A Guide For
SAFE WORKING PRACTICES IN THE NEW ZEALAND THEATRE & ENTERTAINMENT INDUSTRY

Version 11

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This guide was prepared by a committee comprising of the following individuals

Stephen Blackburn, Capital E National Theatre for Children
stephen.blackburn@wmt.org.nz

Phil Conroy, Shand Shelton
phil@shandshelton.co.nz

Nick Kyle, Royal NZ Ballet
nic@nzballet.org.nz

Rob Peters, Theatre Systems & Design Ltd
rob@theatresystems.co.nz

And with the assistance of

Alan Barrett, Team Leader, Workplace Services
Manawatu-Whanganui Region
Department of Labour
PH 00 64 6 952-9841
FX 00 64 6 359-1431
MB 0274 34 1240
Alan.Barrett@dol.govt.nz

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This guide is a living document, which reflects progress in technology and systems within the Theatre & Entertainment industry in New Zealand. While every effort has been made to ensure references relate to the latest regulations, standard or other publication, it is important that readers assure themselves they are using the current guide, and or statutes, standards or other references, which should include any amendments which may have been produced since this guide was published.

All future amendments can be obtained by visiting the ETNZ website:

www.etnz.org

WHY DO WE NEED GUIDELINES?

INTRODUCTION

For many years now the industry has been trying to compose a code of practice without any success. There is concern that it will only take one more serious accident, and the industry will be faced with the prospect of a code being imposed rather than developed.

This document we hope will be a starting point. We stress it is a GUIDE not a code.

It should also be seen as an evolving document, open to change and amendment.

Use it if you feel it has purpose in your particular work environment. Disregard it if it doesn't, but please never under estimate the need for an awareness of the issues raised in it.

The purpose of this guide is to try and identify the key risk hazards of our working environment and present some ideas on how to minimise or eliminate those risks.

The very nature of theatre involves some special hazards, including safety hazards, fire hazards and chemical hazards. Backstage crew, performers, and sometimes even the audience can be at risk.

Within the theatre, there is lifting of heavy scenery, and manipulation of this, often large scenery, props, and lighting or special effects equipment in a very small space.

The hours of work are irregular and the backstage is often very cramped, especially in older theatres, and there is the pressure that the "show must go on."

Because theatres are often cramped, there is a great potential for general fire hazards such as blocked or locked exits, insufficient exits, or unlabeled exits. This is compounded by unsafe storage of scenery and other combustibles, lack of training in procedures if there is a fire, the use and storage of solvent-based materials such as hair spray, cleaners, or paints, the use of pyrotechnics or open flames, and sometimes a lack of fireproofing on items such as props, curtains, and scenery.

Another key safety factor is that most theatres have various physical levels.

These multiple levels can create hazards of falling or of being hit by items dropped from a higher level.

Often work is being carried out on some if not all these multi levels at the same time, Particularly during a fit up.

Sometimes scaffolding or platforms are used to access the grid or upper levels of the theatre.

Stairs leading to the catwalk and grid are often poorly lit and sometimes without rails. During preparation for performance, there is the danger of falling tools, objects, and even accidents involving workers falling from the grid, catwalk, scaffolds or ladders.

Accidents involving falls can occur at any time, including performance.

This is particularly true for the orchestra pit. Where else would you find on a work site the potential hazard of a sheer drop, sometimes onto fellow workers, (namely musicians) that has no protection cover, no warning sign or barrier. Well of course most of these things would look ludicrous when put across the stage for a performance. **But during fit up it has become common practice in the UK to put a barrier across the stage to prevent people falling into the pit. Another idea is to put small led landing lights across the front edge during fit up and performance to remind those onstage where the edge is.**

During the actual performance, there are also risks to the performers on the stage. These hazards include: tripping or falling on the stage; falls from elevations, into pits, or off the stage; collisions with scenery, props, or other performers; falling scenery, lights, etc. Sometimes, sections of the stage, or even the whole stage can rotate.

The guide is divided into headings that will allow you to access the relevant area of concern and or interest.

However we would recommend that you take the time to read the whole document and any relevant legislation listed within this guide.

CONTENTS

EMPLOYERS AND EMPLOYEES LEGAL RESPONSIBILITIES

All organisations involved in the theatre industry must have policies and procedures that aim to protect the health and safety of all. It is advisable for such policies and procedures to be documented and available to all. To this end:

- All who are involved in providing services and/or working on theatre industry productions or events must ensure that, as far as is reasonably practicable, at all times their work activities and equipment are not likely to result in damage to themselves, to others, or their working environment.
- All employees, contractors and volunteers must be made aware of all hazards that may impact upon themselves, their staff or others and what risk control measures are in place for their protection.

All individuals must be involved in developing a safe and healthy working environment through appropriate and mutually agreed consultation processes. This is achieved by ensuring that all involved in production operations are trained, aware of their responsibilities and comply with relevant legislation.

Under the Health & Safety in Employment Amendment Act 2002, there are prescribed methodologies for the implementation and ongoing training of employees with regards to Health & Safety Management and policy development.

Part 2A of this Act details Employee Participation. If you have under 30 employees then it takes only one employee to request participation and procedures must be implemented to accommodate this. If you have over 30 employees you are required to instigate involvement procedures as a matter of course. (see Risk & Hazard Management Chapter)

All productions and events must comply with relevant legislation and any person working outside these requirements should be made aware that they might be subject to disciplinary action and potentially to prosecution. In addition to health and safety legislation, there is other legislation that will impact on the workplace.

The health and safety legislation places responsibility on everyone to ensure that standards are maintained. These responsibilities extend beyond the producing company and its employees to venues, contractors and labour hire agencies to comply with requirements to assist in ensuring all visitors, including presenters, comply with the legislation.

Employees have a key role to play in the implementation of health and safety strategies on all productions and events. In their own interests and as a legal

obligation, all employees therefore have a responsibility to ensure that nothing is done to make health and safety provisions less effective. Each workplace must have in place a consultative process that everyone follows.

Health & Safety is a Joint Responsibility

The producing company and the venue have specific responsibilities for making such decisions and implementing such actions as may be necessary to provide for the health and safety of their own employees, contractors and other people in the working environment.

In order to facilitate the above, it is best practice for the producing company to provide the venue with a written Technical Rider that should include the following:

- Production Schedule
- Technical Requirements
- Health & Safety plan including show specific risk assessment
- Personnel requirements
- Marketing/Front of House

The producing company and the venue should ensure that employees are consulted where work practices and procedures will affect their health and safety.

The producing company and the venue should ensure that suitably qualified and competent personnel are engaged, appropriate to undertake all aspects of the production or event.

All those working on a production or event should be given sufficient information to enable them to perform their job safely. Irrespective of the duration of their engagement period, all those working on a production or event must be given an induction at the work site. It must include an orientation and information relevant to the event or production.

The individual responsible for health and safety during a production or event may vary depending on the activity undertaken and/or the phase of the production or event.

The producing company and the venue must ensure that all persons are advised of the identity of the person to whom that responsibility has been delegated. That person may be the:

- Venue Manager
- Technical Manager
- Head of Department

- Supervisor
- Stage Manager
- Production Manager
- Company Manager

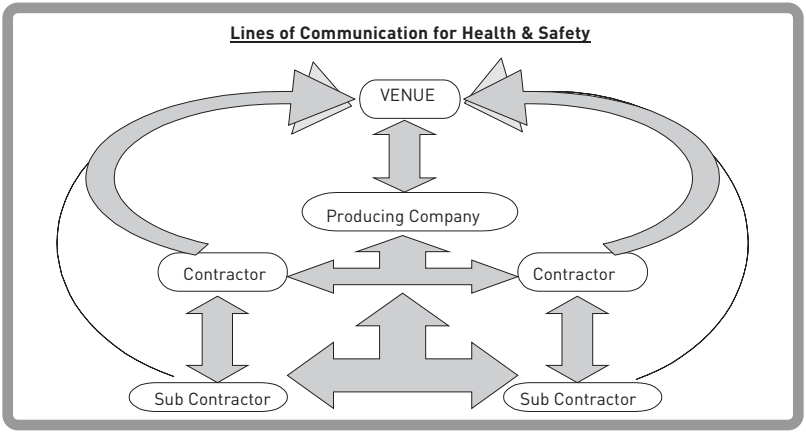
Employees, contractor's employees and volunteers are responsible for ensuring their work practices do not harm themselves, others or the environment.

Follow instructions, if unsure, ask.

Who is the principal under the act?

In most cases in the theatre and entertainment industry the "principal" under health and safety legislation would be identified as the venue management or producing company, dependant on the employee relationship. However the person regarded as "..being in control of the work place" would be the venue management alone. The department of labour define " being in control of the work place" as a) The owner, lessee, sub lessee, occupier, or person in possession, of the place or any part of it, or b) The owner, lessee, sub lessee, or bailee, of any plant in the place.

This means that ultimate responsibility for all issues of management, assessment, and reduction of risk for hazards in the workplace is a prime responsibility of the venue.



Qualified Person

A person who, by possession of a relevant recognized degree, other tertiary qualification or relevant certificate of professional standing, or who, by extensive knowledge, training and PROVEN experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

Competent Person

A person who is capable of identifying existing and predictable hazards in the work place and who is authorized to take prompt corrective measures to eliminate these hazards. This person must have PROVEN experience in the work to be undertaken.

Harm

As prescribed in the Health & Safety in Employment Amendment Act 2002, harm is defined:

(a) means illness, injury, or both; and

(b) includes physical or mental harm caused by work related stress

Hazard

As prescribed in the Health & Safety in Employment Amendment Act 2002, hazard is defined:

(a) means activity, arrangement, circumstance, event, occurrence, phenomenon, process, situation, or substance (whether arising or caused within or outside a place of work) that is an actual or potential cause or source of harm; and

(b) includes-

(i) a situation where a person's behaviour may be an actual or potential cause or source of harm to the person or another person; and

(ii) without limitation, a situation described in sub paragraph (i) resulting from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person's behaviour

Practicable steps

Clause 2A of the Health & Safety in Employment Amendment Act 2002 gives the following definition of all practicable steps;

(1) In this act, all practicable steps, in relation to achieving any result in any circumstances, means all steps to achieve the result that it is reasonably practicable to take in the circumstances, having regard to-

(a) the nature and severity of the harm that may be suffered if the result is not achieved; and

(b) the current state of knowledge about the likelihood that harm of that nature and severity will be suffered if the result is not achieved; and

(c) the current state of knowledge about harm of that nature; and

(d) the current state of knowledge about the means available to achieve the result, and about the likely efficacy of each of those means; and

(e) the availability and cost of those means

(2) To avoid doubt, a person required by this Act to take all practicable steps is required to take those steps only in respect of circumstances that the person knows or ought reasonably to know about.

GENERAL GUIDELINES

General guidelines include the need for you as an employee to

- Have undertaken a safety induction process conducted by your employer prior to commencing work.
- Prior to a Safety Induction, all personnel should be requested to advise their employer of any medical condition/s that may impact on their ability to perform their work duties.
- The Medical Questionnaire should be designed to ensure appropriate regard is given to the health and well being of every person working on a production or event.
- The provision of this information shall be treated confidentially and cannot be used to discriminate against any person in any way. Access to, storage and archiving of such information shall be in accordance with relevant legislative requirement.
- Report hazards or incidents.
- Observe and obey all warning signs/instructions.
- Observe smoking and alcohol restrictions.
- Only go where you are authorised to go.
- Report all injuries.
- Get first aid promptly.
- Report all fires.
- Ensure appropriate meal breaks and rest periods are taken to ensure individual performance is not adversely affected (including having regard to travel time to/from work and excessive work loads).
- Where personnel is required to work extended hours, extra planning should be put into place as to the safety hazards and harm this may create to the staff on duty and the work place in general.
- Follow all procedures associated with the use of naked flame, pyrotechnics and other special effects.
- Ascend and descend from structures only by way of ladders, stairways or other means provided for this purpose utilising hand rails.
- Only use plant and equipment you are certificated, trained or have the skill to use.
- Dispose of waste in accordance with site rules.
- Use the right equipment for the job.
- Avoid walking under suspended loads unless so doing is necessary to fulfil your duties.

- If your duties require you to work under suspended loads, ensure you are familiar with the risk assessment covering working under suspended loads and the procedures in place to minimise risk.
- Wear and use safety equipment when required, including appropriate clothing and footwear.
- Animals, including pets, are not to be brought onto production or event sites by personnel unless they are an integral part of the production.
- If children are not part of the performance, they are not to be brought into the performance area
- If children are part of the performance then adequate checks must be made on all staff likely to be responsible for their welfare
- In theatres that have an orchestra pit, steps should be taken to identify the hazard to all workers and during all work environments. EG: In fit up....(a barrier placed across the proscenium opening, and or lights to indicate the edge of the stage) In performance...(lights that indicate to the performers/crew where the edge of the stage is)
- A pit net should always be rigged to prevent props from falling into the orchestra pit.
- When hiring, leasing or borrowing any plant you should receive training in its use, installation and any maintenance that needs to be undertaken during the period of use. This relates to 18A of the Health & Safety in Employment Amendment Act 2002.
- All volunteers, persons on working place training or experience must now be regarded as an employee of the organization they are working with as prescribed in section 3C, 3D,3E,3F of the Health & Safety in Employment Amendment Act 2002

Relevant Legislation and Documents

We draw your attention to Part 2A of the Health & Safety in Employment Amendment Act 2002, which details the specific process of employee participation in the process of managing Health & Safety in the workplace. Please read this before undertaking any process of employee participation as there are now statutory obligations in this area.

ASNZS 4360

ASNZS 4801

When assessing the risks and identifying the hazards it is recommended that during the time known in the industry as a fit up, up to the point in the schedule when you begin to plot, you should treat the work environment to all intents and purposes as a construction site. From the plot onwards and during performance the work environment becomes something far more unique and specific to our industry.

Risk management in fact involves three distinctive steps:

1: Recognition

2: evaluation

3: control

To complete a risk assessment:

- Identify the environment/plant and equipment/task/activity to be assessed
- Identify specific and associated hazards

Recognition:

Identify potential hazards in a given workplace. This should be done by a combination of a site inspection and talking with those that must work in the given environment. It is also useful to gather historic data such as workplace accident reports that may show other hazards not yet identified.

Then

- Identify the at risk population

When evaluating a hazard it is also important to consider the number of people who may potentially be affected by the hazard (will the hazard effect the audience and performers, or the crew only?) Also, consider the length and frequency that the worker is exposed to the hazard.

- Assess the likelihood of injury occurring
- Assess the probable severity of injury should it occur
- Evaluate the level risks posed by the hazards

Evaluation:

Once you have identified the hazards you must now assess their potential danger.

There are several models for this assessment process.

The following is one of the simpler models:

Rate the likely-hood of an accident (out of five) against the potentially worst consequences of an accident involving that hazard (also out of five).

These two factors are multiplied to rank the hazard in a range from 1 to 25, with 1 being the least hazardous and 25 being extremely hazardous.

Hazards can be rated as low (1-5 on this scale), medium (6-12), or high (15-25).

	Very Unlikely	**Unlikely**	**Possible**	**Likely**	**Very likely**
No Injury	1	2	3	4	5
Minor Injury	2	4	6	8	10
Moderate Injury	3	6	9	12	15
Severe Injury	4	8	12	16	20
Death	5	10	15	20	25

For example:

Loading via the stairs into a venue

Possible to injure back (3)

Potential outcome is a severe back injury (4)

3x4=12 rate 12 is a major hazard

This hazard then requires some management to minimize risk of injury

Having identified the level of risk, the risks will need to be prioritised. What level of priority is allocated to different risks is entirely arbitrary, but the following is an example of priority ranges:

Range	Level of Risk	Action Required
1	Negligible	At the first opportunity
2-5	Low Risk	Within a month
6-12	Medium Risk	Within a week
15-20	High Risk	Today
20-25	Very High Risk	Immediately

Managing the Risk

When deciding on measures to manage the hazard it is best to refer to the following three rankings for efficient management of a hazard.

Level one:

Eliminate the hazard. For example take a lighting company that loads its trucks in the factory but finds that the accumulated exhaust is making all the loaders sick. Elimination would entail removing the trucks to outside of the factory for loading.

Level Two:

Reduce the impact of the hazard by:

Substitution:

For example use trucks that emit lower exhaust levels

Isolation:

Make the loading area an isolated area from the rest of the store and put in plant to extract the fumes

Management Control:

Limit the loaders to half hour shifts so that you reduce their exposure time or only allow one truck in at a time.

Level Three:

Personal Protection Equipment (PPE)

This is the least favoured as it only reduces the workers exposure to the risk without actually eliminating or reducing the hazard.

The following are the key points to remember in relation to the Health & safety in Employment Act 1992

1. First all employers have a responsibility to provide a safe working environment.
    - Second all employees also have responsibilities for the safety of themselves and others in the work place.

- Third all hazards must be regularly and systematically identified. This requires an inventory of hazards accident reporting systems and a review system to determine the whether or not the hazard is significant. All must be documented.
- Fourth, all significant hazards must be eliminated where ever possible.
- Fifth where it is impracticable to eliminate a significant hazard it should be isolated
- And finally, where it is not possible to either eliminate or isolate a hazard then it should be minimised and employees protected and monitored.

