MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Safety in Technology Education

A GUIDANCE MANUAL FOR NEW ZEALAND SCHOOLS

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Introduction

Safety in Technology Education: A Guidance Manual for New Zealand Schools **provides teachers, principals, and Boards of Trustees with the guidelines and information necessary to establish and implement sound health and safety policies and procedures for technology teaching and learning.**

This guidance manual interprets and applies the **Health and Safety at Work Act 2015** and associated Amendments, as well as other relevant Acts and Regulations within the context of technology teaching in New Zealand schools. The manual also refers to other statements with which teachers and Boards of Trustees should be familiar, including the **National Administration Guidelines 3 and 5**.

The Health and Safety at Work Act 2015 with associated Amendments and guidelines also applies to students in Māori-Medium settings so this manual provides guidance for those students and teachers learning **Hangarau** through **Te Marautanga o Aotearoa**.

Continually reviewing safe practices is particularly important as new technologies become part of teaching and learning in technology education. To ensure the health and safety of their students and staff, the Person Conducting a Business or Undertaking (PCBU: Boards of Trustees as a legal entitiy) and Officers (individual board members including the principal) need to ensure that safety procedures and practices continue to be developed and implemented within their school, in keeping with the guidance presented in this manual and with any subsequent changes to Acts or regulations that cover health and safety in the workplace.

However, it should not be assumed that the warnings and precautions stated in this manual are all inclusive. In some situations, the PCBU, Officer and workers (paid employees including teachers and cleaners) need to use their professional judgment and seek additional information from health and safety professionals and relevant websites to prevent unsafe classroom practices occurring.

Safety in Technology Education is designed to assist classroom teachers and their students to take an active role in planning and implementing safe practices for the protection of everyone involved in technology education activities. Safe practices, as promoted by the Ministry of Business, Innovation and Employment (MBIE) and Ministry of Education (MoE) should be viewed as an integral part of the planning for and delivery of technology education.

Teaching and learning programmes in technology integrate the three curriculum strands; **Technological Practice**, **Technological Knowledge**, and the **Nature of Technology**. Safety planning in technology needs to encompass all aspects of the teaching and learning programme.

The definition of safety adopted in this manual is wide, including aspects of physical, emotional, cultural, and environmental safety, as well as the safety of the end-users of the products or systems that result from technological practice.

Technology takes place within cultural settings. This aspect of safety should be addressed when planning student learning experiences in technology. This might include, for example, understanding local Māori protocols, such as whether it is acceptable for both genders to carry out traditional activities like carving or weaving. In one context, it may be acceptable for a whakapapa to be recorded in writing or for a picture of an ancestor to be used in a publication – in another situation, this may not be acceptable.

The key to planning for safety is identifying potential hazards and eliminating or minimising the risks so far as is reasonably practicable. Involving students in developing safety plans for units of work supports their understanding of working safely as a life-long skill. As teachers develop a unit of work in technology education, they should use this manual to develop a safety plan that identifies the hazards involved and the appropriate strategies to eliminate or minimise them. This safety plan should be an appendix to the unit of work and become part of its documentation. In this way, teachers revisiting the unit of work at a later date have the benefit of this planning and an opportunity to add to the safety plan.

The timing of learning about the safe use of equipment and safe working environments is crucial to effective student learning. Specific safety procedures learned when needed, at the time students are about to use the equipment or machinery ensures that students will be able to put the learning into practice immediately. They will then retain this pocket of knowledge and skills.

About this guide

The first two sections of this manual – Legal Requirements and Responsibilities, and Responsibilities of Boards of Trustees and Principals – set the expectations of the school leadership. The remaining sections:

- focus on aspects that teachers and students need to consider when planning for and implementing safety practices in technology classrooms
- document issues that teachers should be aware of when planning for and implementing safety in different areas of the technology curriculum
- suggest approaches to take if an incident occurs
- provide suggestions for when technology students are involved in out-of-school vocational or pathways activities.

Boards of Trustees, principals, and teachers should first read the general information in Sections 1 and 2. Teachers and students should then read sections relevant to specific learning contexts and, if necessary, refer to any applicable specialist information that is beyond the scope of this manual.

Section 1
Legal requirements and responsibilities

The legal requirements and responsibilities of schools for the safety of staff and students are covered by several pieces of legislation. These include the **Health and Safety at Work Act 2015** and its subsequent Amendments, the **Health and Safety at Work (General Risk and Workplace Management) Regulations 2016**, and the **Health and Safety at Work (Hazardous Substances) Regulations 2016**.

The Acts of Parliament and their Regulations form the framework for safety planning in this area and must be complied with. **http://www.education.govt.nz/ministry-of-education/specific-initiatives/health-and-safety/** gives guidelines on how legal requirements can be met in an educational setting.

Some relevant Acts, Regulations, guidelines, and codes of practice are listed below.

Acts

Health and Safety at Work Act 2015

Food Act 2014

Regulations

Health and Safety at Work (General Risk and Workplace Management) Regulations 2016

Health and Safety at Work (Hazardous Substances) Regulations 2016

Guidelines and Codes of Practice

Health and Safety Practical Guide for Boards and School Leaders

Code of Practice for School Exempt Laboratories

Food Risk Management Framework (Ministry of Primary Industries)

New Zealand School Trustees Association (NZSTA)

1.1 Legislation affecting technology education

Health and Safety at Work Act 2015

WorkSafe New Zealand (WorkSafe) is the work health and safety regulator, its functions include:

- Monitoring and enforcing compliance with work health and safety legislation
- Providing guidance, advice and information on work health and safety
- Fostering a co-operative and consultative relationship between the people who have health and safety duties and the persons to whom they owe those duties and their representatives.
- Collecting, analysing and publishing statistics and other information relating to work health and safety

The legislation recognises that a well-functioning health and safety system relies on participation, leadership, and accountability by government, business, and workers.

The purpose of the new Health and Safety at Work Act 2015 is to make clear everyone's responsibilities in keeping workers healthy and safe in workplaces. The Act clarifies responsibilities and accountabilities, strengthens worker participation and creates expectations for effective risk management that are proportionate to the risk.

The legislation will be supported by government regulations, approved codes of practice (approved by the Minister) and guidelines (developed by the Regulator).

The Health and Safety at Work Act 2015 applies to schools in the same way it applies businesses and organisations. In the school setting, the PCBU is the Board of Trustees (as an entity) and has the primary duty of care, the principal is the Officer who has duty of due diligence, and the workers are any person who carries out work in any capacity for Boards of Trustees. Other persons include anybody within the school workplace and/or environment including students, parents, visitors, casual volunteers, members of the public.

Click link below to see table of roles: **http://www.education.govt.nz/assets/Documents/Ministry/Initiatives/Health-and-safety/HealthandSafetyinSchoolsroles.pdf**

Health and Safety in Schools

Duty holders and their responsibilities under the Health and Safety at Work Act 2015

Duty Holder	Definition	School Role	Responsibilities
PCBU (Person conducting aBusiness or Undertaking)	The **PCBU** is usually a legal or corporate entity, including a selfemployed person. In a school this is the Board of Trustees. They have the primary duty of care for the health and safety of workers and others.	Board of Trustees (as an entity)	The PCBU must ensure the health and safety at the workplace of: » all workers » other people, by ensuring they are not put at risk from work being carried out. This means the PCBU must among other things: » provide a safe and healthy environment for workers, including access to facilities » provide the right information and training to all workers » provide and allow for worker participation in health and safety matters » notify all serious illness, injury or near misses » monitor workers' health and workplace conditions to prevent illness or injury
Officers	**Officers** have significant influence over the management of the business or undertaking. They must exercise due diligence to ensure the PCBU meets its health and safety obligations. **Note:** People who merely advise or make recommendations to an officer of the organisation are not officers.	Principals, individual members of the Board of Trustees	Officers must take reasonable steps to: » know about current work health and safety matters » understand the hazards/risks associated with the workplace operations » make sure there are resources and processes for managing risks » ensure there are processes for receiving and reviewing information on and responding to incidents, hazards and risks » ensure workplace health and safety processes and resources are being used.
Workers	**Workers** work for the business or undertaking and can include: » employees » contractors or subcontractors and their workers » labour hire company employees » apprentices or trainees » people on work experience or a work trial » volunteer workers whose work is integral to the business' operations **Note:** Other volunteers, such as for fundraising, are not worker.	Teachers, non- teaching staff, the principal, contractors, volunteer workers, etc	Workers must: » take reasonable care for their own health and safety » take reasonable care that their behaviour does not adversely affect the health and safety of others » comply with any reasonable instruction from the PCBU to allow the PCBU to comply with the Act » cooperate with the PCBU's health and safety policies or procedures **Note:** It is recommended workers should report any incident, risk or hazard to an officer or HSR, and inform visitors of any known hazards or risks in the workplace. Also, a student becomes a worker while on work experience for another PCBU. So when they are on work experience, the host PCBU will have the most influence over their health and safety.

