either they are powerful enough to cause eye damage in a time shorter than the human blink reflex (0.25 seconds) or the blink reflex is by-passed due to the invisibility of the beam. Laser products with power output near the upper range of Class 3B may also cause skin burns.
- Class 4 lasers are high power devices capable of causing both eye and skin burns, their diffuse reflections may also be hazardous and the beam may constitute a fire hazard.

4.13 Cooking – on set/stage

Cooking on stage as part of an event or performance carries a number of risks such as electric shock, electrocution, burns, scalds. Minimising the amount of actual cooking and designing less hazardous cooking methods are ways to eliminate or minimise the risks.



Where it is possible, the use of experienced operators coupled with careful planning and rehearsal of any cooking effects, are other control measures that should be considered as part of the risk assessment.

4.14 Practical household appliances – toasters, irons

Appliances on stage are required to meet the Work Health and Safety Regulations in relation to electricity. These requirements are outlined in the Electricity Hazard Guide. Care should be taken to ensure that the appliance does not create unintended hazards such as fire and/or smoke. On stage appliances must have a mechanism to isolate the power supply that can be activated remotely to the stage.

4.15 Wind – fans

Wind machines vary in size from small hand held devices that produce small flows of air to large wind machines that can produce pressures that can literally blow people and scenery over.

Apart from the standard electrical test and tag, special care must be taken in assessing the action of blades, control positions, surrounding scenery and travel of performers in front of the wind stream. If the fan is used to dissipate haze or smoke, the accumulation of liquid on the blades, in the motor or even the handles should be monitored.

Special care must also be paid to the intake of the fan. If placed in a position that is not clean and clear of debris, the fan can pick up particles of dust and dirt and fire them along the wind path. An example of this was a fan next to a ballet rosin tray and as the rosin was scuffed up by the shoes, the particles were thrown on stage.

Another consideration should be the guards on the blades – are they suitable to protect the fingers of the operators who may have to move the fans – and are the passage ways around the fans at a suitable distance to ensure costumes and other soft materials cannot be sucked into the mechanism?

5. Legislation, Standards and Guidance

The following links are potential sources of information that may assist in the assessing of risk where special effects are being considered for use during an event:

Safe Work Australia (2012). *Managing Noise and Preventing Hearing Loss at Work 2015*
https://www.safeworkaustralia.gov.au/system/files/documents/1702/managing_noise_preventing_hearing_loss_work.pdf

Safe Work Australia (2012). *Preparation of Safety Data Sheets for Hazardous Chemicals 2012*
https://www.safeworkaustralia.gov.au/system/files/documents/1702/understanding_sds_fact_sheet.pdf

Safe Work Australia (2012). *Managing Electrical Risks in the Workplace Code of Practice 2016*



https://www.safeworkaustralia.gov.au/system/files/documents/1705/mcop-managing-electrical-risks_in_the_workplace-v3.pdf

Safe Work Australia *Fact Sheet: Electrical Risks at the Workplace 2012*

<https://www.safeworkaustralia.gov.au/system/files/documents/1702/electrical-risks.pdf>

South Australian Legislation. *Explosives (Fireworks) data sheets 2015*

http://www.safework.sa.gov.au/show_page.jsp?id=2413#.Vy-9zo1Jm00

Worksafe Victoria – Fireworks

<http://www.worksafe.vic.gov.au/safety-and-prevention/health-and-safety-topics/explosives/fireworks>

Safework NSW – Fireworks

<http://www.safework.nsw.gov.au/licences-and-registrations/licences/explosives-and-fireworks-licences/fireworks>

WA Legislation – Explosives and Fireworks Dept. Mines and Petroleum

http://www.cqg.wa.gov.au/Profiles/cqg/Assets/ClientData/DMP_Application_for_a_Fireworks_Event_Permit.pdf

QLD. Fireworks – Mines Industry

<https://www.qld.gov.au/emergency/safety/explosives-fireworks/fireworks/>

Worksafe NT – Fireworks

<http://www.worksafe.nt.gov.au/LicensingAndRegistration/fireworks/Pages/default.aspx>

The Following lists are samples only of what guidance is available if required – There are many others that you can find to help assess the risks:

National Code of Practice for the Storage and Handling of Workplace Dangerous Goods [NOHSC: 2017 (2001)]

https://www.safeworkaustralia.gov.au/system/files/documents/1702/codeofpracticestorageandhandlingdangerousgoodsnohsc2017-2001_pdf.pdf

Australian Code for the Transport of Explosives by Road and Rail

https://www.safeworkaustralia.gov.au/system/files/documents/1702/australian_code_transport_explosives_road_rail_3rd_edition.pdf

WORK-RELATED EYE INJURIES IN AUSTRALIA

https://www.safeworkaustralia.gov.au/system/files/documents/1702/workrelatedeyeinjuriesaustralia_2008_pdf.pdf



Live
Performance
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Australian and New Zealand Standards – available to purchase

AS 2187.2-2006 Explosives – Storage and use – Use of explosives

AS 2187.3-1999 Explosives – Storage, transport and use – Pyrotechnics – Shop goods fireworks – Design, performance and testing

AS/NZS 2211.3:2002 Safety of laser products – Guidance for laser displays and shows