Penalties for failing to follow safe work practices are severe.

If you deliberately take action which is contrary to the Act, knowing it is reasonably likely to cause serious harm to a person, or fail to take action, you are required to take under the act, and you know that failing to act is reasonably likely to cause serious harm, you could be liable for a fine of up to $500,000 and or 24 months in prison.

If you fail to comply with the act or regulations made under the act you could be fined $250,000

An individual and or employer can be served with an infringement notice under section 56c of the act where you could be liable for an instant fine up to $4000

The Health & Safety in Employment Amendment Act 2002 came into force on 5th of May 2003. Some of the key reasons for the amendments are:

(a) make the principal Act more comprehensive in its coverage, in particular by-

  (i) including the maritime, rail, and air industries; and

  (ii) confirming that persons who are mobile while they work are covered; and

  (iii) providing protection to volunteers, persons receiving on the job training or gaining work experience, and employees on loan; and

  (iv) confirming that harm can be caused by work related stress; and

  (v) confirming that certain temporary conditions may cause a person's behaviour to be hazardous; and

(b) include provisions in the principal Act requiring good faith co-operation between employers and employees in relation to health and safety; and...

The critical points for our industry are

(a) (iii) (iv) (v) and (b) although in some touring situations (a) (i) (ii) have some implications.

The most prudent management policy in the case of clause (a) (iii) is to treat all volunteers ,work experience, secondment students as if they were employees. It is a requirement under the amendment to do so in nearly all cases that could be identified as likely scenarios in our industry.

Clause (a) (iv) is dealt with in the earlier chapter on fatigue and stress.

Clause (a) (v) is best dealt with by making all employees aware that they have an obligation to point out to others if they appear to be likely to cause harm to themselves or others through their actions and that they have the obligation to report the person for removal from the work environment, until they are in a fit state for work.

VENUE RESPONSIBILITIES

Relevant Legislation and Documents

The Building Act 2004 , Building Regulations 1992 and any applicable ammendments

Fire Safety and Evacuation of Buildings Regulations 2006

Publications from the Building Industry Authority (particularly C3 "Spread of Fire" and C4 "Structural Stability During Fire".

Hazardous Substances & New Organisms (HSNO) Act 1996 and subsequent regulations

Health & Safety in Employment Act 1992 and all its subsequent amendments

Health & Safety in Employment regulations 1995

Smoke- free environments amendment bill 2003 (see general risk section for detail)NZS9232 Precautions against fire and panic in Cinemas, theatres and place sof public assembly

BASIC CONCEPTS OF LIFE SAFETY

Life safety is the general term applied to basic requirements that will provide a reasonable degree of safety from fire in buildings and structures.

The basic principles of life safety are as follows:

1. Every building or structure shall be constructed, equipped and operated to avoid undue danger to occupants from fire, smoke, fumes or panic during the reasonable time needed to escape.
2. Every building or structure designed for human occupancy shall be provided with enough properly designed exits to allow the prompt escape of occupants in case of fire or other emergency. The number, location and types of exits depend on the type of building and purpose, available fire protection, and number of occupants.
3. Exits shall be arranged and maintained to provide free and unobstructed escape from all parts of the building at all times it is occupied.
4. Exits shall not be locked.
5. Exits shall be marked and clearly visible or the route to the exits clearly marked. Doors or passageways that are not exits but could be confused with exits must be marked or arranged to clearly indicate they are not exits. Exit pathways should be illuminated as required.

Exit Signs and Lighting

1. All fire or emergency exits must have illuminated exit signs over them.
2. In long corridors, open floor areas, and where the location of the exit may not be readily visible or understood, directional signs shall be provided to serve as guides.
3. All exit stairs must be equipped with lights.
4. Most exit signs in theatre should be of the maintained type. This means they are on when mains voltage is present and automatically switch to a battery back up power source in the event of mains failure

Emergency Lighting

1. All performance spaces should have an emergency lighting installation sufficient to provide adequate illumination of egress to exits and to minimise hazards while exiting the premises as specified in the Building Regulations 1992.

Stages and Auxiliary Areas

This applies to theatres and other performance areas using scenery or scenic elements.

1. Scenery or scenic elements may be placed in seating sections if such elements are noncombustible or flame retarded, are adequately braced or secured, and do not obstruct required visibility of, or paths of travel to, exit openings.
2. Platforms or runways for performances, to accommodate cameras, electronic equipment, or motion picture projection machines not using carbon arc or other lighting sources that emit a gaseous discharge, may be constructed in seating sections provided they comply with the above requirements for scenery in seating sections.
3. Joints between lift platforms and floors shall be flush to prevent trip hazards.
4. All scenery and scenic elements must be noncombustible, or be flame retarded. Scenery and scenic elements not complying with these requirements must have the approval of the fire department and or the venue.
5. Curtains located between audience and stage areas must permit air movement required for the emergency ventilation system to bypass or pass through the curtain without excessive billowing, and shall be noncombustible.

6. No workshop involving the storage or use of combustible or flammable liquids or gases shall open directly onto a stage.
7. Stage lights shall be rigged so that they will not heat materials so they might ignite, smoke or deteriorate flame retarding.
8. Current Building Warrant of Fitness and related records should be available for viewing where applicable

PORTABLE/TEMPORARY CROWD CONTROL BARRIERS

Introduction

Barriers at concerts and related events have several functions.

They provide physical security, such as high perimeter fencing at out door concerts or restrict audience access or preventive measures such as access to sound towers, mix towers.

Properly constructed barriers can also be used to relieve and prevent crowd pressure build up.

Barriers will always be subject to crowd loading and should be designed to withstand right angle and parallel loads commensurate with the probable pressures.

Use of barriers.

The organiser must assess whether a barrier is needed and what type should be constructed.

Consideration should be given to crowd density, likely behaviour, crowd size, and nature of venue and location of venue.

Crowd pressure is normally greatest at the front of stage barrier.

During the crowd surge or if the crowd surges, dynamic loading can be considerable.

Although pressure is momentary it can cause serious injury or even death.

This recently happened at a major concert in Sydney

The risks are Crowd fainting and heat exhaustion often compounded by other factors (heat, dehydration, hysteria, alcohol, chemical consumption).

The other risk to consider is the potential of "crowd collapse"; surging or heaving motions near the front of the stage can cause this. This can result in crushing, trampling leading to asphyxiation.

A suitably designed and constructed barrier arrangement can help minimise the risk of collapse.

The barrier should be at a height to prevent thoracic compression.

The ideal barrier height should be between 1.1 and 1.2 metres from the base plate on which the audience stands.

Consideration should be given to younger audiences.

The"Pit".

This is the term used internationally in the event industry for the area between the audience barrier and the front of stage (the *"pit"*) and in this section is referring to this area only, not the *orchestral pit* of a theatre. The "pit"should be designed to assist the work of ushers, security, paramedics and other regulatory / emergency services.

The pit should have a non-slip unobstructed working area behind the barrier which is large enough to allow those in the pit to lift members of the audience into it if it becomes necessary through crushing or distress of the audience.

Some barrier systems are designed with a step arrangement to allow overseeing of the audience and the identification of those in distress or potential difficulties.

Access or egress from the pit should be unobstructed to allow the emergency services clear working environment.

The provision of an unobstructed corridor or access way enables members of the audience taken over the barrier to be led away from the pit.

Types of barrier construction

The demountable barrier system.

The demountable system is custom built for the purpose and easily transported. These systems are in an "A" frame configuration and rely on a tread or base plate at the front to maintain their stability.

They are normally free standing but if used outdoors may be fixed to the stage structure with couplers. Fixing by couplers is only appropriate if the stage is designed to resist the imposed lateral load.

They should not be fixed to a mobile or trailer stage.

They should only be fixed to stage after the appropriate chartered professional engineer (Cpeng or equivalent) has certified the structure as being able to with stand the loadings.

The scaffold barrier.

Scaffold barriers should be system designed to meet the necessary loadings.

Scaffold barriers must be certified by a (Cpeng or equivalent engineer).

Checks must be made by a competent person to ensure that, when erected, the barrier meets the design criteria.

If used for subsequent shows or events it should be checked prior to each to ensure the system has not moved or the couplers are loose.

At no stage should a fixed scaffold barrier be attached to a mobile or trailer stage.

Barrier loading.

The BS 6180: 1999 'code of practice for protective barriers in and about buildings'

Contains detailed guidance about the general design and construction of temporary and permanent protective barriers.

The HSE considers these technical standards as being appropriate for shows and events in the United Kingdom.

Other factors to consider for barrier loadings and construction should include

The venue, size and nature of audience, artificial breaks (split barriers) and the performers anticipated behaviour.

Loadings for barriers and their integral components should be able to withstand a minimum loading of 3kN/m right angle tested 10cm below the top for indoor events.

Loadings for barriers and their integral components should be able to withstand a minimum loading of 5kN/ right angle load.

These recommended standards might need to be varied, depending on size, nature of the venue and the anticipated crowd loading.

Barrier distance.

There should be a reasonable distance between the front barrier and the edge of the stage. It should in no circumstances be less than I metre and should often be more, for outdoor stages a distance between 3 to 4 metres is preferred.

Barrier shapes.

If a venue has restricted space, a straight barrier is suitable. For outdoor events, especially larger shows. A convex barrier extending into the audience maybe preferred.

Concave stage barriers should not be used as these can create areas where people can be trapped, although a finger barrier maybe appropriate.

A curved convex barrier has the following additional safety benefits.

- It dissipates crowd surges away from the centre of the stage.

- It assists means of escape
- It provides a wider front row sightline
- Improves security by increasing distance at the down stage centre edge
- Provide a wider area for security and paramedics to operate within.

Barrier around thrusts.

(A thrust is a section of the stage, which projects from the main body of the stage towards the audience)

Where thrusts extend into the audience, a barrier should be provided in one of the following ways:

(1) A stewarded barrier complying with the design criteria and loading factors for a front of stage barrier.

(2) A scaffold structure close boarded to a height of 2.4 metres and designed to comply with the crowd-loading standard.

It is advisable to construct a thrust in such a way that it does not create poor sight lines.

Care should also be exercised not to create concave trapping points from which crowds can escape.

Side stage barriers or fences.

The construction of a high side stage fence will form a sightline obstruction and will therefore ensure that important exits to the right and left of the stage are kept clear and available for use in an emergency. Such barriers should also be installed for standing audiences and may need to be 6 metres in length in 2.4 metres in height.

Side stage barrier loadings should comply with BS 6180 or equivalent.

Special barrier arrangements.

At large outdoor events, it may be possible to reduce the likelihood of crowd collapse by installing additional barrier systems.

These systems could be in the form of a finger barrier extending into the audience or in the sports stadia a multiple barrier arrangement.

Finger barrier

If a finger barrier is used, careful design is needed to avoid the creation of trapping points

This barrier system assembly should be able to with stand the same crowd loading and dynamic forces as the front of stage barrier.

The barrier should have the same clearances and operating space as outlined for pit operations and which enables security and paramedics to operate along its length.

Multiple barrier arrangements.

Demountable barriers should only be used.

For events held in sports stadia, a multiple barrier system can be used to break the crowd.

If such systems are to be used, careful planning around the escape routes should be detailed.

Multiple barrier systems are not suitable for all venues and would be difficult and expensive to arrange on green field sites.

For example, controlled side stage escapes, which are likely to be possible in sports stadia, would be difficult to arrange at other venues.

Penning of audiences in flat open areas by means other tan the arrangements described below could also create difficulties in evacuation and is considered to be unsafe.

Where double or triple barrier arrangements are used, the barriers should form a convex into the audience with escapes from both ends.

The provision of a corridor or area behind each curved barrier will give security and paramedics' adequate access to the public along the length of barriers.

Barriers used to achieve this should meet the required minimum loading requirements.

Multiple barrier systems require careful management.

The use of a colour code wristband system is one method of controlling audience access and numbers to these areas.

With an over –enthusiastic audiences, it is likely that many of the problems encountered at the front of stage barrier will be experienced at the barrier furthest from the stage.

Adequate numbers of marshals, security and paramedics should be provided.

Due to the wider sightline potential and increased distances form the stage, the incidence of crowd surge and crushing may be reduced.

After assembly of barrier system check list.

- Scaffold barrier – is padding provided on all exposed couplers which may cause injury?

- Are metal barriers smooth with no rough edges or trapping points, either when in position or under load?
- Does the barrier have a smooth rounded timber or steel top of front plate to ease lifting or transfer of injured or distressed people?
- Have all practicable steps been taken to ensure no bolts or sharp edges are protruding from the barrier?
- Do barriers, which have a tread plate or floor panel, have a ramped approach or other similar arrangements to reduce the risk of tripping?

Materials unsuitable for barrier construction.

The following materials should not be used in any barrier construction.

- Timber bearers.
- Fencing wire.
- Wire netting.
- Corrugated iron
- Water filled safety barriers such as the ones used on road work sites.
- Metal bike rack systems
- Any materials that would crush or break and which a chartered engineer would not certify as to meeting the requirements of the BS 6180.

Notifiable Work

Venues should make special note of section 2 and 26 of the Health and Safety in Employment Regulations 1995

Indicated below are some examples of what is notifiable work under the regulations with regards to this industry. The list is not exhaustive but indicative only:

- When working in areas which there is potential for the employee to fall 5 metres or more (eg: catwalk grids, lighting bridges, truss etc)
- When you are likely to have a vertically lifted load of 500kg or more above 5 metres (eg; scenery or lighting bars that meets or exceeds a 500kg load)
- When erecting a scaffold structure a vertical distance of 5 metres or more
- When having to work in a confined space (eg; within set elements)
- Work in which a person is likely to breathe air that is or has been compressed or a respiratory medium other than air (eg: dry ice rolling into the orchestra pit)

You should contact your local OSH office (see listing within this document) for clarification from them as to the frequency of notification required. Some jurisdictions will allow a year long notification rather than individual event based notifications.

Notification of Particular Hazardous Work forms are available from the following:

http://www.osh.dol.govt.nz/services/notification/hazardous-work.shtml

Theatre Log Book

- The fire officer must keep a theatre Inspection Log Book, which is used for the required daily inspections.
- This log is usually held at stage door and may be inspected by others on request.

FRONT OF HOUSE RESPONSIBILITIES.

Relevant Legislation and Documents :

Building Act 2004 sections 108 and 110, Disabled Persons Community Welfare Act 1975*, section 25 (referred to by Building WOF). .....Means of Access and Facilities for use by persons with disabilities.*

Fire Safety and Evacuation of Buildings Regulations 1992

Evacuation Procedure.....approved by New Zealand Fire Service.

NZS 9232 : 1991 *Precautions Against Fire And Panic In Cinemas Theatres*

And Places Of Assembly.

(See also Venue Responsibilities, page 11, and Fire Safety, page 14)

Building and required checks. – Required to allow a performance to take place

Annual Building WOF certificate. Safety requirements should be monitored with regular planned and documented checks, with a current WOF on public display.

Evacuation Procedure, -This must be approved by NZ Fire Service and involve regular practise drills and staff tarining.

Front of House Staff Roster -FOH staff should be rostered to designated positions such as House Manager/Cashier/ Door 1/ Door 2/ Usher 1

Each position should have a written job description for both usual tasks, and emergency action, as required by the venue Evacuation Procedure.

Any FOH staff team should include staff who have the following qualifications or training:

General manager's licence –necessary if the bar is to be open.

First Aid – a minimum of one FOH staff member with a current certificate.

Safety Warden – a minimum of one FOH staff member who has received appropriate training

Floor Wardens –the minimum number of staff required to act as Wardens by the emergency procedure

All should be well versed in the evacuation procedure of the venue

Means of Escape – daily check

At the start of each day, the Means of Escape check ensures :

- Exit routes are clear of obstacles and hazards.

- Exit doors open easily, are not locked, barred, or blocked, and that fire exit signs are secure and clearly visible.
- Smoke control doors are not held open, and closers work easily.
- Fire hoses, extinguishers, and manual alarms are easily visible and accessible.

  And the Evacuation Board tags are placed in each area.

The log book should be signed, and updated with any problems noted in the checks. Problems noted should be rectified, as soon as possible.

If a pattern is seen in a number of problems noted over a period of time, corrective action to a work process may be required.

Pre-show check

Before patrons are admitted to the theatre, a designated member of the venue staff should complete the Pre-show check, which includes means of escape, exit doors, exit lights, fire extinguishers and hoses, fire alarms, safety curtain, and emergency lights. This information should be written in the Log book, together with the designated staff members signature and the time of the inspection. The resolution to any potential problem is noted here, before any performance commences.

During the performance

Sufficient staff are present in the auditorium to take charge of any situation that may arise, and to generally assist patrons when needed.

Sufficient staff should be present in the foyer and box office areas to ensure nothing happens here that could affect the safety and security of the patrons inside.

After the performance

FOH staff should ensure patrons exit the auditorium safely. Once all patrons have left the auditorium all other accessible areas including the toilets should be checked.

Following this the final FOH housekeeping duties should be completed including checking that all exits and emergency doors are secure and that all evacuation tags are returned to the Evacuation Board.

NOTE (1) The Evacuation Procedure should detail the following:

Staff Training

Staff duties

Notification of emergency

The evacuation process.