Duty Holder	Definition	School Role	Responsibilities
Health and safety representatives	**Health and safety representatives** are workers who are elected to represent a defined workgroup. A workgroup is a defined group of workers who are represented by one or more health and safety representatives. The workgroup may be defined by physical location, a business group or a group of workers who have common risks		Health and safety representatives can: » represent workers on health and safety matters » investigate complaints from workers about health and safety issues » monitor health and safety measures taken by the PCBU » provide feedback to the PCBU about health and safety compliance » issue provisional improvement notices and direct work group members to cease unsafe work if appropriate.
Other persons	**Other persons** include parents, visitors, other volunteers, general public and those who may be put at risk by the work of the PBCU. It does not include people who unlawfully enter the premises.	Visitors, parents/whānau, other volunteers etc	Other persons should: » take reasonable care for their own health and safety » take reasonable care that their behaviour does not adversely affect the health and safety of others » comply with any reasonable instruction from the PCBU to allow the PCBU to comply with the Act.
	Other persons includes students	Students	The Health and Safety at Work Act does not specifically mention the age of responsibility for health and safety duties, however under the Crimes Act children under 10 can't be prosecuted at all and children under 14 can only be prosecuted in special circumstances. One of the principles in the Children, Young Persons, and Their Families Act is that unless the public interest requires otherwise, criminal proceedings should not be brought against a child or young person if there is a way of dealing with the matter through alternative means (e.g. a warning or caution, or possibly through a school's disciplinary processes). The likelihood of action against a schoolchild for a breach of health and safety duties is low.

This information is in accordance with the Health and Safety at Work Act 2015 and is not a substitute for seeking legal advice. If you need advice on any aspect of your health and safety system, seek the assistance of a professional advisor.

36 Primary duty of care

In general terms the board has overall responsibility for health and safety in the school and is responsible for providing resources to enable workers, students and others to carry out their health and safety duties.

All PCBUs have a primary duty of care in relation to the health and safety of workers and others affected by the work carried out by the PCBU.

(1) A PCBU must ensure, so far as is reasonably practicable, the health and safety of—
  (a) workers who work for the PCBU, while the workers are at work in the business or undertaking; and
  (b) workers whose activities in carrying out work are influenced or directed by the PCBU, while the workers are carrying out the work.

(2) A PCBU must ensure, so far as is reasonably practicable, that the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking.

(3) Without limiting subsection (1) or (2), a PCBU must ensure, so far as is reasonably practicable,—
  (a) the provision and maintenance of a work environment that is without risks to health and safety; and
  (b) the provision and maintenance of safe plant and structures; and
  (c) the provision and maintenance of safe systems of work; and
  (d) the safe use, handling, and storage of plant, substances, and structures; and
  (e) the provision of adequate facilities for the welfare at work of workers in carrying out work for the business or undertaking, including ensuring access to those facilities; and
  (f) the provision of any information, training, instruction, or supervision that is necessary to protect all persons from risks to their health and safety arising from work carried out as part of the conduct of the business or undertaking; and
  (g) that the health of workers and the conditions at the workplace are monitored for the purpose of preventing injury or illness of workers arising from the conduct of the business or undertaking.

56 Duty to notify notifiable event *(see section 10: If an incident happens)*

Note: if a person is on your school grounds for an unlawful purpose you are not liable if something happens to them.

Health and Safety at Work (General Risk and Workplace Management) Regulations 2016

10 Duty in relation to general workplace facilities

(1) A PCBU must ensure, so far as is reasonably practicable, that—
  (a) the layout of the workplace allows, and the workplace is maintained to allow, persons to enter and exit the workplace and to move within it without risks to health and safety, both under normal working conditions and in an emergency:
  (b) work areas have sufficient space for work to be carried out without risks to health and safety:
  (c) floors and other surfaces are designed, installed, and maintained to allow work to be carried out without risks to health and safety:
  (d) there is suitable and sufficient lighting to enable—
    (i) each worker to carry out work without risks to health and safety; and
    (ii) persons to move within the workplace without risks to health and safety; and
    (iii) safe evacuation in an emergency:
  (e) there is suitable and sufficient ventilation to enable workers to carry out work without risks to health and safety:
  (f) workers carrying out work in extremes of heat or cold are able to do so without risks to health and safety.

(2) A PCBU who contravenes this regulation commits an offence and is liable on conviction,—

(a) for an individual, to a fine not exceeding $10,000:

(b) or any other person, to a fine not exceeding $50,000.

24 Managing risks associated with working under raised objects

(1) A PCBU must manage, in accordance with **regulations 5 to 8**, risks to health and safety associated with work being done under any object that has been raised or lifted by any means.

(2) If it is not reasonably practicable to eliminate the risk referred to in subclause (1), the PCBU must minimise the risk by, so far as is reasonably practicable, providing supports or other devices to be placed or used under the raised object so that the object cannot fall or be lowered while a worker or other person is under it.

(3) A PCBU who contravenes this regulation commits an offence and is liable on conviction,—

(a) for an individual, to a fine not exceeding $10,000:

(b) for any other person, to a fine not exceeding $50,000.

1.3 Other legislation, Regulations and Standards

Because technology education covers a wide variety of subjects and experiences, the requirements of a number of other Acts and Regulations may also be relevant:

» **Food Act 2014**
» **Food Regulations 2015**
» **Food (Safety) Regulations 2002**
» **Animal Welfare Act 1999**
» **Code of Ethical Conduct for the Use of Animals**
» **Wildlife Act 1953.**

Animals

There are a number of situations in which animals could be included in a technological setting. Schools should have an animal ethics policy that meets the legal requirements of the Animal Welfare Act 1999 (see the **Guide to the Animal Welfare Act** on the Ministry for Primary Industries website). Any procedure that involves interfering with the normal physiological, behavioural, or anatomical integrity of any vertebrate animal requires approval from an animal ethics committee. Section 6 of the Act defines “animal”, and the policy paper **The Use of Animals in Research, Testing and Teaching: Users Guide to Part 6 of the Animal Welfare Act 1999** explains this section. When animals are used in any technology investigation, students must adhere to the **Code of Ethical Conduct for the Use of Animals** in school programmes and apply to their local animal ethics committee before starting any such investigation.

Details of this process can be obtained from:

National Animal Ethics Advisory Committee
c/o Ministry of Primary Industries
PO Box 2526, Wellington
Phone: 0800 00 83 33 or (04) 474 4100
Fax: (04) 474 4133
Website: **www.mpi.govt.nz**

Care for animals must include:

- a secure cage or container, with space for the animal to move around freely
- adequate food, water, and shelter
- placing the animal away from draughts and direct sunlight
- providing adequate, clean bedding and changing it regularly
- removing and seeking veterinary attention for unhealthy animals
- appropriate weekend and holiday care
- checking that, when animals go home with students, responsibility is taken for the animals' security and welfare.

Animals caught in the wild cannot be kept at school without a permit. They may be carrying diseases such as tuberculosis. It is good practice to encourage students to wear disposable gloves when handling animals. If students do not use gloves, they must wash their hands before and after handling any animals, and existing cuts and abrasions should be covered.

Under the **Wildlife Act 1953**, it is illegal to keep any species of native animals without a permit from the Department of Conservation.

Local authorities

Some local authority bylaws made under the **Local Government Act 1974** also apply to issues of health and safety in technology education. Because these bylaws vary from place to place, Boards of Trustees and teachers should consult their local authority for advice.

Other legislation, regulation and standards

Many New Zealand and Australian Standards cover aspects of technology education and also need consideration as they apply to general classroom practice.

Electrical equipment (mains powered)

AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment requires all mains-powered electrical equipment in a classroom to have an annual safety check. All electrical equipment, including plugs, sockets, and extension leads should be in serviceable condition. Electrical equipment borrowed from another source for short periods should also be checked before use.

Wherever practicable, the mains electrical supply should be drawn through an isolating transformer or RCD (Residual Current Devices) to provide safety extra-low voltage (SELV).

If portable power boards are used, these should be protected from overloading. Switches, sockets, and associated power supply fixtures in the room should be regularly checked for damage, such as cracks and exposed wiring. All extension leads, flexes and cords should be routinely checked to ensure that the insulation is not cracked, cut or burnt.

Electrical WorkSafe guidance: Safety on Small Construction Sites

This **guide** provides information about electrical supply and safety on small construction sites. It is for a person conducting a business or undertaking (PCBU) who manages or controls a small construction site.

Noise

For advice on noise in the workplace go to

http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/acop-%20noise-in-the-workplace

Overcrowding

Overcrowding can become a safety issue when too many people or things are gathered in one area. Teachers should manage technology classroom spaces so that students are not put at risk by having too many people moving around the room or in one part of the room. The risk should be assessed with respect to the severity of harm and the likelihood of occurrence.

1.4 School policies and procedures

Boards of Trustees and teachers should be aware that the National Administration Guidelines also make reference to health and safety.

National Administration Guideline 4 (c) states that each Board of Trustees is required to:

» comply with the negotiated conditions of any current asset management agreement, and
» implement a maintenance programme to ensure that the school's buildings and facilities provide a safe, healthy learning environment for students.

National Administration Guideline 5 states that each Board of Trustees is also required to:

» provide a safe physical and emotional environment for students;
» promote healthy food and nutrition for all students; and
» comply in full with any legislation currently in force or that may be developed to ensure the safety of students and employees

Boards of Trustees should have policies and procedures that ensure the health and safety of staff and students. These policies and procedures should link with others within the school, such as those for:

» incident reporting
» animal ethics
» education outside the classroom (EOTC)
» hazard identification and assessment
» waste disposal.

School staff are required to adopt safety policies and procedures that have been developed in conjunction with the Board of Trustees. In turn, Boards of Trustees are required to provide adequate safety training, safety facilities, and safety resources and to allow time for safety procedures to be implemented.

It is important that all technology staff accept the policies, practices, and procedures to promote and implement safety. In all safety situations, common sense should prevail.

Incidents recording, reporting, and investigating

By recording Incidents, schools can identify patterns. If minor Incidents occur often in a particular situation, this can be a sign that some aspect of safety planning has not been addressed adequately, and safety procedures should be reviewed before a more serious incidents occurs. For this reason, students and teachers should be encouraged to report all incidents. Information on safety documentation, including report forms, is available on the **Ministry of Education website**.

Emergency procedures

General

Teachers need to be prepared for such emergencies as minor chemical spills, small fires, electric shock, and students injuring themselves. The school should have policies and procedures for dealing with these problems and guidelines for when to contact emergency services. All students and staff should know the procedure to follow in response to an accident. MBIE's Labour Group recommended that a telephone with unrestricted access, capable of dialling emergency services and contacting other parts of the school, be readily available.

Emergency telephone numbers or instructions must be posted by each telephone and should include:

» Fire Service
» ambulance
» hospital
» Police

National Poisons Information Centre, Dunedin
Urgent information: 0800 POISON (0800 764 766) – a 24/7 service
Non-urgent information: (03) 479 7227, Fax: (03) 477 0509

For hazardous materials, including chemicals:

Responsible Care New Zealand 0800 CHEMCALL (0800 243 622) a 24/7 Service

Ministry of Business, Innovation and Employment – High Hazards Unit

There should be first-aid kits in all technology classrooms, and teachers should be trained in first aid. In larger schools, where a nurse is present, classroom first-aid kits need be only minimal, with any serious injury being referred to the nurse.

Fire

The **Fire Safety and Evacuation of Buildings Regulations 2006** require schools to have a fire evacuation scheme under **Section 21A of the Fire Service Act 1975.** Teachers should be aware of the school's policy, and teachers and students should be aware of the procedures to be followed in the event of a fire. Boards of Trustees are responsible for ensuring that the fire-safety equipment meets minimum standards. Appropriate signs must be provided for all fire equipment, and teachers must take responsibility for ensuring that fire equipment is serviced on the required dates and is refilled and/or replaced immediately after use.

Natural disasters

Boards of Trustees are required to have policies and procedures in place in case of a natural disaster such as an earthquake or a flood. Technology teachers should be aware of these policies.

Section 2
Responsibilities of Boards, Principals and Workers: Risk Management

2.1 Boards of Trustees (PCBU)

The Board of Trustees has the primary duty of care for the health and safety of workers and others in the workplace.

The Board of Trustees, as a legal entity, will be liable under the Act if it does not exercise its duty of care. Boards of Trustees must exercise their primary duty of care and ensure the health and safety of:

- their workers (e.g. teachers, principals, administrators, caretakers, maintenance staff, property managers, volunteer workers etc.) while at work (e.g. at school and/or on excursions and/or outside the classroom)
- other workers who are influenced or directed by the PCBU (e.g. contractors and sub contractors and their workers)
- other persons (e.g. students/children, parents, members of the public, casual volunteers and visitors to the premises), by ensuring that they are not put at risk from work that is carried out at the school

Boards of Trustees must also ensure, so far as is reasonably practicable, they:

» Provide and maintain a work environment, plant and systems that are without risks to health and safety
» Ensure the safe use, handling and storage of plant, structures and substances
» Provide adequate facilities at work for the welfare of workers, including ensuring access to those facilities
» Provide information, training, instruction or supervision necessary to protect workers and others from risks to their health and safety
» Monitor the health and safety of workers and the conditions at the workplace for the purpose of preventing illness or injury

Boards of Trustees have a duty to involve their workers in work health and safety and must:

» Engage with workers about health and safety matters that directly affect them and
» Have effective practices that allow workers to have an opportunity to participate in improving work health and safety on an ongoing basis
» These practices may include:
» Having health and safety as a regular agenda item at team meetings
» A feedback mechanism for staff to raise health and safety concerns with the Board of Trustees
» Health and safety representatives and/or health and safety committees

2.2 Principals/officers

Officers must exercise due diligence. This means they must take positive steps to ensure the Board of Trustees (as an entity) meets its health and safety obligations and duties. In many cases the day to day running of a school is delegated by the board to the principal.

Due diligence includes taking reasonable steps to:

» Know about worker health and safety matters and keep up-to-date
» Gain an understanding of the operations of the school and the hazards and risks generally associated with school operations
» Ensure the Board of Trustees has appropriate resources and processes to eliminate or minimise those risks
» Ensure the Board of Trustees has appropriate processes for receiving information about incidents, hazards and risks, and for responding to that information
» Ensure there are processes for complying with any duty, and that these are implemented
» Verify that these resources and processes are in place and being used

Physical safety

Classroom/teaching environment

Staff (teachers, teacher aides, and technicians) and students must be made aware of the safety aspects for all technology courses, programmes, and units, including working in unobservable areas. Health and safety checks include, but are not limited to, those presented in Appendix 1.

Working in unobservable areas

Teachers and their students should not work in spaces where they cannot be observed. Video surveillance may be considered for areas that cannot be made physically observable.

Implications of trades academies in schools

Some schools have established trades academies and/or are using a tertiary provider to deliver all or part of a technology related programme. This approach often requires students to use machinery (and materials) that would not typically be used in school technology classrooms – particularly when students are assessed against industry unit standards that require them to use machinery identified as adult-only equipment (see Appendix 5). When this occurs, Boards of Trustees should work with the tertiary provider to develop a Memorandum of Understanding (MOU) that sets out procedures to ensure the health and safety of students.

The Ministry of Education web page **Students on Work Experiences Legislation** provides guidance on procedures that schools are required to follow when students attend a workplace (including a tertiary provider) to undertake work-based learning or work experience.

2.3 Teachers

Planning for and implementing safety is an integral part of technological practice. The **Health and Safety at Work Act 2015**, along with the associated Regulations, specify the requirements for safety in workplaces. These Acts and Regulations form the basis of this manual's recommendations. Each school is required to develop, implement, and manage a health and safety policy that is approved by the Board.

If technology education is to reflect contemporary practice, methods of safety planning should reflect relevant Regulations and Standards that underlie safe practice in and across the different technological areas.

2.4 Risk Identification, Assessment and Management

WorkSafe helps businesses plan for safety by identifying workplace hazards (materials or equipment) that can cause serious harm and by planning for ways to eliminate them. It identifies specific steps in effective safety planning. When applied within an educational context, these steps include: identifying hazards and considering the educational justification for introducing them assessing whether the hazard is significant and the consequences if something should go wrong eliminating the hazard if possible (by selecting a safer alternative if one exists) minimising the risk to students.

Hazards may be associated with the use of equipment or materials. Boards of Trustees are required to take all practicable steps to manage hazards and identify risk. Offences relating to duties are outlined in the Health and Safety at Work Act 2015 sections 47, 48 and 49. Liabilities of officers are outlined in section 50

As part of creating a healthy and safe environment, it is important that there are good systems and processes in place for hazard and risk management. Boards should focus on the significant risks, rather than using their resources trying to manage every risk, and respond appropriately to the level of the risk.

What is the difference between a hazard and a risk?

A hazard arising from a work activity can be defined as a situation or thing that has the potential to cause death, injury or illness to a person.

HSWA states that hazards also include a person's behaviour where that behaviour has the potential to cause death, injury or illness to a person (whether or not that behaviour results from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person's behaviour).

Risk is the likelihood that death, injury or illness might occur when a person is exposed to a hazard. Risks must be managed by taking action to eliminate them, and if that is not reasonably practicable, minimising them. Eliminating a hazard will also eliminate any risks associated with that hazard.

HAZARD	RISK
A situation or thing with the potential to cause death, injury or illness	The likelihood that death, injury or illness might occur when exposed to a hazard

Management of risks

HSWA emphasises the requirement to manage the risks of harm occurring, rather than managing the hazard. Boards (as PCBUs) must manage risk and ensure, as far as is reasonably practicable, the health and safety of workers and others under the Act. Specifically, the PCBU must eliminate the risk, but if this is not reasonably practicable they must minimise the risk of any harm happening. There should be ongoing monitoring of the situation.

A formal risk assessment enables the board to understand what the significant hazards in their school are. More importantly, it helps the board to focus on the significant risks, rather than using their resources trying to manage every risk.