NOTE (2) Security : people and places

Certain circumstances need to be resolved quickly and calmly as they can escalate into events which may need emergency action.

Only authorised people can be in non-public areas and all FOH staff should be prepared to enforce this. (The safety of people and equipment may be at risk)

This information should be fully documented in the Evacuation Procedure, as approved by the NZ Fire Service for each individual theatre.

FIRE SAFETY AND RETARDANCE

Building Act 2004

NZ Building code C3

Fire Service Act 1975

Fire safety and evacuation of buildings regulations 1992

AS 1530 Part 2 Methods for fire tests on building materials, components and structures

Guidelines

1. There should be written emergency procedures and a fire evacuation plan.
2. There should be routinely scheduled fire drills.
3. Emergency exits should be clearly marked and accessible.
4. Fire protection systems must be functional and maintained as required including appropriate fire extinguishers. This should also include adequate training in their use.
5. If pyrotechnics are used ***refer to pyrotechnics chapter***
6. Combustibles, waste materials and rubbish should be stored in approved containers or disposed of properly.
7. Oily rags, paint rags, oily waste, or similar materials subject to spontaneous combustion should be kept in approved oily waste cans and emptied daily.
8. Keep stored combustible materials away from exits and fire equipment and in a locked metal storage facility.
9. All persons should be aware of the type of Fire Safety Curtain (if installed) in the performance space, the operating conditions of this device (both automatic and manual) and the means of activation. The regulations for Fire Safety Curtains in NZ are set by the relevant local authorities and as such vary around the country.

Fire-Retardant

A fire retardant is a substance that significantly delays and can prevent the onset of fire. All flexible fabrics must have a flammability index not exceeding 12 as defined by AS 1530 Part 2.

1. All flexible fabrics used or provided by the venue must be fire retarded in accordance with the NZ Building Code.
2. All flexible fabrics used on scenery/props must be flame-retarded. If not purchased as such, they can be flame-retarded by applying certain chemicals. Spray on fire retardant can be bought as a pre-made mixture.

3. Confirmation should be obtained by the venue for every new show indicating that all materials used in scenery/props has been properly flame retarded in order to comply fully with the NZ Building Code C3.
4. Costumes should be fire retarded when there is a risk present by the use of naked flame and or pyrotechnics in the production.
5. Approved flame retarding materials and methods of application must be used.
6. Cut flowers, fresh cut decorative greens or natural trees shrubs, etc are allowed if kept in soil/water and maintained. Balsam, hemlock or other materials containing pitch are prohibited.
7. Fresh cut decorative greens should not be hung on a combustible base or framework or hung by combustible materials. Maximum length of time they are allowed to hang should be no more than 24 hours.
8. A register of all items that have been fire retarded, detailing type of fire retardant and when applied, should be maintained and made available to any one upon request.

WORKING AT HEIGHTS

Relevant Legislation and Documents

Regulation 21 of Health & Safety in Employment Regulations 1995

ASNZ 1891 Industrial Fall Arrest Systems and Devices Part 1 – 4

ASNZS 4488 1997 Industrial Rope Access Systems 1&2

OSH Guidelines for prevention of falls

Careful risk management strategies must be made for circumstances involving working at heights and for those working underneath operations being undertaken at heights. This must include planning should the need arise for retrieval of a person who has fallen from an elevated structure, especially if this person is unconscious, in which case you may have only 10 minutes to retrieve this person.

- Specifically, you must wear a fall arrest system and device where specified.
- All harnesses, lanyards, fall arrest and fall restraint devices must be manufactured and maintained to NZ Standards.
- When using inertia reel devices, do not work at more than 30 degrees from the vertical where a fall will create a pendulum effect injury.
- Safe access must be provided for all work platforms more than 1.8 m high.

NOTE:
No person should be allowed to undertake work requiring the use of fall restraint or fall arrest devices without having undertaken appropriate training in the use and maintenance of such devices. A high level rescue plan should also be in place and well documented. NZQA 15757 approved courses are the only accepted evidence by OSH of competence based training.

General Guidelines

1. No person should enter or exit the stage area when anyone is working at heights without the express permission of the relevant Supervisor, eg: Head Mechanist, Production Manager, Technical Director or other.
2. Warning signs must be clear, unobstructed and in conspicuous places.
3. When working at heights, only essential tools and equipment should be used.
4. Prior to ascending, all tools should be secured with lanyards to prevent them falling on those below and pockets must be empty.

5. Vision must not be impaired when working or performing at heights..
6. Where there is the potential for a person to be injured from a fall, appropriate fall protection must be used.
7. Ensure all ascent/descent of ladders is performed facing the ladder and that you grasp the sides and not the rungs.
8. Communication systems must be established between those at height and those on the ground.
9. Do not work to the sides of ladders or guard railings at height.
10. Appropriate footwear must be worn to minimise the risk of slipping; appropriate clothing must be worn to minimise the risk of snagging; hair should be tied back at all times.
11. When working at height on elevated truss or other such structure, a safety wire should always be rigged to allow the person working at height to be able to attach to, in order to safely undertake the tasks required. The safety harness worn must be in accordance with the relevant NZ Standards.
12. Use a lanyard that is appropriate for the height at which you are working (for guidance see ASNZS 1891 part 4 figure 7.1)
13. Be aware of the potential risk ultra violet exposure may have on all harnesses and slings.14.All floor openings must be guarded by a cover or guardrail on open sides, when not in use in rehearsal or performance situations.
14. All platforms above 3m in height that are to be used and could result in a fall a risk assessment must be undertaken and safety guards or a fall prevention system for those using the said platform should be the first options if practicable.
15. If guardrails are impracticable, there should be other mechanisms for at least warning of the potential hazard of falling, such as tape markings.
16. Walking on open beams or sliding down beams that are over 3m high must be done only with appropriate safety harnesses and lanyard.

ELEVATING WORKING PLATFORMS (EWP)AND MOBILE ELEVATED PLATFORMS

Relevant Legislation and Documents

(NB: Certification of EWP plant is currently underway through the Dept of Labour. Best practice standards for the use of EWP's in the industry are currently in development for future training and certification of operators)

HSE Act 1992

Approved code of practice for power operated elevating work platforms

ASNZ 1891 Industrial fall arrest systems and devices Part 1-4

It is often necessary within this industry to use EWPs, including but not limited to, (tallescopes ,genies, scaffold towers, and temporary elevated structures) in situations that do not always conform to some aspects of current codes and manufacturers suggested operating procedure.

Example of risk assessment needed

Moving an EWP with operator in the bucket during a focus session or working from a tallescope without all support braces in place due to the nature of scenery on stage.

If this is necessary then a specific risk assessment must be made for that particular situation and the personnel operating the EWP must be satisfied that they have taken all practicable steps to minimise risk and provide a safe working environment. It should also be noted that a suitable rescue plan should be in place in the event of failure of the EWPs power supply.

For example:

if it is necessary to move an operator in the bucket of an EWP during a focus session

- all arms must be extended and as close to the stage floor as possible
- the mast must not be at full extension
- a minimum of two people should be at the bottom of the EWP to provide stability and movement
- there should be one person onstage who's sole function is to ensure clear communication between the operator and those on the floor
- if the venue permits a person should be situated at either gallery or fly floor level
- in order to maintain clear communication there should be minimal noise and if moving the EWP, working lights/state should be turned on until the EWP is safely positioned

- a clear path should be ensured before any movement is undertaken.

Such steps should always be taken in conjunction with guidelines set out in current codes or manufacturers suggested operating procedures.

Guidelines

1. Before undertaking any work in an EWP make a visual check which should include but not be limited to:
    - check that the EWP has a current certificate
    - check hydraulic oil level
    - check stabilisers are all there and engage correctly
    - check power charge or feed is safe and functioning
    - check battery water level (if applicable)
    - Check cage lock mechanism is functioning
2. People should not ride on lifting devices that aren't meant for human lifting.
3. Platforms should be clear of all obstructions, and kept free of oils, grease or water.
4. Be aware of clearances when operating or travelling with elevated work platforms (EWPs).
5. Operators of EWP's should be trained in the appropriate and safe use of the type of EWP to be used.
6. All boom type EWP's require users to wear a safety harness with a restraint lanyard as short as possible to allow free movement in the confines of the platform. The lanyard must be fixed to an anchorage point within the work platform. This is not required in vertical lift EWP's (eg Genie, Cougar)

SCAFFOLDS

Scaffold usually refers to a structure made from metal tubing or timber, it is usually a temporary structure and maybe manually mobile.

Relevant Legislation and Documents

Health and safety in employment (construction) regulations

OSH Publication "Scaffolding"

NZS 5811 1981, safety belts and harnesses.

Building Act 2004 and building code.

ASNZS 1576 Standards for Scaffolding

Code of practice for safe erection and use of scaffolding

Best Practice Guidelines, SARNZ

1. Scaffolds should be erected and dismantled by experienced personnel using the proper equipment.
2. A certified scaffold rigger must erect any structure that exceeds 5m in height and will provide notification to the nearest OSH office.
3. Scaffolds should be constructed so they can support up to 4 times the maximum intended load.
4. Scaffolds should follow the 4 to 1 rule, meaning that the maximum height of a freestanding scaffold should be 4 times the narrowest side of the base.
5. Scaffolds must never be erected on top of barrels, boxes, cement blocks, or other unstable support but must always be erected on firm foundations.
6. Rolling scaffolds (towers) must have proper cross and horizontal bracing, and at least two of four casters or wheels must be swivel type with locking capability.
7. People should not be allowed to ride on manually propelled scaffolds.
8. Equipment being ferried up and down the scaffolding must be properly secured. All equipment on top must be secured to the main framework.
9. All hand tools must be secured to the worker.
10. Scaffolders must install appropriate, clear, unobstructed and conspicuous signage during construction, dismantling, adjustment or modification of scaffolding.
11. Only correct materials shall be used in line with the current codes.

12. Dynamic load bearing must be considered prior to erecting when assessing the equipment to be utilised.
13. All materials and equipment shall be carefully inspected before they are used and rejected material repaired or disposed of.
14. Scaffolding more than 1.8 metres high must be fully planked out with toe boards and continuous handrails to ensure a safe work platform.
15. Scaffolding must be effectively tied to a building/structure and must be effectively braced, both longitudinally and transversely with safe means of access and egress by ladders.
16. Scaffolding planks must be of correct size and properly supported.
17. You must never mix scaffold systems within an erection.
18. Mobile/wheel scaffolding must not be moved whilst supporting people.
19. All wheels must be locked before working on mobile/wheel scaffold.
20. Unauthorised changes to scaffold structures are illegal.

LADDERS

Relevant Legislation and Documents

ASNZS 1892 .1-.5 Portable metal ladders

ASNZS 1657 Fixed platform ladders and stairways

1. Always use the correct plant for the job and all ladders in a work environment should be industrial rated not domestic.
2. Ladders should always be inspected before use to make sure they are in safe condition. Make a visual inspection of the ladder prior to use and any ladders with broken or missing rungs or other defects should not be used.
3. Never substitute a chair, table or box etc. for a ladder. Never place a ladder on a table or box to increase the height.
4. Ladders should not be "spliced" together to create a longer one.
5. All personnel using a ladder should face the ladder while ascending and descending.
6. A stepladder should be used only in the completely open position, and only climbed on the side with the steps.
7. A stepladder shouldn't be used as a surface from which to work.
8. Workers should not stand on the top step.
9. Ladders should be maintained in good condition, the hardware and fittings, and joints should be securely and smoothly operating. Rungs should be clean of oil, grease or water.
10. The ladder feet should be placed on a secure base, and the area underneath the ladder should be kept clear of debris and dry.
11. Non-skid safety feet should be installed on all straight ladders before use.
12. Manufactured portable wood ladders should have non-slip bases securely bolted or riveted by side rails.
13. Straight ladders should be kept on a level surface. They should be placed so that the distance from the wall or surface upon which it leans is about one quarter the length of the ladder.
14. Straight ladders should be blocked, tied off or otherwise secured when in use. Otherwise, an assistant wearing a hard hat should brace the ladders for the user. For large ladders, two assistants may be needed.
15. Tools and other objects should be secured against falling by being tied to the worker while using the ladder.

16. Materials should never be left on the ladder, or dropped or pitched to another worker.
17. Fixed ladders over 2m in height must be caged.

RIGGING AND FLYING OPERATIONS / FLYING OF PERFORMERS

RIGGING

Relevant Legislation and Documents

Safety in Construction no.26, Rigging Code of Practice, OSH,

1989 Current Rigging Code of Practice, OSH

ASNZS 1891

ASNZS 4488

A guide to dogging (Victoria Worksafe)

General Guidelines.

All persons undertaking flying operations must be deemed competent to operate the relevant equipment by their employer and to the satisfaction of the producing company and the venue. All systems must under go a visual inspection by a competent person prior to each use or event.

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1. Properly trained and competent persons only must be involved with the operation and routine maintenance of any rigging equipment.
2. These persons must be knowledgeable in safe operation and functioning of the equipment, safe working loads, routine maintenance, operation of safety devices, possible dangers during proper and improper operation, and emergency procedures.
3. All rigging equipment must be inspected once per year by a qualified person (a certificate of test/inspection must be provided), before use, after alterations, and at regular intervals between annual inspections. Repairs and modifications to any rigging equipment must only be carried out by a qualified person.
4. Counterweights must be enclosed with a guard preventing passage underneath. The guards must be secured in place.
5. Damaged or defective slings and ropes must be removed from service.
6. Chains or ropes must not be shortened by knotting.
7. Be sure all loads do not exceed the safe capacity of the system.

8. Follow safe procedures when loading, unloading, or operating rigging systems.
9. The operation of an unbalanced counterweight system may be required under special circumstances (eg during the flying of performers). The system must always be operated within the manufacturer's guidelines and the ability of the operator(s) to hold the out of balance load safely.
10. Maintain visual contact with a moving piece and control at all times.
11. Only assigned personnel shall have access to suspended work areas such as grids and catwalks.
12. All hoisting systems must be secured to prevent accidental or unauthorized use.
13. No person shall ever ride on hoist hooks, slings or loads.
14. The safe working load (SWL) shall never be exceeded.
15. When moving flown scenery always warn those below and or above verbally prior to flying said items. unless it is not practical to do so (e.g. during performance) in which event appropriate communication systems must be implemented and understood by all.
16. Aerial performance sequences must be planned with appropriate rigging for the size of the performer/s and the tasks to be completed. This may include the need for crash mats, safety netting and appropriate emergency contingency planning. Consideration of lighting, set or sound changes must be communicated to both riggers and aerial performers.
17. The Safety Factor of any rigging is 1:5 (unless stated otherwise).
18. Checks of rope locks of a flying system must be conducted prior to use.
19. Testing of all rigging equipment must be in line with manufacturer's recommendations.
20. Steel slings shall be used as a secondary for fibre slings if there is a risk of fire.
21. Packing must be used between slings and sharp edges.
22. The rigging and operation of chain hoists, truss, etc, must only be undertaken by competent persons and within the manufacturer's specifications and recommendations.
23. Flown props and scenery which is used to fly a performer must be designed and manufactured by a qualified person. Initial operation must include a training process by the qualified person for both operators and performers.
24. All loads at or over 500kg lifting to 5 metres vertical must be notified to your nearest OSH office.

Flying of Performers

The creation, design and installation of effects for the flying of performers is a highly specialized area of rigging and must only be undertaken by a suitably qualified person.

Operation of a system for the flying of performers must only be undertaken by persons who are deemed competent and who have received training by a qualified person in the use of the particular equipment to be used.

A complete inspection of all system components must be performed by a competent person prior to each performance. Any damaged flying wires or other components shall be replaced immediately, prior to any further use.

All flying system operators and performers, including understudies, must be fully trained by a qualified person and rehearsed with the flying equipment. The exact nature of the training may be dependent on the specifics of the flying effect and the situation(s) in which it is to be used.

IF IN DOUBT, DON'T !!!

Equipment specifications:

ASNZS 1891

Harnesses:

Any flying harness shall only be manufactured by a qualified person and shall be considered as part of the rigging and NOT part of the costume. Careful attention shall be paid so that any costume elements worn over the flying harness do not impair the vision, mobility and/or safety of the performer. No part of the costume shall be attached to the harness. No harness shall be cleaned, dyed, painted or marked with a substance which may degrade the strength and/or integrity of the harness materials.

The flying harness must have a minimum designed **safety factor of 8 : 1.**

All flying harnesses must be inspected for wear or other defects by a competent person prior to each performance.

Flying props:

All flying props which support a performer must have a minimum designed **safety factor of 8 : 1.**

Performers flown on flying props must be secured to the prop, by means of cables and harnesses that meet these specifications, during flying effects.

Rigging equipment:

All rigging equipment which supports the performer's GENERATED weight must have a minimum designed safety factor of 8 : 1.

(ie when calculating the SWL it should be noted that the weight of the performer applies an active, dynamic load not only a static load)

Wire ropes to be used for the flying wires shall be sized depending on the weight to be lifted, flying choreography (pendulums, somersaults, etc), number of wire ropes supporting the performer, rigging method, inspection schedule and other relevant factors. This shall include the method of termination of the wire rope. Wire ropes must be labelled with the SWL.

Where two or more flying wires are supporting the performer, and both wires support the performer at all times, each wire rope must have a minimum designed **safety factor of 5: 1**.