Identifying hazards

A hazard is not limited to an object and can be a situation, or a person and their behaviour both physically and emotionally. Bullying is an example of a person's behaviour that has the potential to cause harm to a person. These can also be unpredictable and occur at any time.

A process should be implemented to regularly identify and assess hazards and risks. You should consider if the hazard is an actual or potential cause or source of notifiable event or is a cause or source of harm, which increases with exposure to the hazard or which occurs sometime after exposure to the hazard.

What are examples of hazards and their potential harm?

- **falling objects, and falls, slips and trips of people** – bruises, lacerations, dislocations, fractures, concussion, permanent injuries or death
- **vehicles, plant, machinery, equipment** – bruises, lacerations, dislocations, fractures, concussion, permanent injuries or death
- **repetitive movement** (eg data entry) – muscular strain, occupational overuse syndrome (OOS)
- **biological** (bacteria, viruses) – eg leptospirosis
- **loud noise** (from power tools in technology classes or children's noise levels) – permanent hearing damage
- **bullying** in the workplace – stress-related illness
- **hazardous substances** – burns, skin conditions, respiratory problems

Managing work health and safety risks involves the following four steps:

Step 1: Identify the risks

Start by identifying all potential sources of harm or illness arising from the work. This includes places where a worker is likely to be while at work. Health and Safety Risks can be identified in many ways. You can come across them while you are working, identifying a risk through a work group review, guessing what they might be before starting a new work task, or going onto another workplace. For remote workers, this means identifying risks before going to other workplaces. As health and safety is everyone's responsibility, you can take reasonable steps to eliminate or minimise the risk yourself. Make sure that you are not putting yourself or others in harm's way. You will still need to report the risk.

Step 2: Assess the risks

If a risk has been identified, but you are unable to safely eliminate or minimise the risk yourself, you will need to escalate this to your relevant school leader. School leaders need to assess the level of risk that has been escalated. A risk assessment takes into consideration factors such as the frequency of exposure to the risk, the likelihood of harm, and previous incidents involving that risk.

Step 3: Control the risks

Now that the risk has been assessed, the relevant school leader and affected workers need to determine what control is needed to manage the risk. The below table describes the steps to work through to control the risk.

Step 4: Monitor and Review the risks

Once the controls have been implemented, the controls must be regularly monitored and reviewed to ensure they are effective. The relevant school leader is expected to do this in consultation with workers. The regularity will depend on the risk rating. The principal collates all risk registers on a regular basis for board reporting. The PCBU has to consider what is reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters such as the likelihood of, and consequence of harm occurring, and the availability and suitability of ways in which to eliminate or minimise the risks.

Cost can be considered, but only in the context that it has to be grossly disproportionate to the risk. This means that, for example, while you don't have to consider how to avoid an unsafe activity, you should consider if it is better simply not to do a particular task/event if it is inherently unsafe.

An example of a risk matrix to assess the risk likelihood and consequences

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Critical
Almost Certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	High	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	High

How do you control risks?

Once the risks have been assessed, the important step of controlling risks can begin — e.g. fixing the problems. There are a number of ways to control risks. Controls can be ranked from the highest level of protection and reliability to the lowest. This is referred to as the hierarchy of control measures and is required for many risks.

The most effective way of controlling risks is to:

1. **eliminate a hazard**, for example, by removing trip hazards on the floor or disposing of unwanted chemicals from your science lab.
2. *If elimination is not possible, the next step is to **minimise the risks** by doing one or more of the following*:
    a. **substituting** the hazard with something safer – e.g. using non-toxic chemicals in your science lab
    b. **isolating** the hazard from people or preventing people from coming into contact with the hazard - this involves physically separating the source of harm from people by putting distance between them or using barriers, e.g. storing hazardous substances in a secure place or roping off a broken swing
    c. using **engineering controls** (e.g. modifications to tools, plant or equipment) – e.g. placing guards around moving parts of machinery used in technology classrooms. If, after these steps, the risk still remains, it must be minimised by using
    d. **administrative controls**. Administrative controls are work methods or procedures that are designed to minimise exposure to a hazard. For example, procedures for the safe use of playground equipment, using signs to warn people of a hazard, or limiting exposure time to a hazard (e.g. organising outdoor activities for the cooler part of the day, using sunscreen and covering up in the sun).
    e. **Personal Protective equipment**: If the risk still exists after implementing administrative controls, then it must be minimised by using suitable personal protective equipment (PPE). Examples of PPE include ear muffs, dust masks, hard hats, gloves, aprons and protective eyewear. PPE limits exposure to the harmful effects of a hazard, but only if workers and other people (e.g. students, visitors, etc) wear and use the PPE correctly.

A combination of controls should be used if a single control is not sufficient for the purpose.

1. Can you **ELIMINATE** this risk? 2. if this is is not possible, **MINIMISE**...	Completely removing the risk. If this is not possible, minimise by doing one or more of the following (a, b, c, e, f, g)
a. Can you **SUBSTITUTE** the risk?	Substituting a safer process or material for the risk identified.
b. Can you **ISOLATE** the risk?	Separating the risk from workers.
c. Can you put in an **ENGINEERING** control?	Designing and/or adding physical safety features to the working environment.
d. Can you put in an **ADMINISTRATION** control?	Requiring systems to be established or amended in order to control the risk.
e. Can you use **PERSONAL PROTECTIVE EQUIPMENT** (PPE)?	PPE should only be used when all other control measures are impractical. It should be used in conjunction with other more effective measures.
3. **MONITORING** and **REVIEWING**	Once the controls have been implemented, the controls must be regularly monitored and reviewed to ensure they are effective. The relevant school leader is expected to do this in consultation with workers. The regularity will depend on the risk rating. The principal collates all risk registers on a regular basis for board reporting

How do you review control measures?

Controlling health and safety risks in the workplace is an ongoing process that needs to take into account changes in the workplace. Procedures and risk controls must be reviewed regularly to ensure they are still effective. The board must review and, if necessary, revise the control measures in the following circumstances:

- when the control measure is not effective in controlling the risk, eg when the results of monitoring show the control measure does not control the risk or a notifiable incident occurs because of the risk
- when a change at the workplace is likely to give rise to new or different health and safety risks
- if a new hazard or risk is identified
- if the results of consultation with workers indicate a review is necessary
- if a health and safety representative requests a review

Hazardous Substances and New Organisms Act 1996

The purpose of this Act is to protect people and the environment by ensuring the management of hazardous substances and new organisms. The Act is administered by the Ministry for the Environment and implemented by the **Environmental Protection Authority** (EPA). There are a number of Regulations that support the Act, and teachers should refer to these if they are planning to use hazardous substances during technology education.

Hazardous substances

A hazardous substance is any material that can harm people or the environment. As well as chemicals used in school laboratories, dishwasher detergents, methylated spirits, bleaches, and petrol can all be dangerous or poisonous. The **Hazardous Substances (Classification) Regulations 2001** give further descriptions of hazardous substances.

Safe procedures with chemical substances

Many technological investigations involve the use of chemicals. Section 10 of the **Code of Practice for School Exempt Laboratories** gives details relating to the use of hazardous chemicals, safe storage, handling practices, and the disposal of waste.

Section 10.6 in the *Code of Practice for School Exempt Laboratories* describes forbidden chemicals. Technology teachers should become familiar with this information before planning any teaching.

New organisms

The Act requires all school biotechnology investigations that involve transgenic manipulation to be approved by the EPA New Zealand. This approval needs to be sought for the genetically modified organism that will be produced, not the technique used to produce it. Information about how to seek approval for new organisms can be obtained from the **EPA Hazardous Substances** section.

Section 10 of the **Code of Practice for School Exempt Laboratories** provides information on substances allowed in schools and those that are prohibited by the Ministry of Education.

The Hazardous Substances and New Organisms Regulations that support the Act:

» define a genetically modified organism
» specify how to assess the risk from developing genetically modified organisms.

Disposing of hazardous materials

If a technology programme requires the use of hazardous materials, there could be a need to dispose of any material.

Advice on the disposal of hazardous waste is covered in the **Code of Practice School Exempt Laboratories** or for further information go to **http://www.hazardoussubstances.govt.nz/guide**

Section 3
Responsibilities of teachers

Teacher competence

Teachers involved in technology education activities are expected to assess the likelihood of an incident occurring and the potential severity of harm caused by that incident prior to carrying out the activity.

An induction and training programme should be in place to ensure all teachers and support staff are competent to make valid risk assessments for the area they are working in.

Teaching student competencies

Students need to be taught safe procedures when working with equipment and materials. Ideally, students should receive training and be assessed in safe practice in any area of technological practice. See **Appendix 5** for a guidance list of year levels when students should use specialist machinery and equipment.

One way to ensure student capability is to design and award certificates of competency in skills that include demonstrating safety practices. An example for young students could be in soldering or using knives.

Introducing a safe buddy system in specialist learning environments and classrooms across all levels of learning, will enhance engagement in the safe monitoring of student colleagues in their practice. The safe buddy system will also help build a community of responsible practice.

They should also be involved in identifying possible hazards to themselves and others and determining how to avoid or mitigate them before doing an activity. The use of an online hazard identification form is one way to engage students in safety and hazard identification.

As well as being comprehensive, instructions should be comprehensible to all students, including students with special education needs and those for whom English is a second language.

Wherever possible, instructions should be:

- given orally
- recorded in the students' workbooks, on the whiteboard, in online reminders, or in chart form
- modelled through teacher demonstration and practice
- reinforced with signage
- demonstrated through images of correct safety procedures – particularly for students with special education needs and those with English as a second language
- monitored during students' practice and activities.

Planning for safety in technology education should include educational activities outside the classroom, such as those with community and enterprise links.

3.2 Safety planning in technology education

Appendix 1 includes a safety planning template for teachers to use when planning for safety in technology education. Notes, examples, and suggestions for completing this safety planning template can be found in **Appendix 2**.

The planning template is designed to help teachers to:

» identify potential hazards in technological activities

» minimise risks for students and the environment.

The planning sheet is based on current industry practices, which have been modified to include classrooms and other educational settings. This planning process reflects technological practice and the integrated strands of the curriculum. See **Appendix 1** for instructions of completing the template and a copy of the blank the template.

Section 4
Responsibilities of students

4.1 Students (Others)

Students are Others in the Workplace and have duties under the legislation:

A person at a workplace (whether or not the person has another duty under this Part) must—

(a) take reasonable care for his or her own health and safety; and

(b) take reasonable care that his or her acts or omissions do not adversely affect the health and safety of other persons; and

(c) comply, as far as he or she is reasonably able, with any reasonable instruction that is given by the PCBU to allow the PCBU to comply with this Act or regulations.

Planning for and undertaking safe practices are a central part of technology education.

Throughout all your technology education, a very important part of planning, designing, and creating technological products and systems is to:

» identify any hazards or

» assess them for their level of possible harm

» eliminate the hazard or risk if possible – if not, then minimise it.

Hazards may relate to materials, equipment, the way a product or model works, or your actions when undertaking technological activities.

Using a safety form, that your teacher will provide (an example is shown below), during the planning stages of a technological activity will help you to reduce potential hazards. It will also assist you to decide on the best course of action to eliminate, or minimise hazards. Your teacher will assist and support you to make sure your technological practice is safe for you and others.

	Activity	Risk	Assessment	Action
1.	Drilling a Ø16 mm hole in 6 mm thick steel on a drill press	Having the steel spin around the drill	Could occur if I try to hold the steel with my hand when drilling the hole	Clamp the steel firmly to the table of the drill press
2.	Removing food from a hot oven	Getting burnt if I am not wearing dry protective gloves	Will occur if I don't wear protective gloves	Wear protective gloves

Add to the table by identifying hazardous activities, stating the risks and the actions that are needed to minimise or remove the hazard.

As a student, you need to tell teachers in advance if you have allergies to any substances, such as latex, nuts, gluten, dust or lactose and make it clear in your safety plan the steps that have to be taken if you come into contact with any of these substances you have an allergy to. Your teacher should also include this information in the technology activity safety plan.

A rigorous system should be in place to ensure medical information for students visiting a school is available to teachers at the school.

Impairment through illness, drugs, alcohol, or other cause must be brought to the teacher's attention. Your behaviour also must be appropriate at all times to ensure the safety of yourself and other students in the class.

If you are injured during a technology class, you must report it to your teacher, who will record it in the school injury/incident register.

If tools or machines are not working correctly it should be reported to the teacher.

This register will provide:

» information to help prevent injuries
» information to help fulfil the school's reporting requirements
» information for ACC claims.
» Information recorded in the register will include:
» date and time of the injury/incident
» name of the individual
» type of injury
» part of body affected
» cause of injury
» treatment provided.

Section 5
Safety in food technology

5.1 Information for all teachers, including safety in non-specialist rooms

Teachers **planning for safety in food technology** should have an understanding of health and safety and risk assessments in food technology. If this is not the case, teachers should seek advice from a specialist. The hospitality industry website **Service IQ** may provide information for teachers in some areas of food technology.

Before commencing work with students, teachers need to do a risk analysis of any food production process to identify hazards and how these will be mitigated. The **Ministry of Primary Industries website** has useful information relating to current legislation and expectations.

In good technological practice, students should also be made aware of the importance of risk analysis. This process can become an integral part of classroom practice from an early age. Each school is required to develop, implement, and manage health and safety policies and procedures, which must be approved by the Board of Trustees. These policies and procedures are expected to be adhered to in addition to implementing the recommendations of this manual.

Any safety requirements for using equipment should be demonstrated to students immediately before they use it independently. This includes the use of small non-electrical equipment, such as egg beaters, peelers, hand blenders, and knives, as well as electrical equipment such as microwave ovens, stoves, food processors, dehydrators, coffee machines, and deep fryers. As new equipment becomes available in schools, teachers should ensure students are trained in how to use it safely.

In general classrooms, preparing and cooking consumable food should, if possible, occur in a teaching space specifically designated for food technology. In primary schools, an area of a classroom could be set aside for food technology for the duration of the work. This environment should contain:

» hand washing facilities
» separate dishwashing facilities, such as a sink, hot and cold water, detergent, and tea towels
» non-porous workbenches or tables
» adequate lighting and ventilation
» cleaning agents, such as a broom, a mop, a brush and shovel, detergent, and disinfectant
» rubbish disposal facilities.

Never carry out food processing in an area designated for science (especially chemistry). There is a danger that toxic or harmful chemicals could contaminate food.

There are elements of a food technology unit that are non-food related, such as the design, packaging, and marketing of food. If books are placed on a food preparation surface, the surface should be sanitised before it is used for food preparation.

If consumable food products are the outcome of an activity, equipment should be designated specifically for food preparation and cooking. Kits of equipment for food technology should be well labelled, and none of this equipment should be used for other purposes. Plastics used for moulding foodstuffs, such as chocolates and jellies, must also be food safe. All equipment used for preparing and cooking food should be regularly maintained, checked for damage, and repaired or disposed of when necessary.

Electrical safety

All electrical equipment and installations must comply with local authority and electrical safety regulations. A registered electrician must carry out all wiring and electrical maintenance except for replacing a fuse. The following defects must be investigated immediately and corrected by a registered electrician:

» machinery or equipment that gives electric shocks, however slight
» overheated switches or plugs
» sparking or spluttering from cords or plugs
» broken or frayed leads or cords
» broken switches.

Electrical regulations require that all electrical appliances including portable power tools, isolating transformers, and RCDs (Residual Current Devices) used in school workshops or specialist rooms are:

» inspected and tested before use
» inspected before being used again after repair
» inspected at intervals not exceeding 12 months
» tagged at inspection – each piece of equipment should be tagged, and all inspections should be carried out by a registered electrician or an approved inspector.
» recorded in a school register of all electrical equipment.

Do not set up or use electrical equipment near water supplies, and do not allow students to handle electrical appliances with wet hands. Electrical appliances used in classrooms should always be plugged into an approved RCD. Ensure that appliances are assembled according to the manufacturer's instructions, that all appropriate safety precautions are followed, and that these appliances are regularly serviced. If electrical appliances are donated to the school, they should be checked by an approved authority before they are used by students.

Ventilation

Food rooms generate a lot of heat and can become very warm. Extra ventilation should be considered for specialist food rooms. Additional ventilation or cooling equipment is relevant where food areas also contain computers– especially when a number of these are running at the same time.

Food production

Before students prepare consumable food products, teachers and students must check the quality of each food item by:

» ensuring that the 'use by' or 'best before' date has not expired
» checking for damage to food packaging, such as bulging tin cans, broken seals, or the swelling sides of plastic bottles
» observing any abnormal changes to the colour, smell, or texture of food
» ensuring that food is kept at the correct temperature until use – frozen foods are still frozen and perishable foods, such as meat, dairy products, and fish, are chilled to 4°C or below.
» Checking for evidence of pest infestation

Storing food

Food must be stored at temperatures that inhibit the growth of pathogenic micro-organisms that may cause food poisoning. Always refrigerate fresh, perishable, or high-risk foods at 4°C or below before using in food preparation and if storing them before consumption. In the refrigerator:

» cover cooked foods and store them above raw foods
» keep all cooked and raw foods apart
» remove left-over canned food from the can and place it in an airtight container before storing it in the fridge
» date and label stored food
» keep frozen foods in the freezer at -18°C.