If in any doubt the wire rope must be rated at a minimum designed **safety factor of 8: 1**.

The equipment which connects the flying wire(s) to the harness is frequently of a non-standard nature. While these connectors must be proof tested to establish the SWL they are rarely stamped and rated items. The system designer and/or user must satisfy themselves that the connectors are capable of safely carrying the required loads and that any quick release system has a satisfactory, positive safety lock. Proof test certificates for all items must be available for inspection if required.

Pulleys, blocks, sheaves and drums must be designed in such a fashion as to prevent the wire rope from coming out of the groove and becoming jammed between the sheave/drum and side plate of the pulley or block. Installation and use of these items must take into account recommended fleet angles when the flying wires are subject to swing during operation.

If tracks are used for the transverse movement of the flying performer, these must have a minimum designed **safety factor of 8: 1**. In the case of a cable or wire rope track, these must have a minimum designed **safety factor of 12: 1**. This includes all load trolleys.

All track must be supported according to manufacturer's recommendations and must be designed and rated specifically for the flying of performers.

Installation, Testing, Inspection and maintenance of the flying equipment:

The equipment to be used for the flying of performers is often attached to the stationary structural members of a building or theatre, to a movable batten of a mechanical counterweight or motorized rigging system, or to a temporary truss or supporting member.

A written statement of methodology for the installation and intended use must be provided well prior to the installation of the equipment to allow a suitably qualified person to assess the appropriateness of the venue and equipment to be used, the method of rigging the flying equipment and the competency of all personnel involved, including the performers.

The initial installation of the flying equipment must be supervised by a qualified person who is familiar with the specific equipment being utilized for the flying effect, its design, proper use and installation requirements. The level and actual on-site supervision is subject to the competency of the installation persons involved, each individual situation and any other factors which are deemed necessary for a safe installation of the flying equipment.

After installation, the entire system must be proof load tested to **1.5 x the designed SWL**.

Relevant Legislation and Documents

ASNZS 4860 Hazardous Substances & New Organisms (HSNO) Act 1996

These hazards will all be controlled through appropriate planning by all involved in various areas and departments. All supervisors should be required to prove that their risk assessment/s and planning process have addressed these hazards. The relevant Supervisor should, where necessary, consult the director and other relevant personnel in the completion of risk assessments for issues associated with performance hazards and how such hazards will be controlled. Copies of the risk assessment/s and risk management plan should be made available to all employees and sub contractors on request. Flag with your Supervisor if any of these issues have not been addressed.

For any sequences involving stunts, fights, aerial, acrobatic work, or any work identified in the Risk Assessment as requiring specialist supervision, an appropriately qualified and experienced Safety Supervisor should be engaged to supervise the set-up of such sequences and, if necessary, to supervise their ongoing operation.

Most of the hazards associated with performance will be in the category of:

- Set interaction.
- Interaction between members of cast, crew, musicians and the audience.
- Specific hazards associated with performance.

Set interaction hazards include the following:

- Stage lifts, holes, openings, pits, revolves, traps and elevated areas.
- Inappropriate performance surfaces including inadequately supported floors.
- Inappropriate performance surfaces for dancers, such as floors that are not sprung.
- Raked and/or moving stages and/or moving set.
- Tripping on uneven surfaces, slipping on wet or greasy surfaces.
- Inadequate fall protection systems.
- Crew or performers being in the wrong place on stage at the wrong time (including performers missing their marks).
- Inadequate access and egress points on multi-level sets.
- Moving scenery flown incorrectly or unsafely.
- Machinery and equipment failure.
- Scene changes.

- Placement of props near unprotected edges.
- Design and operation of swings, harnesses, etc.
- Costume and wig design.
- Maintenance of costumes and wigs in safe hygienic working order.
- Moving through different light levels from very bright stage lighting to dim backstage lighting.
- Makeup including allergy sensitivity.
- Design and application of prosthetic makeup.
- Difficulty associated with costume changes arising from the design of the costumes.
- Inappropriate crew clothing and/or footwear.
- Potential exposure of costumes, including underwear, to naked flame.
- Insufficient rest and food breaks.
- Inadequate crewing levels.
- Automated stage machinery
- Practical light fittings on sets
- Obstructions in wings EG: booms, truck units)

Performance interaction hazards include the following:

- Choreographed dance scenes.
- Choreographed fighting scenes.
- Scenes utilising firearms and/or weapons.
- Acrobatic, aerial and stunt sequences.
- Use of performance devices such as roller blades, stilts, cycles, etc.
- Aggression from crowds or affection from over exuberant fans.
- Involvement of children in the performance.
- Involvement of animals in the performance.

Specific hazards associated with performance include:

- Exposure to substances, lasers and other physical hazards including special effects such as explosives, dry ice, smoke, fog machines and pyrotechnics.
- Inadequate warm up time and inadequate performance preparation.
- Inadequate access to appropriate medical/physio or other therapy support.
- General fatigue or specific fatigue associated with high levels of physical exertion or unusual or awkward physical postures or activities.

- Nudity.
- Overuse injury associated with performance activity.
- Back strain (see manual handling chapter and appendix)
- Vehicles of any kind on stage.
- Water on stage.
- Climate and environmental considerations including temperature and humidity (both indoor and outdoor), rain, hail, sleet, snow, fog, lightning, sun, wind, tides, current and water conditions.
- Stress or work related aggression.
- Noise and light levels.
- Inadequate, dangerous or faulty communication systems.
- Remotely operated or automated stage machinery.

Most of these hazards are discussed in other chapters, but if not you should set about making a risk assessment and managing that risk.

SET CONSTRUCTION AND CARPENTRY OPERATION

Relevant Legislation and Documents

OSH Guideline for Health & Safety in construction

Hazardous Substances & New Organisms (HSNO) Act 1996

(see fire safety and fire retardant section)

Most hazards associated with carpentry and other set and prop manufacture/repair are associated with:

- the material the set was constructed with and the dusts that can be generated;
- the types of chemicals associated with construction; and
- the plant and equipment used in manufacture.

Sets constructed of certain substances can place those required to cut into them at increased risk of disease if those sets are made of certain timbers whose dusts may be carcinogenic or contain hazardous substances such as arsenic, styrene or formaldehyde. It is important that all those involved in activities which may generate some type of dust from set construction can identify the material of construction to then adopt appropriate control strategies. This includes control strategies in case of emergency such as fire. Be aware of any risks associated with timbers treated with light organic solvent preservative as PPE's would be required.

The material used in construction is also significant when considering manual handling risks to those required to handle the loads but also falling and other risks to those personnel such as performers who have to interact with the set. The set designer must take these factors into consideration when specifying materials to be used.

Risk assessment for sets must be undertaken at the design stage and progressively as required through the construction, installation and strike phases of a production.

Appropriate dust management systems and use of appropriate extraction devices must be utilised as appropriate in workshops.

Information regarding chemicals used in the set construction must be passed onto the set installer/repairer to ensure that these personnel are made aware of potential risks. Safety Data Sheets shall be provided to the installer of all glues, adhesives and paints that were used in set construction so that personnel are aware of potential risks when required to modify sets or props.

HAZARDS RELATING TO PORTABLE TOOLS

Relevant Legislation and Documents

Health & Safety in Employment Regulations 1995

OSH guidelines on machine guarding

General Guidelines

1. Any defective or unsafe equipment should be tagged as such, reported to the Supervisor, and not used until repaired.
2. Cutting tools should be maintained in a sharp condition and protected when not in use.
3. Loose materials such as rags, clothing and hair must be away from all moving parts.
4. Never attempt to hold work pieces with your hands where there is a danger of them moving, for instance, pieces of wood during drilling. Work pieces should be secured with clamp/s or similar devices when there is a possibility of them otherwise moving.
5. Tools must not be used beyond their design capacity.
6. Cutting discs must not be used for grinding or vice versa.
7. Tools or electrical leads must not be left where they can create tripping hazards.
8. Hands must be kept free of oil and grease while using tools.
9. Greasy, wet, slippery or dirty tools must be cleaned before use.
10. Machinery with moving parts must have proper guards.
11. Employees must not use explosive powered tools unless certificated to do so.
12. Do not distract people who are working with machinery.
13. Tools must be stored appropriately when not in use.
14. Safety glasses, fully enclosed shoes, and other appropriate PPE must be worn when using power tools.
15. Appropriate respiratory protection must be worn. Refer to the tools' operating manuals for advice.
16. Unattended power tools must be switched off.
17. All power tools must be fitted with the guards with which they were manufactured and must be functioning properly.

18. Where portable plant has specific emissions, it is essential that the hazards associated with those emissions be monitored. Monitoring must ensure that all maintenance is in line with manufacturers' recommendations.
19. Spray painting must be conducted in a spray extraction area.

Explosive Powered and Compressed Air Tools

Hazardous Substances & New Organisms (HSNO) Act 1996

20. Investigate the use of alternative tools before committing to the use of explosive or compressed air tools.
21. Secure the work area with barricades and signs.
22. Eye and ear protection must be used.
23. Explosive Powered Tools (EPT) storage boxes must be locked when not in use and explosive charges of different strengths must be separated.
24. A log book must be kept for each EPT and all inspection, maintenance services, repairs and incidents involving the tool recorded.
25. At no time should discharge of compressed air come in contact with any part of the human body.
26. Setting of any safety/reducing valves must only be altered by those certificated.
27. The pressure of the compressed air must never exceed the maximum working pressure of any air compressor, pipe, hose, tool or receiver. Hoses must be protected from traffic by suitable covers/ramps.
28. Release pressure in any hose before uncoupling.
29. Hoses must never be kinked.

Adequate illumination should be maintained for the safe operation of all powered tools. This is particularly so when working on stage during a production fit up or bump out.

HAZARDS CREATED BY PLANT, EQUIPMENT, SUBSTANCES AND TRANSPORTATION

Relevant Legislation and Documents

Hazardous Substances & New Organisms (HSNO) Act 1996

(Forms & Information regulations 2001) (emergency Management regulations 2001) (Disposal regulations 2001)(Identification Regulations 2001)

Resource Management Act

Transport Act 1998

General Guidelines

1. For all plant, equipment and substances, the relevant Supervisor should have:
    - recorded maintenance schedules for all plant and equipment including documented daily operational checks;
    - operating instructions for all plant, equipment and substances;
    - plans provided for storage and transportation of any hazardous substances or dangerous goods;
    - proof that any specific first aid or emergency requirements for substances brought onto the production site have been catered for;
    - where required, copies of all certificates for those using any plant or equipment. (If use of certain substances requires certification, this also needs to be available, for instance, a driver transporting dangerous goods must be able to produce their dangerous goods licence).
2. When not in use, all plant, equipment and chemicals must be stored, used, transported and disposed of in accordance with the manufacturer's recommendations and statutory requirements.
3. The materials chosen for any plant item (set, wardrobe, wigs, and props) must be appropriate for the activities that will occur on stage such as the use of special effects, firearms and weapons, the level of activity required, etc.
4. A hazardous substance register should be developed for all substances brought on to the site.
5. All defective equipment must be tagged by the user and repaired prior to further use.

6. A risk assessment must be conducted covering all plant, equipment and substances associated with a production or event and appropriate controls implemented where necessary.

Working with Fixed, Mobile Plant and Vehicles

1. Unless registered for road use, vehicles cannot be driven on public roads.
2. No additional person(s) should be allowed to ride on or in a vehicle unless a seat has been specifically provided for that purpose.
3. Trucks being un/loaded should be parked on even ground.
4. All scenery should be properly secured on the truck and packed in a manner to reduce manual handling risks, i.e. vertical rather than horizontal stacking.
5. Special care should be taken when opening a truck due to potential load shift in transit.
6. Manifest for the truckload should be completed before truck departure and checked off on arrival at site. Manifest and packing diagram should accompany the delivery of sets prior to bump in.
7. Forklifts and front end loaders must not be driven with tines or bucket elevated.
8. Forklifts operating within the work environment must be operated only by drivers holding a licence from an OSH approved training course. If driven on a public road then vehicles shall only be operated by drivers with the appropriate and current class of licence and endorsements.
9. Forklifts, front end loaders and similar equipment must be fitted with an amber revolving light or flashing rear lights with audible reversing beepers.
10. Forklifts shall be primarily used on flat ground. When that is not possible and forklifts are to be used on sloping ground, they must travel forward with the load up the slope and travel in reverse with the load down the slope.
11. When using any mechanical plant that lifts either equipment or people, special care must be taken to be aware of any overhead objects.
12. Vehicles should not be left unattended whilst the engine is running. If this is unavoidable, braking systems must be applied.
13. Care shall be taken alighting and dismounting from vehicles, climbing up and down, and checking the ground before getting off. Jumping from the vehicle should be prohibited.
14. Seat belts must be worn and seats should be adjusted by each user for their body size.

15. Care must be taken by all working in or near mobile equipment.
16. If you are having to unload on a public right of way then you must have a temporary traffic management plan that ensures the safety of the workers and the public.
17. This plan must be lodged with the venue and through them with the appropriate authorities.
18. The plan should be formulated by a person that has undergone STMS training with Tranzit New Zealand.
19. Vehicles that are to be driven on public roads in relation to the production shall have current road registration and warrant of fitness and be maintained in good working order. Any defects must be reported immediately.
20. All vehicles, including customised vehicles used as action props, must be capable of being restrained.

Hazards created by Substances

1. The production manager should supply a register of hazardous substances (including chemicals) to the venue , if requested, and be responsible for providing the Safety Data Sheets (SDS) to all those using them.
2. Risk assessments should be conducted for every hazardous substance to be used in association with a production or event.
3. Anyone working with any hazardous substance must consult the SDS prior to use, taking special note of:
    - required safe work practices;
    - acute and chronic exposure effects;
    - first aid and emergency procedures; and
    - safe storage, transportation and disposal procedures.
4. Each venue must have specific procedures relating to how hazardous substances are to be utilised.

    These should generally involve:

    - A risk assessment relating to how the substance will be used, including the accompanying SDS supplier information. This shall be provided to the production manager and venue owner as part of the planning process and shall indicate the need for a dedicated fire person, possible ticket warnings and the types of emergency equipment that will be required. It is also important that the characteristics of the substance are understood in order to anticipate how it will behave in the circumstances in which it will be used.

- Appropriate procedures and approvals for the isolation of fire detection equipment.
- Documentation regarding training, certification and licences necessary for the transportation, use, storage and disposal of the substance as required by the jurisdiction in which the production is being staged.
- A demonstration in a controlled environment prior to use on stage.
- Atmospheric monitoring requirements.
- Agreement that there will be no change to the effect or its staging after the demonstration without approval from the venue owner or their delegate and in which event a further demonstration shall be conducted.

5. The venue reserves the right to refuse the use of any hazardous substance in their venue.

WORKING IN A CONFINED SPACE

Relevant Legislation and Documents

ASNZS 2865 –2001

Health & Safety in Employment Regulations 1995

A confined space is a space which has restricted means for entry and exit and has inadequate ventilation, is oxygen deficient or contaminated (for instance, spray booths, fibreglass manufacturing booths, air conditioning ducts, orchestra pits with dry ice if not vented).

These may include but are not limited to any compartment with only one person hole access for entry, open top spaces more than 1.5 metres deep such as pits that do not have good natural ventilation. All work to be carried out in such a space must be performed under strict procedures where work plans are submitted by the relevant supervisor to the production manager for approval.

This must include:

- atmospheric testing;
- ventilation;
- cleaning and purging of the space;
- appropriate respiratory protection devices;
- safety harness, lifelines/other rescue equipment;
- observer in constant contact;
- isolation/lockout of all mechanical equipment;
- delivery vessels and power within the confined space;
- signposts and barricades, and
- emergency and rescue procedures.
- Working in small, restricted areas requires special attention to ergonomic principles and where working in such areas cannot be avoided, regular short rest breaks are crucial.

WELDING

Relevant Legislation and Documents

Hazardous Substances & New Organisms (HSNO) Act 1996

ASNZS 4711

1. Only competent persons are permitted to conduct welding operations.
2. All loose, combustible materials must be removed from the welding area.
3. An appropriate fire extinguisher must always be available.
4. Electrode stubs shall be deposited in a container.
5. Electrical cables in immediate area shall be covered.
6. Welding equipment shall be inspected for damage prior to operation.
7. All acetylene cylinders must be kept vertical at all times.
8. Welding area/s must be barricaded and screened from other nearby personnel.
9. Prior to welding any container, an inert gas purge and test shall be conducted especially where containers previously holding flammable matter.
10. No welding shall be done in a hazardous area unless precautions have been taken.
11. Air quality shall be ensured if working in a confined space (see Section on confined space)
12. Suitable protection must be worn at all times.
13. Equipment shall never be left live and the on/off button must be clearly marked.
14. Fume extraction systems must be incorporated into job plans.

MANUAL HANDLING

Relevant Legislation and Documents

OSH Code of Practice for Manual Handling

Manual handling not undertaken effectively or in a safe manner, is the single biggest cause of ACC claimants injuries in New Zealand. Do not under estimate the damage that can be done, some times long term, through improper manual handling.

No person should be required to lift more than they are capable of lifting on the day.