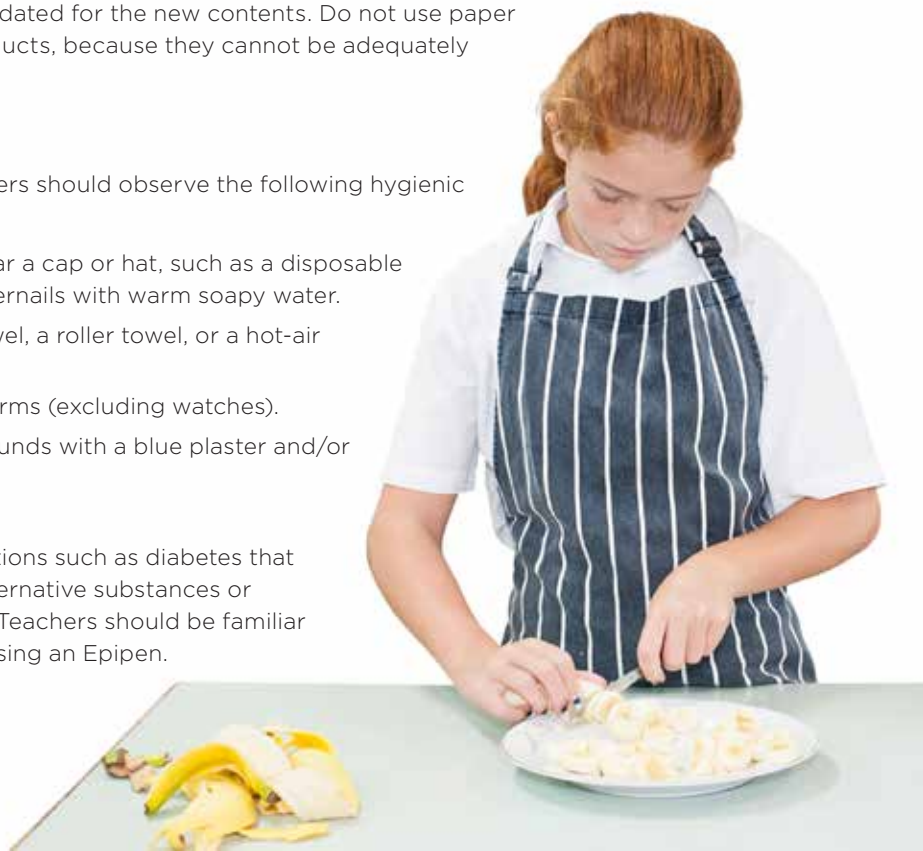
Store non-perishable food in an area that is dry, cool, well ventilated, and free of pests such as insects and vermin. Do not store food on the floor if at all possible.

Before being used, all containers should be sterilised. Containers that no longer store their original product should be clearly re-labelled and dated for the new contents. Do not use paper containers to store consumable food products, because they cannot be adequately sterilised.

Preparing food

Before handling food, students and teachers should observe the following hygienic practices:

a) Tie long hair back from the face or wear a cap or hat, such as a disposable paper hat. Wash hands and scrub fingernails with warm soapy water.
b) Dry hands with a disposable paper towel, a roller towel, or a hot-air hand dryer.
c) Remove all jewellery from hands and arms (excluding watches).
d) Cover all cuts, scratches, and open wounds with a blue plaster and/or a waterproof disposable glove.
e) Wear an apron/chef's jacket.
f) Identify any allergies or medical conditions such as diabetes that students have and ensure there are alternative substances or materials available for these students. Teachers should be familiar with administering antidotes such as using an Epipen.



During food preparation, observe the following principles of food hygiene:

a) Clean and sanitise work surfaces with hot water and detergent before, during, and after food preparation. If the surfaces cannot be adequately cleaned, do not place food directly on these surfaces. Instead, cover the surface with a clean, wipeable covering.
b) Do not sit on surfaces used for food preparation.
c) Wash hands between handling raw foods and cooked foods. Also wash them after handling rubbish, using cleaning chemicals, visiting the toilet, blowing the nose, coughing, or touching the hair, nose, or face.
d) Thaw frozen foods either overnight in the fridge or by using the defrost function of a microwave.
e) Observe culturally appropriate food hygiene practices.
f) Use separate knives and chopping boards for raw products and for cooked products.
g) **Use separate chopping boards** for meat and for fruit and vegetables.
h) Cook meat to an internal temperature of at least 75°C.
i) Reheat cooked products to an internal temperature of at least 83°C.
j) Reheat food only once.
k) Do not refreeze frozen foods if they have not been cooked since thawing.
l) Cool cooked food quickly by placing it in shallow containers or dividing it into small portions before placing it in the fridge for storage. Cooked foods needing refrigeration must be placed in the fridge within 30 minutes of being cooked.
m) Taste food with a clean spoon or appropriate utensil rather than the fingers. Do not put the spoon back in the food.
n) Any food additives, for example, dyes and paints used when making coloured popcorn or other consumable food products, must be safe to eat and culturally appropriate.

Safe use of knives

Students should be trained in the safe use of knives and safe working practices when sharpening them. Use a knife suitable for the task and for the food when cutting. Keep knives sharp. Cut on a stable surface. Handle knives carefully when washing up. Carry a knife with the blade pointing downwards. Store knives securely after use, eg in a scabbard or container. Use protective equipment as required.

Eating food

Students must not share eating utensils. All equipment used in serving and eating food must be clean and manufactured from food-safe materials. Food products that are to be eaten at a later date should be transported from the food technology area in food-safe containers covered with a lid or with plastic or foil wrap and labelled.

Fish should not be bottled in schools because of the risk of food poisoning caused by contamination from *Clostridium botulinum*.

Cleaning up

Appropriate cleaning procedures are important in food technology to prevent cross-contamination and the spread of food-borne illnesses.

The following are good practices to prevent cross-contamination:

a) Rinse dishes before washing.
b) Wash dishes in hot (55°C) soapy water (replacing water frequently and providing rubber gloves to protect hands from heat) or in a dishwasher.
c) Use clean tea towels to dry dishes, washing them after each use.
d) Use tea towels only for food – separate cloths should be used for wiping bench tops and floors.

e) Wash stainless steel surfaces and benches with hot water and detergent and wipe them with a clean, wet cloth before use.
f) Clean walls, ceilings, and shelves regularly with detergent followed by a sanitising agent.
g) Mop floors regularly with hot (55°C) water and detergent or a detergent-sanitiser.
h) Clean chopping boards and wooden surfaces with hot (55°C) water and strong detergent or, preferably, soak them overnight in a chlorine sanitiser or white vinegar.
i) **All chemicals** for cleaning food preparation areas should be stored in a lockable cupboard with an appropriate hazard warning, if necessary.
j) Dispose of food scraps and other rubbish carefully to prevent the spread of food-borne illness.

Regular and safe disposal of rubbish is extremely important. Guidelines to follow are to:

a) Store rubbish receptacles above ground away from food storage and preparation areas and sunlight.
b) Ensure rubbish bins have tight-fitting lids.
c) Securely tie paper or plastic rubbish bags when full.
d) Dispose of rubbish daily.
e) Clean rubbish bins and the surrounding storage area daily.
f) Where appropriate, designate separate rubbish containers for food scraps, plastics, glass, paper, and cardboard.
g) **Dispose of chemical** waste regularly, seeking advice on its disposal from the manufacturer, supplier, or nearest local authority.

Non-food related activities

Dyes and paints used for purposes other than food preparation should not be in areas designated for cooking.

Food technology that involves routine scientific chemical analysis should be carried out in a separate space designed for chemical usage, such as a science laboratory.

Animal-related products

If students are involved in technological activities that develop products for animal consumption, such as pet food treats, and wish to trial their suitability with animals, schools should have an animal ethics policy that meets the legal requirements of the **Animal Welfare Act 1999** or any other subsequent legislation.

Equipment hazards

Examples of potential equipment hazards are:

» ovens
» microwaves
» electric beaters
» food processors
» toasted sandwich makers
» rice cookers
» coffee machines

5.2 Additional safety in specialist areas

The classroom environment

If possible, the teaching space used for the preparation, cooking, and evaluation of food should be a specialist area designated specifically for food technology.

If the Food Technology room is used by non-specialist teachers and classes or outside agencies the food hygiene and safety and health and safety of workers and others should be considered.

In addition to the required facilities for general classrooms, this teaching space should also contain:

» laundry facilities
» cooking equipment, such as microwave ovens, stoves, and gas or electric hobs
» storage facilities for food products, chemicals, and equipment used in preparing, cooking, and evaluating food
» a first-aid kit
» fire extinguishing equipment
» a telephone for use in emergencies
» adequate seating for students
» adequate ventilation.

A registered electrician or gasfitter must install electric or gas stoves, and a certificate of compliance must be obtained from that tradesperson on completion. In the case of gas stoves, a mains gas supply switch must also be installed to turn off the gas supply to the classroom. This gas switch must be easily accessible to staff and be regularly checked.

Food testing

Food presented for sensory evaluation must be held at the correct serving temperatures (chilled foods at 4°C, hot foods at 75°C, and reheated foods at 83°C). Food must be served in or on food-safe containers (preferably disposable).

Evaluation booths or compartments should be properly lit, painted a neutral colour, temperature controlled, well ventilated, free from foreign odours and materials, and constructed in such a fashion that students can be easily seen at all times by the teacher.

Mass production

Where large quantities of food are produced, all members of the production team must observe practices for personal hygiene, safe food handling, and safe food selection. Correct cooking temperatures, cooling techniques, and storage temperatures must be used at each stage of the production process.

When using industrial equipment, ensure that all safety procedures for using particular pieces of equipment are observed. These include:

» using safety guards on commercial mixers, mincers, and other relevant equipment
» keeping electrical cords off the floor and away from water supplies
» closed in footwear should be worn
» wearing safety glasses and earmuffs or earplugs when appropriate.

Section 6
Safety in biotechnology

6.1 Information for all teachers, including safety in non-specialist rooms

Teachers planning for safety in biotechnology should have an understanding of health and safety and risk assessments in biotechnology. If this is not the case, teachers should seek advice from a specialist. This is especially important when culturing micro-organisms, where teachers should have some training in microbiological techniques. Each school is required to develop, implement, and manage health and safety policies and procedures, which must be approved by the Board of Trustees. These policies and procedures are expected to be adhered to in addition to implementing the recommendations of this manual.

Before commencing work with students, teachers need to **undertake an initial risk analysis** of the process for the work so that they can identify potential hazards in relation to:

- the people involved, such as students, resource personnel, and the intended end users of the outcomes that are produced (including considering cultural and ethical issues)
- the materials and equipment used, including energy sources and wastes
- the environment, particularly in separating food and non-food items for storage, during the production of the final outcome.

In good technological practice, students should also be made aware of the importance of risk analysis. This process should become an integral part of their classroom practice.

When hazards are identified, risks can often be minimised by incorporating appropriate procedures.

Many investigations involving biotechnology can be carried out successfully in general classrooms with typical facilities for year 1–6 students. The multi-purpose nature and architecture of general classrooms, however, presents some health and safety concerns.

It is desirable to have a separate area in the school for biotechnological investigations or to have an area of the classroom set aside for the duration of the project. Investigations involving biotechnology are often ongoing, necessitating material being set up over lengthy periods of time, which can create problems with care, hygiene, and security.

Schools using specialist materials for biotechnological investigations must have effective policies and practices for storing, handling, and disposing of these materials. This includes a policy for disposing of unwanted micro-organisms and chemical residues, both of which are classed as hazardous wastes.

When working with living material, it is important to prevent cross-contamination with pathogenic (disease-causing) organisms. In some situations, it may be necessary to establish a workspace where sterile conditions can be maintained.

The following guidelines should be followed to minimise the risk of contamination:

a) Only work with material of known biological characteristics.
b) Never work with unknown living material.
c) Never culture pathogenic (disease-causing) organisms.
d) Prevent contamination of culture material by establishing and following sterile work procedures.
e) Dispose of material carefully and thoroughly, ensuring that living material cannot reproduce.

Electrical safety

All electrical equipment and installations must comply with local authority and electrical safety regulations. A registered electrician must carry out all wiring and electrical maintenance except for replacing a fuse or wiring an extension cord. The following defects must be investigated immediately and corrected by a registered electrician:

» machinery or equipment that gives electric shocks, however slight
» overheated switches or plugs
» sparking or spluttering from cords or plugs
» broken switches.

Electrical Regulations require that all electrical appliances including portable power tools, isolating transformers, and RCDs (Residual Current Devices) used in school workshops or specialist rooms are:

» inspected and tested before use
» inspected after being repaired
» inspected at intervals not exceeding 12 months
» tagged at inspection – each piece of equipment should be tagged, and all inspections should be carried out by a registered electrician or an approved power tool agent
» recorded in a school register of all electrical equipment.

Teachers should encourage students to examine all electrical equipment before it is used, including all plugs, sockets, extension leads, and other electrical equipment used for biotechnology activities, such as bread makers, dehydrators, computer data-logging equipment, and digital balances. This also applies to any electrical equipment borrowed from various sources for short periods of time. Careful positioning of electrical extension leads and equipment within the classroom can minimise the potential for incidents.

Animals

There are a number of teaching situations where animals could be included in a biotechnological setting. Students may wish, for example, to develop a biotechnology convenience pet food and trial its suitability with certain animals.

Schools should have an animal ethics policy that meets the legal requirements of the **Animal Welfare Act 1999**, or any other subsequent legislation, and any procedure that involves interfering with the normal physiological, behavioural, or anatomical integrity of any vertebrate animal requires approval from an animal ethics committee.

Section 6 of the Animal Welfare Act defines "animal", and the policy paper **The Use of Animals in Research, Testing and Teaching: Users Guide to Part 6 of the Animal Welfare Act 1999** explains this section.

When animals are used in any technology investigation, students must adhere to the *Code of Ethical Conduct for the Use of Animals* in school programmes and apply to their local animal ethics committee before starting any such investigation.

Food-related biotechnology

In some instances, biotechnology can be approached through the area of food technology, as in the production of yoghurt, bread, and cheese. Where this is the case, including taste testing, the work should be carried out in the area of the school or classroom designated for food technology. This area should be kept separate from areas set aside for other aspects of biotechnology. Any biotechnological investigation linked with food technology poses additional safety concerns, and teachers should also comply with the safety guidelines relating to food technology (Section 5).

Micro-organisms

Many biotechnology investigations make use of a range of micro-organisms. The major groups of micro-organisms are algae, protozoans, fungi, bacteria, and viruses, and the two groups most commonly used in school biotechnology are fungi and bacteria. Teachers need to take particular care and attention when students work with micro-organisms.

Only named and identified micro-organism species from a reliable source should be used. Teachers or students should never culture unknown species, especially bacteria.

Brewer's and baker's yeast available from supermarkets, yoghurt-forming bacteria cultured from existing yoghurt, or fungi cultured from cheese are all good starting points. A list of micro-organisms suitable for use in schools can be found in Appendix 4.

The *Code of Practice for School Exempt Laboratories* should be consulted when culturing micro-organisms. Teachers should be aware of and follow this Code when collecting, handling, culturing, and disposing of micro-organisms. When culturing micro-organisms, biotechnology teachers should be aware of the following guidelines:

a) Do not use human or animal sources of micro-organisms.
b) Do not take samples from toilets and toilet areas, including sinks and door handles.
c) Do not take samples from rubbish bins and drinking taps.
d) Cultures originating from skin surfaces may be used only if the cultures remain sealed.
e) Use sterile swab sticks to inoculate plates.
f) Wash hands thoroughly after working with micro-organisms.
g) Label each culture clearly with the student's name, the date, and the source of the sample.
h) If Petri dishes are used to culture micro-organisms, cover and seal them to prevent contamination and the spread of spores. Use adhesive tape or cling film to seal these dishes, and incubate the cultures upside down.
i) To pipette culture samples, use only automated pipettes, never mouth-operated pipettes.
j) Transfer microbiological material from one culture to another in sterile conditions. Always wear safety glasses and gloves.
k) Incubate microbiological cultures at temperatures of 25°C or below to avoid the risk of culturing pathogenic organisms.

l) If using glassware for fermentation investigations, never seal it, because the build-up of pressure could cause an explosion. Either lightly plug containers with cotton wool or cover them with aluminium foil. If using plastic drink bottles as simple fermenters, as in the production of ginger beer, be aware that considerable pressure can build up in sealed bottles to the point of explosion.

Many fungi are significant in the biotechnology and food industries. Care should be taken when collecting or handling fungi because many (including toadstools, mushrooms, moulds, and puffballs) may be poisonous. Spores released from many species can also cause allergic reactions in some people.

Bioremediation (waste management)

Before teachers set up small-scale experiments to illustrate waste breakdown by micro-organisms, they must be aware that unknown pathogens could be present. Small-scale fermenters must be designed to ensure that gas pressure does not accumulate, as the build-up of flammable biogas could be dangerous.

Clean-up and disposal of biotechnological wastes

Many waste materials from biotechnology are classed as hazardous wastes, so they must be disposed of in a way that does not endanger people or the environment. Chemical wastes should be disposed of in accordance with local bylaws.

All microbiological cultures must be sterilised before disposal. This can be achieved by using one of the following methods:

» heating in a pressure cooker for at least 20 minutes
» soaking in a 10 percent bleach solution for three days
» incinerating (with the incinerator very hot).

The person responsible for disposing of microbiological cultures needs to be trained. This person could be a teacher or an ancillary staff member, but not a student.

If a culture is spilled, a teacher wearing disposable gloves must deal with it immediately. Cover the broken container and/or spilled culture material with a cloth soaked in a disinfectant of 10 percent bleach (100 ml [millilitres] of bleach in a litre of water) for at least 10 minutes. Then clear away the spillage using disposable paper towels and a dustpan. Place the contaminated material in a separate bag for disposal, along with the gloves, and disinfect the dustpan. Note: Household bleach solutions may not be strong enough to ensure sterilisation.

Plants

Biotechnological investigations using plants may include working with whole plants, plant parts, or plant cells. Because many plants are poisonous, teachers should help students identify those that are safe to use in their investigations. Care must also be taken with the development of plant extracts because many known drugs and poisons originate from them. During their investigations, students may make use of plants of cultural significance. They should be made aware of the significance associated with these plants, for example, harakeke, heritage potato, and various ferns.