There are 18 risk factors in the Manual Handling of items and weight is only one. Other considerations include movements and posture required, layout of the workplace, actual handling task, exposure to the task, task requirements and object characteristics (weight, dimensions, grip, what the load is), the work environment and individual work factors.

Where possible, mechanical lifting devices should be used to move anything heavy or awkward. Always ensure the pathway is clear prior to moving anything.

Guidelines

For loads that can be carried by the individual:

1. Stand as close to the load as possible with feet apart for good balance, bending your knees and straddling the load.
2. Always try to lift when standing or at least half squatting rather than kneeling or not using your legs.
3. Keep your back as straight as possible whilst lifting and carrying.
4. Always keep the load as close as possible to your body, with elbows close to your sides making sure you can see where you are going.
5. Do not twist your body to change direction, use your feet.

Team Lifts:

1. Ensure one person is in charge during a team lift.
2. Where possible, ensure members of a team lift are of similar height.
3. Position people for the lift having regard to the size, shape and balance of the load.

The risk assessment for the production or event should incorporate all manual handling activities including set transportation, storage, installation and removal.

GENERAL RISK / SMOKING/ FATIGUE / DRUGS / STRESS / HOURS OF WORK

Relevant Legislation and Documents

OSH Guide on Stress and Fatigue

Smoke-free environments amendment act 2003

Layout and Surface of Set

Risk assessments shall include analysis of the layout and surface of the set and performance areas. Appropriate controls shall be implemented in respect of any identified hazard.

Rehearsals

Final dress rehearsals should incorporate all conditions that will apply during performance and include all special effects, full lighting, audio and air conditioning, etc.

Smoking

Under the Smoke-free environments amendment act 2003

No person may smoke in the indoor area of a workplace. A 'workplace' is an 'internal area' occupied by an employer, and usually frequented by employees or volunteers during the course of their employment.

An 'internal area' means an area within or on the premises or vehicle that, when all its doors, windows, and other closable openings are closed, is 'completely or substantially enclosed' by:

- a ceiling, roof or similar overhead surface
- walls, sides, screens or other similar surfaces
- those openings.

A workplace includes the following examples:

- office, factory, shop, or warehouse
- work cafeteria, lift, lobby or stairwell, toilet or washroom, or other 'common area'
- taxi, work vehicle, internal area of a ship aircraft or train, indoor passenger lounge or travel terminal/premises
- public institutions, (eg, university, prison, hospital, government buildings)

- workplaces in otherwise 'private' premises (eg, home office, marae-based kohanga reo, bar in a residential massage parlour)
- RSA, sports club, or housie hall with at least one employee
- hospitality venue
- educational institutions for children under 18 (eg, school, early childhood education centre).

People may smoke in areas of a workplace that do not fit the above definition of an indoor area.

Which work-related areas or people won't be covered by the smokefree provisions?

The prohibition against smoking in an indoor workplace does not apply, if the following situations exist:

- outdoors – any outdoor areas, except school grounds
- non-employees such as contractors and self-employed workers, if they do not work with other employees/ volunteers in an indoor work setting
- infrequent work on private homes or temporary private premises
- private home, hotel or motel room, ship cabin, individual prison cell, foster home, community/church hall, marae etc (if not used as a workplace, school/preschool or licensed premises)
- places like a hotel room that are not frequented much by workers (unless management designate rooms smokefree). Home carers, cleaners, repairers or builders who visit someone's private home to do certain work will need to negotiate with the home-occupier about smoking
- smoking room for live-in patients or residents
- some work vehicles – if everyone who uses a work vehicle agrees, and if the vehicle is not used by the general public (eg, a private pick-up truck), then they may smoke in the vehicle
- areas not within the definition of being 'substantially enclosed'.

Note that each situation differs, and may be defined in different ways/possibly caught by different aspects or definitions in the smokefree law. Anyone wanting specific legal advice should contact a lawyer or legal expert. There is nothing to stop businesses choosing to designate additional outdoor areas smokefree too.

When does the smoking ban apply to volunteers and or independent contractors?

In the case of the volunteer as under Health and Safety legislation they must be treated as an employee and for the independent contractor only if they work in an indoor workplace that has at least one employee present.

You can no longer allow separate smoking areas in indoor workplaces!

What happens if someone smokes in a workplace? Who is liable?

An employer is liable for a fine of up to $400 (individual) or $4000 (body corporate) if they allow someone to smoke on the premises in a smokefree area.

They will not be prosecuted if they have taken all reasonably practicable steps to prevent unlawful smoking eg,

- if they display no-smoking signs,
- do not provide ashtrays,
- give the smoker an oral warning

HerbalCigarettes

The smokefree law extends the existing provisions to cover herbal smoking products as well as tobacco

Smokefree Officers gained limited powers to enter and inspect premises at a reasonable time, take photographs, inspect advertising or display material, and require some limited identifying information.

There is a fine for obstructing an enforcement officer exercising their powers or failing to provide the information required. The maximum fine is $1000.

Working in Darkness or Diminished Lighting Conditions

Working in darkness or diminished lighting conditions is a hazard that cannot be avoided in some productions. Risk assessments must identify procedures to reduce the associated risks.

Consideration should be given to the use of blues and other work lights, use of fluorescent tape markings on floors, steps and edges, etc.

Consideration must be given to those who need to move from areas of bright lighting to low lighting. Appropriate access and egress must be maintained from the stage through the wings.

Appropriate warnings should be provided prior to light levels being reduced.

Exit and safety lighting must be maintained and visible at all times.

Fatigue

Fatigue can occur for many different reasons-physical, mental, or emotional. Being tired, "drained", or exhausted are familiar feelings for everybody. These feelings, if severe or prolonged, can lead to a person becoming "unsafe". Laboratory experiments indicate, for example, that people who have gone without sleep for long enough are just as impaired as people who are over the legal limit for alcohol. The result is of course varies from individual to individual.

Everyone has a responsibility to ensure exposure to fatigue is minimised. Attention must be paid to good diet, adequate sleep, meal and rest breaks during working hours and adequate breaks between shifts.

There are many points at which intervention can occur to prevent stress and fatigue. These suggestions relate purely to work situations and not external factors.

1. Take active steps to design jobs and tasks so that people are mentally and physically stimulated and thus enjoy their work.
2. Design
3. The physical environment with human factors in mind, so that people can work in congenial surroundings
4. Job and task design- provide optional levels of physical and mental activity interspersed with appropriate breaks to allow adequate recuperation.
5. Design rosters safely with adequate regular breaks of at least 1(one) hr within any 5(five) hour work period
6. Travel/driving time should be factored in rosters/schedules
7. Ensure adequate staffing levels.
8. Select people who fit the requirements of the task.
9. Train people so they can do the work/ tasks effectively.
10. Encourage participation at work.
11. Make sure that work/tasks are clearly defined.
12. Provide feedback to employees about their performance and provide feedback from employees about the performance of supervisors.
13. Provide support for people at work – when they encounter problems doing their work, or when they have emotional or family difficulties.
14. Create mechanisms for resolving interpersonal conflicts.
15. Encourage all to maintain health and fitness.
16. Learn to recognise fatigue in others as well as yourself.

Alcohol and Other Drugs

At no time should any illegal drug/s be brought into or consumed in the working environment.

No alcohol should be consumed in the working environment during working hours without the express permission of the producing company and/or the venue.

If the producing company or the venue owner considers any person to be intoxicated or under the influence of any drug to the extent that the anyone in the work environment voices concern that the person's performance is affected or the person presents a risk to themselves or to others, they may enforce that person's removal from the work environment.

If any person is taking medication that may affect their work performance, the producing company and the venue must be notified and due consideration given to the ability of that person to perform work tasks.

This area of Health & Safety has been clarified in the Health & Safety in Employment Amendment Act 2002 where they have amended the definitions of the terms harm and hazard. Under hazard they define it as:

(b) Includes-

(i) a situation where a person's behaviour may be an actual or potential cause or source of harm to the person or another person; and

(ii) without limitation, a situation described in sub paragraph (i) resulting from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person's behaviour

Stress has also been identified as a main purpose behind the amendments. This means we must identify when an employee is not working in a safe way due to all manner of temporary conditions affecting their judgement.

The definition of harm in the amendment Act also explicitly says that harm includes not only physical but also mental harm caused by work related stress. This can be even as simple as consistently setting unrealistic deadlines for an employee to deliver on tasks.

LIGHTING AND ELECTRICAL

Relevant Legislation and Documents

ASNZS 3112

ASNZS 3760 testing

ASNZS 3100

ASNZS 3112

ASNZS 3012 2003 electrical installations

ASNZS 3002 2002 shows and carnivals

ASNZS 4249 Safety film, television and video sites

Electrical Engineers Association SMEI Parts 1-3 2004

Electrical regulations 1997

If there is any concern relating to procedure in the mind of the electrical contractor or the production manager, the relevant authority should be contacted for clarification prior to work beginning

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Guidelines

1. Only those persons accredited under relevant legislation shall be engaged to undertake electrical maintenance and or installation.
2. All electrical equipment shall be well maintained.
3. All portable electrical tools/appliances used in connection with productions and events must be protected by residual current devices (RCDs) or, in the event use of RCDs is incompatible with the use of a particular electrical tool/appliance (for instance, dry ice machines), then protection must be provided by current protection on the distribution board.
4. All electrical equipment / devices must be tested for function by a qualified electrician or competent person. Testing requirements must follow those outlined in legislation and NZ standards.
5. When there is a possibility of moisture, any joins will be provided with adequate weather protection including RCD protection.
6. All leads must be off the ground where possible. . In the event it is not possible to keep leads off the ground, a full risk assessment must be

undertaken and appropriate controls implemented with consideration being given to the use of covers.

7. All electrical equipment/devices must be protected from the weather; or constructed to a suitable IP rating.
8. Cables should not be twisted, crushed or kinked.
9. All cables should be secured and clearly identified.
10. Cable routing should take into account and not create a tripping hazard.
11. Before working on any electrical equipment, it must be properly isolated.(This includes when having to service the lamp after the luminaire is rigged).(eg replacing bulb)
12. All outlets should be considered live unless proved dead.
13. Conducting materials such as earth, concrete, wet/damp timber, flames, all metal objects such as rulers, tapes, rings and belts and yourself shall, where possible, be removed from contact with any electrical work.
14. There should be RCD's at mains not at sub mains
15. All lights must be safely secured, this includes safety chains.
16. All lights and other powered equipment should be properly grounded.
17. Deteriorated or poorly maintained lighting equipment fixtures, sockets, fixture wiring, etc.should be replaced.
18. All lighting fixtures or stands should be properly supported to prevent tipping.
19. All hung fixtures should have a safety chain.
20. High voltage gas discharge lamps - such as neon's, HMIs, CSIs and fluorescents - should be properly grounded, inspected for lens cracks that could leak ultraviolet radiation, and otherwise handled with the care given high voltage equipment. Personnel using them should be aware of the ballasts used and ensure all safety devices are working. Keep people away before striking the lamp.
21. All personnel should be warned of the dangers of ultraviolet radiation from "arc" type lamps, and care taken to protect against skin and eye damage.
22. There should be adequate lighting backstage.
23. Lasers must meet requirements (see later chapter) and only those personnel with correct laser-operation permits are allowed to operate lasers.
24. Black light output should be low in ultraviolet radiation.
25. Appropriate fire extinguishers must be available.
26. All switchboards must be of robust weatherproof construction and have a

locking device, protective doors that will not damage flexible extension cords, securely fixed to a structure, have an isolating switch, and be locked after work each day/shift.

27. Care must be taken when using tap on plugs and adaptors that the circuit is not over loaded
28. Clearance should be maintained between lighting equipment and flexible cords to prevent overheating.
29. Maximum loads of lighting dimmers shall not be exceeded so as to avoid overloading and a consequent fire hazard.
30. Cables shall be protected against contact with sharp edges or heavy loads.
31. All portable generators must comply with current NZ standards and be fitted with an earth leakage device.
32. Danger tags on portable appliances shall only be removed by authorised personnel
33. All electrical personnel should be aware of the load-bearing capacity of cables and boxes and not overload this capacity.
34. Cables should not be spliced; they should be connected to approved terminals or connectors.
35. Cables should be checked regularly for overheating, loose connections, fraying or other damage.
36. Worn and frayed electrical cables should not be used. Keep electric cables away from sharp corners or doors that can pinch and damage them.
37. Flexible cords should not be substituted for fixed wiring.
38. Set Practicals should be wired internally, and the fixture stem should reach through the back of the scenery where a bushing should be placed on the end of the stem. All fixtures should be securely fastened in place.
39. Portable stage switchboards must be supplied by outlets of sufficient voltage and ampere ratings.
40. All circuits from a portable switchboard shall be provided with suitable over-current protection.
41. Portable switchboards shall be enclosed with substantial construction that is lined with corrosion resistant metal. All switches and circuit breakers should be externally operable and enclosed, and must be test tagged.
42. Portable switchboards must have a pilot light that is lit even when the master switch is opened.
43. Temporary hook ups to an electrical system must have a Certificate of Compliance issued by the registered electrician that undertook the work.

44. Electrical devices used for special effects (e.g., simulating lightning, waterfalls etc.) must be constructed so that sparks and flames do not contact any combustibles.
45. All AC circuits must be earthed. The venue may provide a specific technical earth.
46. The path to ground from all circuits, enclosures, and equipment shall be permanent.
47. All switches shall be clearly marked.
48. Powered tools and electrical equipment with exposed metal parts must be grounded.
49. Lighting, including Ultra Violet Light (UV light) can create very interesting effects but have the potential to affect the health and safety of those in the workplace. Strobe lighting has been known to induce epileptic seizures. Epileptics who are flicker-sensitive are likely to experience a full seizure if triggered. If this type of lighting is to be used the audience should be warned at the point of ticket sale and also at the entrance to the auditorium.
50. Flicker rates of 4 flashes/second or less are recommended and all strobes should be synchronised when more than one is used.
51. All exposed metal work must be earthed.(eg: rostra, staging, scaffolding, grid, set elements).
52. Safe disposal of discharge lamps (to be completed)

LASER

Laser Safety Considerations

All laser light show systems have intrinsic dangers. Observation of basic laser safety rules and the specific safety regulations of the jurisdiction in which you operate are essential.

We will focus on some general safety information that applies across

the board. If you require specific safety information for a particular jurisdiction, contact the authorities in your area and ask.

Laser Hazards

The danger from lasers can be divided into the following major categories:

1. **Eye hazards such as retinal or cornea burns.**
2. **Skin hazards such as burns.**
3. **Electrical hazards from high voltage equipment.**
4. **Fire and flood hazards.**

For further information on these hazards see the appendix on Laser

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NEVER point a laser at someone's eyes no matter how low the power of the laser.

Guidelines

1. NEVER point a laser in someone's eyes, even low power hand held units can cause eye damage due to the focusing effect of the lens in the eye.
2. Stay outside of any 'safe zone' around lasers at shows. The 'safe zone' is there to prevent audience access to the laser equipment and to prevent spectators [you] from harming themselves or being hit by laser beams.
3. Higher power static (un-scanned) beams such as those projected by beam tables or reflected from bounce mirrors should be kept above the spectator's heads and out of the audience's reach. The ANSI standard (used internationally) and the CDRH standards (used in the USA) specify that such un-scanned (static) beams are to separated from the audience by 3 meters vertically and 2.5 meters laterally.
4. Un-scanned laser beams should NEVER be projected into an audience.
5. Ensure that any item with a reflective surface does not come into contact with the laser beam.

NEVER deflect laser beams with hand held mirrors as they are difficult to control and can direct beams in unexpected ways causing eye damage.

6. To eliminate skin burns, don't stick your body parts into high power laser beams.

Electrical Safety

1. When working on the electrical systems of lasers, use the 'buddy' system. In the event that you come in contact with a live high voltage AC power line, your muscles will spasm making it difficult or impossible to let go of the line. Your 'buddy' should use a broomstick or other non conductive instrument to remove your hand from the power terminals.

HIGH VOLTAGES CAN KILL YOU!!

2. If you have to operate the laser system with the cabinets open (E.G. when troubleshooting), have an assistant standing by to disconnect the power at the main switch/breaker in case of problems.

3. To avoid electrical problems from water in the exciter (power supply), check that all fittings are tight, replace worn washers and keep the floor dry.

Audience Scanning

1. In enlightened jurisdictions where audience scanning is permitted, you must take all precautions to make sure the audience scanning effects are intrinsically safe. The power of the effects used must meet the exposure levels permitted in your area. Audience scanning is a big responsibility as you could ruin hundreds of people's vision.

RETINAL INJURY IS PERMANENT

Relevant Legislation and Documents

Hazardous Substances & New Organisms (HSNO) Act 1996

(fireworks, safety ammunition, and other explosives transfer regulations 2003)

Arms Act 1983 and the Arms Regulations 1992

Arms Code 1993

An Armourer is defined as a person licensed to use firearms on a set and competent to carry out the duties of Armourer.

An armourer requires one or more of the following licences:

- A type **A** firearms licence allows the holder to have and use sporting type shotguns and rifles.
- A type **C** firearm licence allows the holder to have pistols and or restricted weapons. There is an endorsement for "employees of theatrical groups or film making organisations". This endorsement is subject to the condition that the holder shall not under any circumstance use live ammunition in the pistol or restricted weapon. This licence is subject to strict storage security and the firearms are registered with the Police.
- Type **E** firearms licence is required for people to have military style semi-automatic rifles and shotguns.

So the most common required for theatre is a Type **C**.

Guidelines

1. An unloaded weapon without ammunition (live, blank or dummy) present is considered a prop, and can be handled by armourers or property masters. This individual should have all required licenses and permits for the types of firearms to be used, and should be knowledgeable about local laws concerning the transportation, storage and use of firearms.
2. Only firearms that have been deactivated should be used for non firing props. The firearm should be deactivated, modified or repaired only by qualified gunsmiths with the approval of the manufacturer.
3. If ammunition is present, then a weapons expert with the appropriate licence should be present and responsible for the weapons and ammunition.
4. It is advisable to inform the local police authority of an intention to discharge a firearm in performance.
5. Live ammunition should never be used, or even be allowed on the set.

6. Only use the particular type of ammunition designed for a specified firearm. Manufacturer guidelines for weapons and ammunition should always be followed.
7. Do not modify factory-loaded blank ammunition. Use the lightest and safest loads of blank ammunition possible. Only regular or crimped safety blanks should be used on sets.
8. I f dummy bullets are used, it is absolutely essential to ensure there is a method to distinguish them from live bullets. The dummy bullets should be filled with shot so the bullet will rattle, or some other definitive identification means used to distinguish live and dummy rounds.
9. The weapons expert should know all the expiration dates, manufacturer warnings, and storage and handling procedures associated with the blank ammunition being used.

Firearms /weapons on the Set

1. All personnel (crew, actors, etc.) should be informed in advance of the intention to use firearms.
2. No one should be forced to use a firearm.
3. All performers using handguns must be given instruction in their proper and safe handling. This should be listed on the call sheet.
4. Even if firearms are to be used in a scene, rehearsal should be done with non-firing weapons.
5. The weapons expert should have time to discuss the use of firearms in a scene and related safety requirements with the director and performer.
6. The weapons expert is responsible for instruction of performers in the safe use of guns.
7. Firearms should never be given to someone without first determining that he or she is knowledgeable in their proper and safe use.
8. All ammunition and firearms - even private ones - should be turned over to the weapons expert when the weapons come on stage.
9. Except when in performance or for necessary rehearsals, all firearms should be locked up by the weapons expert, with sign in and sign out procedures.
10. Weapons and ammunition should be stored separately whenever possible.
11. No smoking signs must be posted where powder or blank ammunition is stored.
12. All firearms should always be treated as if they were loaded.
13. Playing around with firearms should be forbidden.

14. Guns should never be pointed at anyone, even when being fired during a scene.
15. The crew and other personnel on the set should be warned prior to firing of weapons.
16. Firearms should be loaded and unloaded only by the weapons expert.
17. Loading and checking of weapons should occur just before they are required on stage.
18. Guns should be unloaded and checked as soon as they are off stage and then locked up by the weapons expert.
19. Guns should be checked and cleaned before and after each use and inventoried after each day's use by the weapons expert.
20. A firearm should never be fired if the barrel is clogged with dirt or other foreign matter.
21. The gun should never be put down in such a way as to clog the barrel or workings.
22. Jams and malfunctions should only be worked on by the weapons expert.
23. If the cause of malfunction is unknown, the gun should be taken out of use until it is determined to be safe.
24. Risk assessments must be conducted for the use of any firearms or weapons to ensure there is minimum risk to those in the workplace and in the audience.
25. Written procedures documenting the use of firearms and weapons shall be implemented.
26. All swords, knives and blades must be blunt.

PYROTECHNICS

Relevant Legislation and Documents

Hazardous Substances & New Organisms (HSNO) Act 1996

(Fireworks, Safety Ammunition, and other explosives Transfer Regulations 2003)

(Forms and Information Regulations 2001)

(Fireworks amendment regulations 2003)

(Fireworks Regulations 2001)

(Emergency Management Regulations 2001)

(Disposal regulations 2001)

(Identification Regulations 2001)

Crimes Act 1961

Gas Act 1992

Gas regulations 1993

Fire safety and evacuation of Buildings Regulations 1992

NFPA 1126 Standard for the use of pyrotechnics before a proximate audience

The main problems of pyrotechnics include prematurely triggering the pyrotechnic effect, use of larger quantities or more dangerous materials than needed, causing a fire, lack of adequate fire extinguishing capabilities, and, of course, inadequately trained and experienced pyrotechnics operators. As a result of these risks, all pyrotechnics special effects are regulated.

See also appendix on pyrotechnics

All pyrotechnics must be in accordance with the requirements of the Act and Regulations and have the required Test Certificates.

A separate Code of Practice for pyrotechnics is currently being prepared.

Under the HASNO Act all pyrotechnics displays/effects are required to be under the control and execution of an approved handler. The approved handler will be required to plan, obtain all necessary approvals, purchase and fire all pyrotechnics.

Planning

Determine the type of effect that you are looking to achieve. Obtain all necessary Safety Data Sheets [SDS] and Test Certificates relating to the product you are looking to use.

Undertake a site visit to determine the local conditions and prepare a risk assessment and complete a hazard sheet. Where possible eliminate or isolate as many of the hazards identified as possible.

A suggested checklist of the items to address is attached in Appendix ..... Items worth noting in terms of indoor displays are: -

- Smoke detection
- Emergency evacuation plans for the building
- Safe and secure storage at the venue
- Security
- Placement of fire hoses/extinguishers

From the SDS determine the best and most suitable product for the effect you want to achieve taking into account the safety zones and the requirements of your performance.

Once the product has been selected prepare a scale drawing indicating the location of the pyro and the safety zones required and the audience.

Once the planning and selection of the product has been completed it will be necessary to obtain the following approvals: -

i. Property/Building Owner sign off
ii. Fire Safety sign off from the local Fire Brigade
iii. A Fire Permit from the local Council if the display is outside
iv. Notify OSH a minimum of three [3] days before the display

Once all of this information is to hand it will be necessary in the case of an outdoor display to obtain a Test Certificate from a Test Certifier – Whilst not currently a requirement, it will be necessary in the near future to obtain a Test Certificate for an inside display.

With all the approvals in place and where applicable, a Test Certificate to hand, you will be able to purchase the required pyrotechnics.

Packaging, Transportation and Storage

Packaging, transportation and storage of pyrotechnics is to be in accordance with the requirements of the HASNO Act, Amendments and the HASNO Regulations and Amendments. Attention is also drawn to the LTSA requirements for the Transportation of Hazardous Substances and the requirements for endorsements on licences.

Execution

On arrival at the venue or the site, you should contact the Property Manager, or Building Owner and Stage Manager/Production Manager and confirm that you are on site with pyro.

Revisit the checklist and hazard sheets prepared as part of the planning and update to determine any changes from your previous visit.

Brief the team who are responsible for the pyro and ensure that the appropriate signage is in place and exclusion zones are set up.

Ensure where pyro is part of the performance that all performers, technical staff, Theatre management and others involved in the performance are aware of PYRO.

A safety kit should also be on hand when rigging and firing pyro. This kit should include: -

- Ear protection
- Eye protection
- Gloves
- Fire proof clothing
- Fire extinguishers
- Fire blanket
- Danger tape and signage
- High vis vests if outdoors

Ensure that you have plenty of time to rig the display and that all necessary continuity tests have been undertaken. Once pyro is rigged it will be necessary to have a minder to ensure that safety zones are not breached.

When firing pyro ensure that you have line of sight to the product so that you can ensure that safety zones have not been breached and that the product can fire safely. IF IN DOUBT DON'T FIRE. It is better for the pyro not to be fired rather than risking people or property to injury.

After Execution

Identify that all effects have successfully fired. If any effect has not fired, treat as live. Any unfired effects will need to be returned to safe storage. The unfired effects will be required to be labeled as such.

Confirm there are no hot spots or fall out that has caused/will cause damage.

Pyrotechnics are dangerous and will cause significant damage to personnel and property. In all cases treat with care and caution and if in doubt, DON'T FIRE.

DRY ICE AND SMOKE EFFECTS / NAKED FLAME

Relevant Legislation and Documents

Hazardous Substances & New Organisms (HSNO) Act 1996

See also appendix on smoke/fog & fire safety section

When a Dry Ice Machine was operated on stage during a preview performance of a popular musical in the UK - carbon dioxide (CO2), being heavier than air, seeped into the pit. A member of the theatre staff who was in the orchestra pit became disorientated and collapsed. The member of staff was taken to hospital and later released, fortunately without suffering any apparent long-term injury.

HSE prosecuted the producer

This accident highlights the problems associated with such effects and the need for technicians to be aware of the associated problems.

Guidelines

1. Smoke, fog and naked flame on stage, is a hazard.
2. All personnel (stage crew, actors, etc.) should be informed in advance of the intention to use smoke or fog or naked flame and the type to be used. Before use, there should be a discussion of the hazards and precautions being taken.
3. Obtain Safety Data Sheets on all smoke and fog products. In particular note whether the Reactivity section lists any hazardous decomposition products.
4. The choice of product depends on whether it will be used indoors or outdoors, in enclosed spaces, and whether people will be exposed for any significant period.
5. Children, elderly and people with respiratory problems should be informed of their possible higher risks. A medical opinion should be obtained as to whether they should be exposed.
6. Use only fog and smoke machines with the chemicals recommended by the manufacturer. Other materials may clog, or otherwise interfere with proper operation of the machine. Keep the fog machine in good repair and use as instructed.
7. Use the minimum concentration of smoke for the minimum period of time necessary. Avoid heavy concentrations when people are exposed.
8. Only allow essential personnel on the stage when using smoke and fog effects. Also evacuate any nearby areas where the smoke could reach.
9. Respirators should be available for anyone wanting one in any situation.

10. On stages, interior sets or in enclosed areas, rapidly exhaust the smoke once not needed.
11. In theatres it is particularly important to exhaust the fog away from the audience or orchestra pit.
12. Minimise the number of exposures to risk, so if it is not essential for all rehearsals then don't use it.
13. When burning organic materials, you should have a designated fire watch on hand.
14. If performers are using naked flame then their costume/wig items should all be fire retarded

NOISE / SOUND

Repeated exposure or continued exposure to excessively high noise levels can result in irreversible damage. Noise is measured in the logarithmic decibel scale and can be measured by devices ranging from those that can be easily measured by those in the workplace to sophisticated equipment requiring specialist skills.

The following general guidelines to control damaging and nuisance noise apply to all performing arts workplaces:

- To preserve hearing, exposure for each noise should be kept below 80 decibels on average per day.
- Peak sound pressure levels should not exceed 140 decibels.
- Nuisance noise such as high pitch, unexpected or distracting noises shall be minimised.

To do this, the following strategies may be employed:

1. Identify or isolate sources of noise and measure these to determine the amount of noise being generated.
2. In workshops, use quiet machines and make sure they are well maintained.
3. Enclose or isolate noisy equipment where possible.
4. Separate noisy and quiet work.
5. Use sound absorbing materials in the workplace (e.g. ceilings and screening e.g. baffling) where possible.
6. Use of personal hearing protectors (when all other methods have failed).

When choosing hearing protectors, the pitch (frequency) of the noise must be taken into account. Different types of protective equipment have maximum damping effects in certain frequency ranges. Data on the characteristics of hearing protectors can be obtained from the suppliers. In order to encourage the use of hearing protectors, personal preferences in comfort must be taken into account. Different types of ear protectors should therefore be made available.

It is important that those operating high-risk noise devices such as firearms and weapons are made aware of the potential to create instantaneous deafness with inappropriate handling and use.

They aim to protect workers from the risk of hearing damage due to excessive noise. How do these regulations affect theatre personnel?

See also Noise/sound appendix

Noise/Sound in Theatres

1. Hearing damage is cumulative and the effects of hearing damage are often not noticed until many years later when loss of hearing due to aging exposes the damage. Hearing damage is also irreversible. However, hearing does fluctuate due to colds and other illnesses, and loud sounds may produce a temporary threshold shift with no permanent after effects (e.g. after a rock concert). Apart from extremely loud sounds, which can cause immediate injury, the acceptable level of noise exposure depends on the level of the noise and the time of exposure. Sound level and exposure level are usually measured exponentially in decibels (dB). A 10dB increase in level increases the exposure level by 10dB and each doubling of the time exposure increases the exposure level by 3dB. For example, exposure to 90dB(A) for 8hours is equivalent to exposure to 99dB(A) for 1 hour.
2. The trigger point for action is "when any ...employee is likely to be exposed to the first (or peak) action level or above"

   UK code of practice guides suggest that as a rough guide, if two people have to shout or have difficulty communicating when standing 2m apart, a noise assessment should be made. This assumes that the sound level is constant for a normal working day. In the theatre the sound levels are very rarely constant for a working day and it is difficult to make a simple rough guide.

   Areas for concern are sound technicians working long hours preparing sound effects or amplified music, musicians in pits and pyrotechnics.
3. Once a noise assessment has been made it should be reviewed when the work assessed changes. This means that the assessment may need to be repeated for each new production, and even during production periods. There is no provision to 'drop out' from assessment once an assessment has been made although there is not a requirement to actually measure for each assessment.
4. Measurements can be made using 'clip-on' noise dose meters or integrating sound level meters. Because of the varied nature of the sound levels, movement of staff and working hours, an assessment will require more than simply making measurements. For varied activities, a noise 'dose' can be established for each activity and these levels combined.

   Making an assessment will probably involve a specialist who can interpret results and advise on any necessary actions.

   This need not exclude a sound technician from actually making measurements, both for the assessment and to ensure compliance.
5. When a production tours, noise measurements made in one theatre may not be the same as in another. This will depend on the size of the

auditorium, the amount of backstage space, the reverberation times of stage and auditorium, and the size of the pit if in use.

6. If an assessment is made, theatres may benefit from applying for exemption from daily levels to weekly levels in borderline cases. For example, if a single performance has an LEP,d of 87dB(A) on matinee days the LEP,d will be 90dB(A), the second action level. Over a week of 8 performances the LEP,w will be 89dB(A).
7. Measurement methods for peak action levels are not clearly defined although a rough check can be made using a fast reading sound level meter (not integrating, as required for LEP,d measurements). If a reading over 125dB(A) is made further measurement is necessary. Peak action levels may be exceeded when pyrotechnics are used or in drum booths.
8. Where action levels are exceeded, most theatres will wish to reduce noise exposure without compromising the noise levels set during the design process.

   The best method of doing this is by managing the noise. This can be done by:

   a) Placing loudspeakers so that employees are not exposed to louder levels than the audience.

   b) Ensuring that as few staff as possible are on stage when the production is noisy.

   c) Rotating staff duties so that they are not exposed to loud noises each performance.

   d) Ensuring that staff involved in noisy work have quiet breaks.
9. Zoning and hearing protection may be required where pyrotechnics or very loud sound effects are required. Legally and practically, they are a last resort. They also trigger a requirement for training and information. Where pyrotechnics must be operated with line of sight, there may be no alternative. If hearing protectors are used, octave band analysis of the noise hazard will need to be made.
10. The production period is not well covered by the provisions, as the work is not repetitive. It is common practice to keep production periods as quiet as possible and this should be encouraged.

    Where possible noisy work should be scheduled to minimise general exposure and all unnecessary staff encouraged to leave the noisy area.
11. Musicians, including freelancers are definitely employees and covered by the regulations. Employers' duties include freelance staff and people employed elsewhere, so consideration should be made, for example, of

musicians employed by a theatre in the evening but teaching or playing all day as well. If musicians set their own monitoring level, care should be taken that this will not exceed action levels. Research has found a difference in hearing between violinists' left and right ears, so it should not be assumed that it is only brass, percussion and electric instruments that can cause high exposure levels.

12. There is no agreed method for measuring noise dose from headphones although broadcasters are beginning to limit headphones to 'safe working levels'. Headphones are available with built-in limiters (e.g. Canford Audio).
13. Employers also have a duty where employees visit other sites and this includes riggers, touring and maintenance crews who visit different sites, even in the same day. Apart from equipping all staff with personal dose meters, it is difficult to see how such a varied work load can be monitored.
14. Sound engineers should be particularly careful when preparing sound effects. Listening at high level should be kept to an absolute minimum.

    Spreading the work, so that work is not all done on the same day, can help to reduce exposure. A loud sound effect at a level of 110dB (a baby crying can make that noise!) can be listened to for only five minutes before exceeding the second action level.
15. HSE in the UK have published a 'Pop Concert Guide ' which states that although the audience is not covered by their regulations, suggests a maximum of 106dB for the audience.

    Note: this does not exempt members of the audience who are 'at work' e.g. ushers, artists, production staff, sound engineers or (?) critics.
16. Engineer controls. In an orchestra, a major source of high intensity sound is created by the brass and percussion sections. Therefore, effort should go into deflecting and decreasing the noise from these instruments. Methods include erecting plexiglass shields in front of these sections to provide a partial barrier or building risers for the rear section of the orchestra. Sound baffles on individual musicians' chairs may also deflect high intensity sound.

Summary

Sound technicians should be aware of the risk of hearing damage and of the regulations. They may be asked to take, or assist in the taking of, measurements for a noise assessment. Where possible, timetable and equipment planning should avoid prolonged exposure to loud sound levels. Where the second action level is exceeded, hearing protectors must be worn. Assessments must be made by 'competent persons' and need to be reviewed when productions change.

Sound technicians should seek information from suppliers of equipment likely to cause sounds over the first or peak action level. One practical way to manage sound exposure levels in the theatre may be to create a database of noise exposure for different tasks and productions.

Finally it should be remembered that many theatres' workload varies considerably, some on an annual pattern, but the regulations are based on daily exposures although a weekly exposure may be used with written permission.

OSH have prepared the following table for exposure for unprotected ears:

Duration of exposure per day	
8 hours	85db(a)
4 hours	88db(a)
2 hours	91db(a)
1 hour	94db(a)
30 minutes	97db(a)
15 minutes	100db(a)
8 minutes	103db(a)
4 minutes	106db(a)
2 minutes	109db(a)
1 minute	112db(a)
30 seconds	115db(a)

Initial sound checks and audio tuning should be scheduled when other cast and crew members are not present.

TEMPERATURE

Some working environments will have people involved in close proximity with heat. Special precautions need to be taken where possible to reduce the risk of exposure, especially in relation to design of costumes, choice of fabrics and the likely activity to be performed during the performance to avoid overheating. In any event, it is essential that there is appropriate water available and any clothing does not create problems in overheating. For outdoor performances, adequate shade must be provided. Risk assessments shall take account of any necessary temperature controls that may be required.

Risk assessments should analyse appropriate working environment temperatures for all aspects of the production or event to ensure potential exposure to extremes of heat and cold are avoided. Where sites are not air conditioned, other means of heating/cooling should be provided and may require monitoring on a daily basis. Acceptable performance temperatures will vary according to the activity undertaken.

SECURITY & TRANSPORT TO AND FROM WORK

Land Transport Act 1998

The following may want to be included in management procedure for touring companies particularly.

The producing company and the venue owner shall ensure the security of persons working on a production or event, including ensuring safe entry and egress from the working environment.

Option 1:

Having regard to the time of day/night, the presence or otherwise of crowds and other relevant matters, the producing company and/or venue owner shall take all reasonable measures so that all persons have safe access between the working environment and transport to and from work.

OR

Option 2:

Any person having concerns regarding safe access to travel to and from the work environment shall raise such concerns with the producing company and/or the venue owner.

The following is taken from the LTSA web site in regards to Drivers hours of work. This of course relates to HT licensed drivers but should be considered within our industry for those expected to drive trucks below the 5 tonne threshold.

The existing limits (11 hours driving, or 14 hours on duty with a minimum 9-hour break between working days) will be replaced by a limit of 13 hours of work time in a working day. The break between working days will be a minimum of 10 hours. This reduces the length of the working day by 1 hour, but provides more flexibility about what work can be done inside that frame.

New limit to working week

The week was 66 hours driving or 70 hours on duty – it will now be 70 hours of work time. This maintains the number of hours that can be legally worked before a 24-hour break is required.

Short break requirements differ by type of service

Standard requirement is break after 5_ hours work time; varies for taxis and urban bus services. Note that there is no extension of the time allowed between breaks when "non driving" work is done.

New chain of responsibility

Extends liability for causing or allowing a breach of work time requirements past

the employer to any person who requires or directs a driver to breach the legal limits.

Penalties for breaching hours

Divided into two levels

- less than 60 minutes "over" (or rest breaks missed) will have fine, optional directed course, optional disqualification (if applied, minimum is one month).
- 60 minutes or more "over" mandatory disqualification (as now)

Defences - delays Unavoidable delay remains; "emergency" is also added to cover situations such as a civil defence emergency or where a severe crash imposes delays on a vehicle.

Relevant Legislation and Documents

Hazardous Substances & New Organisms (HSNO) Act 1996

1. Individual make-up kits should be provided for each performer to guard against potential disease transmission.
2. Each performer should be provided with **dedicated costumes including shoes and wigs** to reduce the likelihood of infection.
3. It is the producing company's responsibility to maintain and launder costumes and wigs.
4. All props should be maintained in a clean and hygienic condition during rehearsals and production. Particular care must be taken with props used for eating and/or drinking.
5. Any catering operations must adhere to strict hygiene principles in relation to both food preparation and presentation. These must be in line with the relevant Public Health and Food Acts.
6. In any situation where medical assistance or first aid is rendered, universal precautions should be practiced to guard against infection transmission.
7. Waste disposal is a crucial issue on site. How this is conducted during the production must be identified in the Risk Assessment and made clear by the production manager to ensure the likelihood of infection transmission prior, during and postproduction is minimised. Procedures must be clearly understood by contractors.
8. All facilities, including dressing rooms, back stage, stage, wings and all workshops, should be kept in a clean and hygienic condition.
9. Adequate Male and female toilet facilities must be provided for before, during and after any production or event for both personnel and the audience.
10. Cleaning of toilet facilities and food areas should be conducted daily to ensure the possibility of infection transmission is reduced as far as reasonably practicable.
11. Toilets and shower facilities, appropriate to the needs of the performance or event, should be provided and easily accessible.
12. Where production sites involve the use of portable or permanent air conditioners, they shall be kept maintained in good clean working order.
13. The quality of all drinking water, whether sourced on site or brought onto the site, should be evaluated before it is used.

14. If productions or events are to be conducted on or around water, or if water is to be used during a production or event, the water should be evaluated for safety.

WARDROBE

(see Fire Safety and Fire Retardance section)

A manufacturing workroom should be treated as a factory and the layout and safety measures should comply with the Health & Safety in Employment Act 1992 and its subsequent amendments

Guidelines

1. Ensure there is adequate illumination for the task to be undertaken. For fine handwork, dedicated light sources should accompany the workstation.
2. Each machine should also have adequate illumination that provides safe working light level with minimal glare.
3. Always use the appropriate machine for the task.
4. All machines should be switched off and the machinist should wait for the motor to wind down before changing bobbins or needles
5. Always ensure that the needle is the appropriate one for the task.
6. All machinery should have regular maintenance
7. The department should maintain a maintenance schedule that details each machine and its recent service history.
8. An adequate first aid kit should be available and sited close to the machinery.
9. Safety zones should be clearly marked around all work areas but particularly around presses and ironing areas.
10. Fabric should not be stored at heights likely to cause injury when retrieving them.
11. Dyeing should be done in a separate area from all other tasks and take into account waste disposal and ventilation as per local bylaws.
12. All hazardous substances should be stored in a fireproof lockable container.
13. A well-ventilated spray room should be provided and used for all spraying.
14. Workrooms should be clean and tidy at all times.
15. Clear pathways of egress through the workroom should be maintained at all times.
16. The plant and machinery should be connected to a safety cut off switch that will kill supply of electricity to all equipment, in the case of emergency.
17. The cut off should be accessible from each workstation.

PRODUCTIONS UTILISING THE ENGAGEMENT OF CHILDREN

Relevant Legislation and Documents

Health & Safety in Employment Regulations 1995 Part 5 regulations 54,55,56

Further information is available from Actors Equity.

Special requirements associated with children include:

A child is defined as a juvenile of 16 years and under.

1. Age appropriate recreational materials, food, rest breaks, facilities and, where necessary, accommodation facilities.
2. Trained and adequate supervision.
3. Maximum working hours are:

Age of Juvenile	Maximum Hours per Day
Up to and including 8 year olds	6 hours
8 to 11 year olds	8 hours
12 to 16 years	10 hours

4. Juveniles must work no more than 5 consecutive days, and no more than 5 days in a calendar week. It is expected that young children will work fewer days.
5. Juveniles must have at least a twelve hour overnight break exclusive of travel time.
6. Babies under 12 weeks of age must be cared for by a parent or parent's approved alternative and must not be exposed to harsh light, extreme temperatures, irritants including irritating or contaminated make-up, infections or excessive handling.
7. Professional baby care present at all times and parental access to the baby guaranteed at all times.
8. Babies must not be exposed to direct lighting.
9. Makeup used must be non-irritating and uncontaminated.
10. No more than four people to handle baby during any single period of employment.
11. No person with respiratory or skin infection to come into contact with baby.
12. Access to parents and or adult accompaniment to and from work must be made available.

13. Adult chaperones should be employed on the basis of one to every five juveniles, depending on the age and time of day they are working.
14. These chaperones should undergo a thorough check as to their suitability to be in charge of minors. This should include a police record check.
15. 14 is also applicable to those working in Theatre in Education and has become a prerequisite for funding within the policies of the Arts Council of England.
16. All juveniles should be safe guarded with appropriate privacy and non-exposure to distressing scenes.
17. Children shall not be required to perform naked or with a naked person.
18. Children should be kept well away from pyrotechnics and or weapons
17. The Education Act must be complied with. This means that young actors of compulsory school age (in 2000 this means 6-16 years old) must not be engaged in work (whether as employees or independent contractors) in such a way that it has a detrimental effect on their education.
18. The production company must allocate appropriate time, facilities and supervision for the completion of school work for all juvenile actors, including those younger than 6 years old who are engaged in formal school programmes.

    Methods of complying include:

    - Short term engagement. *School work can set by school, supervised by an appropriate tutor or chaperone.*
    - Long term engagements. *Correspondence School can be a suitable way of complying with the Act*
19. The production company will ensure that the children will be given at least 2 hours per working day to be allocated to schoolwork. This period shall not be broken into more than two periods except under extreme circumstances.
20. It is the responsibility of the parents to apply to the New Zealand Correspondence School to be educated by correspondence as required by the Education Act 1989.
21. When setting hours of work for the chaperones, bear in mind the age of their charges and the effect this has on fatigue levels for the chaperone.
22. Any juvenile under the age of 15 must not be in the work environment during a fit up or pack out.

Relevant Legislation and Documents

Animals Protection Act 1960, its regulations and amendments

Special considerations in relation to animal use include:

1. Engagement of suitably qualified and experienced animal wrangler/s.
2. Animal contact and possible disease transmission. The wrangler/s are responsible for ensuring all necessary vaccinations and inoculations are current and should make documentation available if requested.
3. Distance between and potential contact between animals, performers, crew, audience and general public.
4. Performers/crew who are being exposed to the animals should be notified in the call sheet
5. Well being of the animals. This should include the provision of a stress free area and any specialist arrangements required for loading or unloading the animal.
6. Potential problems with the animal/s' performance.
7. Appropriate facilities to house, feed and transport the animals in hygienic conditions without affecting the hygiene of nearby areas.
8. Ability to dispose of animal waste and problems this waste may create.
9. Contingency plans developed in consultation with animal handlers in relation to emergencies.
10. The set should be constructed to meet the requirements of the animals and action they will undertake in the performance.

THEATRE HEALTH & SAFETY CHECK LIST

The following is a simple checklist you can use to assess the safety measures of a venue and or production and assure yourself that you are entering a safe working environment.

General Considerations

- Who is the person responsible for Health & Safety issues.
- Is there an evaluation procedure for new hazards caused by use of new materials, special effects or productions?
- Are there material safety data sheets and operating manuals for plant and equipment or chemicals in use on the production
- Is there a right to know training for all employees
- Are there special procedures for the health and safety of child performers

Fire Safety

- Are there written emergency procedures and evacuation plans clearly displayed
- Are fire drills routinely scheduled
- Are the emergency exits clear marked and accessible
- Is the sprinkler system functional
- Are there enough and appropriate fire extinguishers
- Are the extinguishers marked as having been checked and tested
- Is there adequate training in their use
- Is there a working fire alarm system
- Are there working smoke alarms
- Are the set and props and if appropriate costumes, fireproofed
- Is there a fire officer at each performance
- Is there a fire safety curtain and if so are you made aware of how it is operated

Venue Conditions

Stage

- Is rigging safely secured
- Are props safely secured
- Are lights safely secured
- Are trap doors and pits adequately marked

- Are electrical outlets safe and working
- Is all cabling secured and clearly marked in the wings
- Are elevations clearly marked and safe
- Does stage floor have enough resiliency
- Are the floors dry and clean
- Is the stage clear of splinters, loose boards, nails etc

Lighting

- Are the stage lights properly focused, and rigged
- Is there adequate working light backstage including in galleries, the grid, trap room etc
- Do lasers meet basic safety requirements (see separate chapter)
- Is black light output low in UV radiation
- Are there adequate precautions when using strobe lighting (see separate chapter)

Stairways

- Are the treads and backstage stairs maintained in good condition
- Are the stairwells properly lit
- Are the alleyways clear of rubbish and obstructions

Environmental Conditions

- Is the temperature comfortable
- Are the costumes modified appropriately for extremes of temperature
- Is the humidity level optimal
- Is there sufficient airflow with adequate intake of clean outside air
- Is the stage area free of drafts
- Is the air free of contaminants

Stage Conditions

Stage Traffic

- Are entrances and exits well choreographed and rehearsed
- Are onstage movements well choreographed and rehearsed

Stunts/ stage combat

- Are there written procedures
- Are stunts and combat carefully choreographed and planned by qualified personnel

- Is there adequate training and rehearsal time
- Are there padded landing areas for jumps over 2m

Firearms and weapons

- Is there a competent person in charge of all firearms and weapons?
- Are there the appropriate licences?
- Is there secure storage for firearms when not in use?
- Is there adequate training and procedures for those using firearms
- Are the firearms and weapons routinely inspected?

Special effects (fogs, fire, smoke, etc)

- Is the a permit where required
- Is there hearing protection if required
- Are materials chosen for optimum safety?
- Is sand and artificial snow free of contaminants?

First aid/medical

- Are there adequate first aid kits available?
- Are they accessible and clearly marked
- Are there defined medical procedures and are all trained in them
- Is there a list of local physicians and medical facilities prominently displayed?
- Are there emergency ice packs easily available?
- Is there a sick bay, rest area, set aside should any one become ill.

Make Up

- Are there individual make up kits for each performer
- 2 .Are ingredients listed on make up
- Is there appropriate ventilation in the dressing rooms when using aerosols (hairspray etc)?

Travel/Tour

- Is there advance inspection of stage and dressing rooms etc
- Is there adequate rest time between arrival at a location and rehearsal/performance
- Are buses/trucks recently serviced and licenced
- Is the accommodation provided of a reasonable standard
- Is there available sanitary drinking water backstage
- Have you been warned of any dietary considerations relating to the locale

- The touring party should have copies of the following:
  - Health & safety in Employment Act 1992 and its subsequent amendments
  - Health & safety in Employment Regulations 1995
  - HSNO Act 1996 and regulations
  - Building regulations 1992
  - A copy of this guide

APPENDICES

LASER APPENDIX 1

A laser can be considered as a highly collimated source of extremely intense electromagnetic radiation that is defined by three characteristics:

- monochromatic, directional and coherent. Due to the temporal and spatial
- coherence of the laser beam it can be considered as a point source of
- phenomenal brightness than can easily exceed the brightness of the sun.

Lasers are a more directional light source than any other common fixture such as stage lights or a follow-spot. The higher the optical output power of the laser, the greater the potential hazard.

Eye Hazards

The major danger of laser light shows is hazards from beams entering the eye since this is the organ most sensitive to light. The simplest way to explain this is to say, "just as a magnifying glass can be used to focus the sun and burn wood, the lens in the human eye focuses the laser beam into a tiny spot that can burn the retina".

Lasers in the visible and near infrared range of the spectrum have the greatest potential for retinal injury, as the cornea and lens are transparent to these wavelengths and the lens can thus focus the laser energy onto the retina.

The maximum transmission by the cornea and lens, and the maximum absorption of laser energy in the retina occurs in the range from 550 nM to 400 nM.

Argon and YAG lasers operate in this range clearly making them the most hazardous lasers.

Wavelengths of less than 550 nM can cause a photochemical injury similar to sunburn. Photochemical effects are cumulative and result from long exposures (over 10 seconds) to diffuse or scattered light.

Laser damage and retinal burns can occur when a laser beam enters the human eye. Lasers are a 'point source' of light much like the sun thus the eye focuses on infinity when viewing lasers especially in a darkened space where no other light sources are present. Laser beams are almost parallel thus the lens of the human eye will focus them down to a

small spot. A laser beam with low divergence entering the eye can be focused down to a spot 10 to 20 microns in diameter.

The laws of thermodynamics do not limit the power of lasers. The second law states that the temperature of a surface heated by a beam from a thermal source of radiation cannot exceed the temperature of the source beam. The laser is a non-thermal source and is able to generate temperatures far greater than it's own. A 30 mW laser operating at room temperature is thus capable of producing enough energy (when focused) to instantly burn through paper!

Due to the law of the conservation of energy, the energy density (measure of energy per unit of area) of the laser beam increases as the spot size decreases. This means that the energy of a laser beam can be intensified up to 100,000 times by the focusing action of the eye. A one watt laser beam when focused down to a small spot can produce temperatures higher than the surface temperature of the sun! Thus even a low power laser in the milliwatt range can cause a burn if focused directly onto the retina.

Eye damage can also occur when laser beams are scanned across the eye even for very brief periods. The amount of exposure is difficult to estimate as 'dwell' or 'transit' time must be taken into account in your calculations.

For example a 1 mW laser illuminating a 7 mm aperture (the average size of the dark adapted iris) for one second is the equivalent of a 10 mW laser illuminating the same 7mm aperture for 1/10 of a second.

The international laser safety standard, IEC-825, defines a short exposure as 2.5 mW per square centimetre. Each jurisdiction has it's own maximum exposure levels for laser radiation. You should consult with your local regulatory authorities and get their official methodology and formula(s) for calculating the MPE (Maximum Permissible Exposure).

SKIN HAZARDS

Exposure of the skin to high power laser beams (1 or more watts) can cause burns. At the under five watt level, the heat from the laser beam will cause a flinch reaction before any serious damage occurs. The sensation is similar to touching any hot object, you tend to pull your hand away or drop it before any major damage occurs.

With higher power lasers a burn can occur even though the flinch reaction may rapidly pull the affected skin out of the beam. These burns can be quite painful as the affected skin can be cooked and forms a hard lesion that takes ages to heal.

ELECTRICAL HAZARDS

Most medium and high power lasers operate on 220 or even higher AC voltages; draw lots of current and frequently use multi-phase electrical connections. The power supply (exciter) for the laser typically doubles or even triples the line

voltages before feeding them to the laser head where lethal voltages can be present. An average of two people per year die from laser electrocution.

If it become necessary to open the power supply to diagnose or correct problems, you should insure that the main power has been disconnected at the breaker or disconnect switch. With the cabinet of the laser head or exciter open, terminals carrying lethal voltages may be exposed. In some systems large electrolytic capacitors are used for smoothing DC voltages. Even with 'bleed' resistors these can take several minutes to discharge fully and should be treated with caution and possibly discharged manually before working on the system.

An additional hazard exists where water cooling of the power supply (exciter) is used. Minor leaks in the water cooling pipes can cause high voltages to short to the water or case of the unit both of which are usually at ground potential.

In high humidity conditions, condensation can form on the water cooled parts inside the laser power supply. In combination with dust and residue in the power supply, the condensation can form a conductive path shorting components and causing an explosion. Condensation on water pipes and fittings inside the laser head can also drip onto vital components causing problems. Puddles of water on the floor are also a hazard when working with the high voltages present in laser equipment.

FIRE AND FLOOD HAZARDS

High power laser beams deflected onto flammable materials can cause ignition and fires. A 10 watt laser will drill a hole in cinder block (when focused). Almost any material except metal is a potential fire hazard, especially wood and drapes (flameproof drapes make little difference). Nylon or rayon clothing is especially bad for burns as the plastic fabric melts and can cling to your skin increasing the burn duration and intensity.

You should be aware of beam path positions and avoid directing high power beams at dry bushes, drapes or other flammable surfaces. Watch out for beams when you are around the projector so as to avoid burning holes in your clothing and setting fire to your fashions.

Hose connections at the water feed and the hoses themselves can leak. Water cooled system can also leak in unexpected places inside the equipment causing flooding and water damage.

Types of Pyrotechnic Materials

In general, all pyrotechnics are explosives, but not all explosives are pyrotechnics. Class A explosives (high explosives) are materials like dynamite and Primacord which may detonate even if unconfined. Pyrotechnic special effects materials are Class B explosives. They will burn, but not explode unless confined.

Examples are black powder and pellet powder, safety fuses, igniters, igniter cord, fuse lighters, Class B special fireworks, and Class B composite solids propellants.

Class C explosives are common fireworks. Note that short lengths of Primacord may be classified as Class C under certain conditions. Both Class B and C explosives are also called low explosives.

All pyrotechnic materials and other explosives consist of an oxidizer (source of oxygen) and a reducer (fuel).

Examples of oxidizers include potassium nitrate, strontium nitrate, potassium perchlorate and potassium chlorate. Examples of fuels include metals like magnesium and aluminium, sulphur, silicon dioxide, and organic fuels like charcoal, starch, resins, and chlorinated hydrocarbons. The choice of fuel and oxidizer determines the type of effect (flash, smoke, sound, etc.) its colour, and its intensity.

There are two basic types of pyrotechnic materials: single component and two component systems. Single component materials will either burn if ignited, or explode if ignited when enclosed, since the oxidizer and fuel are in the same mixture. Flash paper, for example, is a partially nitrated cellulose and contains both fuel and oxidizer internally.

The traditional black powder has potassium nitrate as the oxidizer, and sulphur and charcoal as fuels.

In two component or binary systems, the oxidizer and fuel are separate components, which are transported and stored separately and only mixed when ready to use. These separate components should be pre-packaged and labelled as A and B. A typical binary system could have strontium nitrate as the oxidizer component and magnesium and aluminium as the fuel. It is important to store oxidizers carefully since they can utilize many types of organic materials as fuels. Potassium chlorate, for example, is one of the best oxidizers, but is particularly dangerous because it is so reactive.

Lycopodium is also used by pyrotechnicians for fire effects. It is not actually a pyrotechnics materials but a combustible material. Since it is a combustible, organic dust, it is explosive when enclosed.

Smoke and Fog Hazards

In the last 10 years, the use of fog and smoke to create atmosphere or special lighting effects has greatly expanded, due in great part to the influence of music videos.

There are a wide variety of products and machines used to create smoke and fog effects, with varying degrees of hazard.

The data sheets only discusses non-explosive materials that depend upon a change in physical state to create the effect, not a chemical reaction.

Fog and smoke effects are created by generating a fine mist, a dispersion of very small particles, or an actual smoke by burning organic materials. All smokes and fogs are easily inhaled. Some chemicals used to generate the smoke or fog are toxic; however even chemicals that are not appreciably toxic can be irritating to the lungs. In particular, high risk groups such as people with asthma or other respiratory problems, children, or elderly, and people having to do deep breathing (e.g a musician playing a wind instrument or a singer) might be more susceptible to inhalation of any material.

It is often difficult to obtain information on many of these products, even from Material Safety Data Sheets (MSDSs), because many manufacturers claim that the compositions are trade secrets. Manufacturers of these products often make extravagant claims as to safety. For example, many products state that the chemicals used have been approved by the US Food and Drug Administration (FDA) for ingestion. However, the fact that it might be safe by ingestion does not mean it is necessarily safe by inhalation.

Many manufacturers have done acute toxicity studies on their products. These animal studies only tell the effects of single exposures and not of repeated exposures. In addition

these studies would not pick up reversible, respiratory irritation, which can be crucial to actors or singers.

Another problem is determining the length of exposure. The assumption is that these fogs are used only for short periods of time. However in theatre, actors could be exposed daily. In addition most theatres do not have an efficient method for clearing out the fog between scenes, so that there can be an accumulation of the fog chemicals over a period of time. This can result in longer exposures not only for the actors but also the crew.

In attempts to evaluate the safety of some of these fogs and smokes, unions and other groups have had these products analyzed.

Hazards of Particular Fogs and Smokes

Petroleum Distillates

Many of the earlier types of fogs were based on kerosene, fuel oil or other petroleum distillates. These were vaporized by heating to generate a fine mist. Unfortunately inhalation of these chemicals caused eye and respiratory irritation, chemical pneumonia, and narcosis (dizziness, headaches, nausea, etc.). In addition, the mist of these petroleum distillates is a fire hazard. I definitely recommend against any fog product containing fuel oil or other petroleum distillates.

Zinc Chloride Smoke Generating Devices

A number of companies sell smoke generators based on zinc chloride (e.g. smoke cookies, smoke pots, smoke candles, smoke bombs). Some of these also contain chlorinated hydrocarbons such as perchloroethylene, a suspect carcinogen. The smoke is generated by heating or burning the product.

These are available in sizes that generate small to very large amounts of smoke. The Material Safety Data Sheets on many of these products are not adequate and do not reflect their hazards. Use of these smoke devices in fire fighter training exercises has

resulted over the years in complaints of breathing problems, chest pains, hot and cold flashes, headache, fever, fatigue, sore throat, nausea, cough and even some fatalities. Some of these symptoms might be due to chlorinated hydrocarbons, but most are due to the generation of high concentrations of hydrochloric acid from the reaction of the zinc chloride with water. In some studies hydrochloric acid concentration have even approached levels considered immediately dangerous to life or health. Even lower levels of smoke have caused symptoms. It is recommend against the use of zinc chloride smoke devices, or devices based on titanium chloride and similar materials indoors or in outdoor situations where either crew or actors could be exposed to any substantial amount of the smoke.

Ammonium Chloride

Ammonium chloride (sal ammoniac) is a common method of generating smoke on stage and outdoors. The smoke is created by heating the ammonium chloride. Air sampling studies have found large concentrations of ammonium chloride. Also that some decomposition of the ammonium chloride to hydrogen chloride occurs during this heating.

The hydrogen chloride dissolves in water in the respiratory system to produce hydrochloric acid, a respiratory irritant. The levels of hydrochloric acid are much smaller than caused by the zinc chloride smoke devices, but are still high

enough to cause concern. It is not recommended that ammonium chloride be used indoors or in enclosed spaces.

Mineral Oil

This includes oil crackers and diffusion foggers. Oil crackers involved bubbling air through a drum of mineral oil.

The air bubbles reaching the surface contained "cracked" oil of particle size 1 to 50 microns. This oil is not "cracked" in the sense of chemically breaking down the oil but is merely creating smaller droplet size. This has also been used in combination with dry ice.

The diffusion fogger produces a mineral mist of less than 1 micron size by using a compressor to force mineral oil through a series of fine filters.

No toxicological studies have been made on inhalation of mineral oil of particle size less than one micron. However there is concern about long-term problems such as lipid pneumonia since the very fine mineral oil mist gets deep into the lungs and stays there. This is not recommended for use indoors or where personnel could inhale the mineral oil.

Glycol Fogs

During the last decade, a whole range of products have been developed that use mixtures of water and polyfunctional alcohols, including ethylene glycol, propylene glycol, diethylene glycol, triethylene glycol, polyethylene glycol and glycerin. In general these are safer than most of the other fogs and smokes with the exception of dry ice. Ethylene glycol and diethylene glycol are toxic by ingestion, causing kidney damage and possible death; the other glycols mentioned are considered only slightly toxic.

Ethylene glycol has been removed from most fogs after studies showed that it is a teratogen (can cause birth defects).

Unfortunately long-term studies have not been done on inhalation of the mists of most of these glycols, although respiratory irritation is sometimes listed on Material Safety Data Sheets.

A more serious concern is how the fog is generated. These mixtures are heated in a fog machine that heats the liquid to a temperature near 600 F. One air sampling study found significant levels of acrolein in the mist generated.

Acrolein is a strong respiratory and eye irritant.

It is likely that some chemicals could generate more decomposition products than others.

Reformulation and finding ways to reduce the temperature needed to create the mist are possible solutions. Despite these problems, at this time the glycol fogs

are probably the least hazardous fogs to use, although some will probably turn out to be safer than others.

Burning Organic Materials

The burning of gums such as olibanum gum (frankincense), paper, and other materials can also generate smoke. These smokes are irritating and considerable amounts of carbon monoxide may also be generated. In addition to the smoke hazards, there is the concern about the open flames. These materials should not be burned inside or where people would be exposed to substantial amounts of smoke.

Types of Respirators

The following table lists the types of respirators to use with different mists and fogs:

Table 1. Respirator Selection for Smoke and Fog

dry ice	none needed; test oxygen concentration in enclosed spaces.
zinc chloride	acid gas cartridge and dusts and mist filter; high concentrations need air-supplied respirators
ammonium chloride	acid gas cartridge and dusts and mists filter
mineral oil	dusts and mists filter
glycol fogs	organic vapour cartridge and dusts and mist filter
burning materials	dusts and mists filter for smoke.

The regulations set a maximum eight hour day 'dose' of sound energy of 85 dB which should not be exceeded. If this level would otherwise be exceeded, the employer must attempt to reduce the sound or transmission path or failing this, create a 'noise zone' in which hearing protectors must be worn.

A lower level of 85 dB is set at which employees are entitled to hearing protection on request, and the employer must provide information.

The regulations are geared to a workplace where there is a regular pattern of work such as a production line. In the theatre the varied nature of productions and workload makes assessment difficult, except for West End type shows, and the regulations cover all noise 'at work' so the exposure of freelance or self employed work should include all their work activities.

An idea of the level of noise we are talking about can be best explained in the following way:

Whisper	20db
Conversation	60db
Vacum cleaner	80db
Orchestral Music	83-92db
Subway	80-110db
Rock Music band	105-111db
Disco	120db
Jet takeoff (300 feet distance)	140db

A daily dose of 90dB would cause hearing damage in approximately 60% of the population if they were exposed to the same level every working day for 40 years. The regulations make no distinction between 'music' and 'noise'.

Where a work place has a fairly constant activity over a period of time, the procedures laid down give a reasonable assessment of the employees' likely exposure. In the theatre, where activity is much more varied, the prescribed measurement procedure may not be a good reflection of the likely exposure, but this does not affect the requirements to comply with the legislation.

Three action levels of exposure –

first(Lepd=80dB):

second (Lepd=85dB):

Peak (95db) are defined.

The daily exposure level can be measured directly using a noise dose meter or calculated from a series of measurements. If the first or peak action level might be exceeded a noise assessment must be made by a 'competent person'. The Assessment must be reviewed when the work assessed changes. A competent person does not have to be a specialist.

If the second action level is exceeded the exposure should be reduced, as far as practicable, by means other than ear defenders. Ear defenders must be provided to all employees if the second action level or peak action level is still exceeded and on request if the first action level is exceeded.

The ear defenders must be suitable for the particular noise, be maintained, worn and the zone where they are needed must be clearly marked.

Approved hearing protectors are graded on scale of 1 to 5

Grade 1	86-91 db(a)	earplugs/earmuffs
Grade 2	92-97 db(a)	earplugs/earmuffs
Grade 3	98-103 db(a)	earmuffs
Grade 4	104-109 db(a)	earmuffs
Grade 5	110-115 db(a)	earmuffs

If the first or peak action level is exceeded the employer must provide information and training on hearing protection.

The regulations allows a certificate of exemption to be issued by OSH allowing the second level to be determined by the weekly exposure where the work fluctuates on a day to day basis.

MANUAL HANDLING APPENDIX 5

The lower back is subject to greater mechanical stress than almost any other part of the body. Because of this it is important to know how to care for it and to minimize the risk or permanent injury. We recommend the following web site for further reading: **http://artsandfilm.healthandsafetycentre.org/s/Theatre.asp**

The code of practice for manual handling is available from the Dept of Labour OSH offices.

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adapted from: Lights! Camera! Safety! A Health and Safety Manual for

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Health & Safety at Work Act 1974 HMSO

Management of Health and Safety at Work Regulations 1992 HMSO

Noise Guides 1& 2 HSE Noise Guides 3-8 HSE

Introducing the Noise At Work Regulations (free leaflet) HSE

Guide to Health Safety and Welfare at Pop Concerts and Similar Events HSE

BS 4196 Sound power levels of noise sources.

BS 5330 Method of test for estimating the risk of hearing handicap due to noise exposure

BS EN 60651 Specification for sound level meters

BS EN 60804 Specification for integrating-averaging sound level meters
BS EN 61252 Specifications for personal sound exposure meters
BS 6655 Specification for pure tone air conduction threshold audiometry for hearing conservation purposes
OSH bulletin P179/10,000
AEIA Draft Safety Code Oct 2000

This Guide has been endorsed by the following companies, organisations and venues:

EVANZ, Entertainment Venues Association of New Zealand
ETNZ, Entertainment Technology NZ
Royal NZ Ballet, Wellington
Shand Shelton Ltd, Wellington
Theatre Systems and Design Christchurch
Toi Whakari, NZ Drama School, Wellington
Capital E, National Theatre for Children, Wellington
Invercargill City Council – Civic Theatre and Centre Stage
Metro Productions, Wellington
St James Theatre, Wellington
Wellington Opera House, Wellington
Expressions Arts Ctr, Upper Hutt
Wellington Festival & Convention Ctr
Regent Theatre, Palmerston North
Hamilton City Council, Theatre Services, Founders Theatre, WetspacTrust Theatre
Baycourt, Tauranga
The Plaza Theatre, Putaruru
Venues Rotorua
Convention Ctr, Napier
Napier Municipal Theatre
John Herber Ltd, ChCh
Edmonds Manufacturing, ChCh
NCC Ltd, Chch
Shipleys, ChCh
Marlborough ctr, Blenheim
Aurora Ctr, ChCh
The Light Site, ChCh
Trailer Stages Ltd, Chch
Theatre Royal foundation
ID Entertainment Ltd, ChCh
Hang-Up Entertainment Services, ChCh
Stage-Right Ltd, ChCh
Stadium Southland
Regent Theatre, Dunedin
Invercargill Musical Theatre
Fortune Theatre, Dunedin (await official confirmation)
Auckland Theatre Co., Auckland

Bruce Mason Ctr, North Shore City
Centennial Theatre, Auckland
Academy of Performing Arts, Waikato University, Hamilton
Sky City Auckland Ltd
Multi Media Systems Ltd, Auckland, Wellington, Christchurch
UNITEC, School of Performing Arts, Auckland
Selecon NZ Ltd, Auckland
Adena Stage Lighting, Hamilton
Hawkes Bay Opera House, Hastings
Napier Operatic Society. Napier
TPC Ltd, Wellington
Spotlight Systems, Auckland
Spotlight Services, Auckland
TSB Showplace Theatre, New Plymouth
Taki Rua, Wellington
Bats Theatre
New Zealand Symphony Orchestra