Tissue culture

Many kinds of biotechnological investigations may involve simple tissue culture practice. Several practices that students can carry out illustrate basic techniques that have been developed further in industry. Many tissues such as cauliflower curd, carrot, pine seeds, or willow leaf can be simply propagated from small pieces of material, either in fluid or gel media.

6.2 Additional safety in specialist areas

Most safe practice for biotechnology education of students in years 10–11 is outlined in 6.1 above.

Teachers of students in years 12–13 need to consider a number of safety practices for using specialist equipment, chemicals, and procedures. Recent New Zealand science, technology, and biology curriculum statements recognise the growing significance of biotechnology, particularly micro-organism biotechnologies and genetic modification, in our everyday lives, such as in food derivatives, medicines, pharmaceuticals, and environmental remediation. Senior secondary school students are encouraged to carry out increasingly sophisticated investigations. Facilities, equipment, chemicals, enzymes, micro-organisms, and advice are readily available from a number of supply firms.

There are a growing number of specialist school facilities for teaching biotechnology. These facilities, however, can often be shared, and vary considerably in their design and available equipment. Teachers should carefully consider where equipment is placed, because many (such as fermentation and growth investigations) are ongoing while other groups of students and teachers are using the room for other purposes. For security and safety, other staff and students should be made aware of any ongoing investigations.

Equipment often found in specialist classrooms could include controlled plant-growth facilities, autoclaves (for example, pressure cookers), incubators, fermenters (often modified plastic bottles), refrigerators, dehydrators, and computers, all of which require regular general and electrical maintenance. Regular checking by teachers should ensure that these are maintained in a safe state.

> *Teachers who are unsure about any practice should obtain information and instruction from other local teachers or science experts before attempting any unfamiliar procedure or using unfamiliar equipment.*

Many chemicals associated with biotechnological investigations are toxic. Copper sulphate, a chemical commonly used as a fungicide and for growing crystals, is poisonous and can cause serious eye damage. Student access to it should be limited and supervised. Refer to the *Code of Practice for School Exempt Laboratories* for information about substances and chemical procedures that are forbidden in schools.

Bacteriogenetic methods and practices

When using micro-organisms in teaching biotechnology at senior levels, teachers need to be vigilant about obtaining safe species and strains from reliable supply sources. Generally, soil bacteria, such as *Bacillus subtilis*, are relatively safe as are genetically-crippled strains of *Escherichia coli*. The fungus *Saccharomyces cerevisiae* (baker's yeast), including its many strains, is not only very safe but can be used in a variety of investigations.

A number of bacteria, such as *Serratia marcescens*, have known carcinogenic properties and should not be used; neither should the gut bacteria *Escherichia coli* unless genetically crippled, with records kept of the use, including certificates and strain numbers. There is concern about using any *Escherichia coli* as it can cause food poisoning, and *Escherichia coli* 0157 can cause kidney failure and death. When culturing micro-organisms, take care that no one inhales the reproductive spores. These spores, in particular from the cultures of *Mucor* or *Penicillium*, can affect people with asthma and allergies. Do not use *Aspergillus* such as *Aspergillus niger*, which will grow inside lungs. *Aspergillus flatus* produces a mycotoxin that can cause food poisoning. Student laboratory practice should keep to that detailed in the *Code of Practice for School Exempt Laboratories*.

In schools, the safest method for inducing mutations in micro-organisms is by using ultraviolet (UV) radiation. Students should wear UV-protective glasses.

Only named and identified micro-organism species from a reliable source should be used. Teachers or students should never culture unknown species, especially bacteria.

Investigations using bacteriophages, such as those that attack *Escherichia coli* and lactic acid bacteria, are harmless both to humans and to the environment.

Enzymes

A common technique for investigations that isolate deoxyribonucleic acid (DNA) involves using enzymes and sodium dodecyl sulfate (SDS). In industry, extracted DNA is often precipitated by using chloroform in a fume cupboard. However, as chloroform is a banned substance in schools (see *the Code of Practice for School Exempt Laboratories*), a safer procedure involves isolating DNA after treatment with washing-up liquid, followed by the enzyme lysozyme and then ethanol. An alternative is to autolyse dried yeast in an alkaline solution at 40°C, filter, concentrate by dialysis, and precipitate with ethanol.

Chemicals that are supplied by manufacturers in powder form, such as enzymes and SDS, need careful handling because of their effects on living tissue. An experienced teacher or technician should prepare these reagents in a force-ventilated space, such as a fume cupboard. Always wear a face mask when handling powdered enzymes. Specialist biotechnology facilities may contain electrophoresis equipment. DNA from bacteria can be broken into fragments with restriction enzymes and then separated electrophoretically in a gel. Methylene blue is the recommended safe stain for this application.

Transgenic manipulations

All school biotechnological investigations that involve transgenic DNA manipulation will, by law, require approval from **Environmental Protection Authority** (EPA) New Zealand. This organisation has the role of approving all new genetically modified organisms in New Zealand.

The practice of students inserting genes into plants by using a gene gun, to illustrate disease resistance or herbicide resistance, is currently outside any school programme. However, students could visit industries where such practices occur, and natural methods of DNA transformation, such as gall formation by the common vector *Agrobacterium*, can be easily induced in a variety of plant tissue in the laboratory. *Agrobacterium* can be obtained by extracting live samples from active galls on such trees as willow or lacebark.

Teachers in any doubt about a planned activity involving transgenic procedures can seek advice from the **Biotechnology Learning Hub**.

Disposing of hazardous waste

Section 6 of the *Code of Practice for School Exempt Laboratories* should be consulted for a list of how to dispose of hazardous substances. Some substances must be sent to a specialist waste operator. If a liquid or hazardous waste operator is used, ensure the operator has been certified by the Liquid and Hazardous Waste Certification Council. **WasteMINZ** has a list of certified operators. Using a certified operator will provide assurance that hazardous wastes are being dealt with in a responsible manner.

Section 7
Safety in electronics and control technology

7.1 Information for all teachers, including safety in non-specialist rooms

Teachers planning for safety in electronics and control technology should have an understanding of health and safety and risk assessments in electronics and control technology. If this is not the case, teachers should seek advice from a specialist. Each school is required to develop, implement, and manage health and safety policies and procedures that are approved by the Board of Trustees. These policies and procedures are expected to be adhered to in addition to implementing the recommendations in this manual.

Before commencing work with students, teachers need to **undertake an initial risk analysis** of the production process to identify hazards in relation to:

- the people involved, such as students, resource personnel, and the intended end users of the outcome produced (including cultural and ethical considerations)
- the materials and equipment used, including energy sources and wastes
- the environment, for both the production process and location where the final outcome will be placed.

In good technological practice, students should also be made aware of the importance of risk analysis. This process should become an integral part of their classroom practice.

When hazards are identified, risks can often be minimised by incorporating procedures into the process.

In general classrooms, activities relating to control technology do not need to include soldering or the use of specialist chemicals. The types of activities undertaken depend more on teacher confidence and experience. But if programmes include activities such as soldering and printed circuit board (PCB) manufacture, then full safety procedures as outlined later in this section must be followed.

Generally, electronics and control activities involve simple circuit connections using separate components and basic connecting techniques, such as crocodile clip leads, screw posts, and banana plugs. A number of commercially available electronic and control technology kits have components that are simple to join and are easily disassembled. Because most electronic components are small, these should be mounted on a larger insulator base made of wood or plastic. This can help to prevent injuries. It can also make components easier to handle and easier to keep track of.

Dry-cell batteries can power most electrical circuits. Alkaline AA size or larger batteries are easy to handle and are long lasting. They should be of a non-toxic composition and should never be cut or penetrated. When practicable, remove batteries from the circuit or device to prevent short circuiting, overheating, and the battery casing from breaking down and leaking corrosive chemicals. This is especially important when equipment is stored for long periods of time. Be careful not to short out batteries as this can cause wires to overheat and catch fire.

Batteries in storage (especially button cell type) must be stored in such a way that their terminals will not be short circuited (risk of rapid decomposition & fire) ie. batteries are not to be stored loose in a container.

It is recommended that students should not use any power supply over 30 V (volts) and have a circuit breaker (fuse) of no more than 10 A (amperes).

Teachers, and senior students under supervision, may use a low-voltage supply, many of these supplies are not current limited and care should be used to avoid short circuits or excessive loads. Where power supplies do have a manual current limit control then the control should be set to a practical limit for the work being undertaken. If using a power supply connected to the mains it should have a New Zealand mains plug with insulated pins and be operated from a mains circuit which is protected by an RCD (residual current device). It should be noted that some mains sockets for ICT use may not be RCD protected. Students should not use mains powered equipment in the classroom without a teacher present.

Hazards

Examples of hazards in electronics technology are:

- burns from soldering
- fumes from soldering
- chemical stains and burns from PCB etching
- electric shock (where mains equipment is used)
- cuts from broken equipment, such as light bulbs
- injury from high-pressure air, for example, from pneumatics
- injury from high-pressure oil or water, for example, from hydraulics.

Animal-related products

If students are involved in developing products for animal consumption or use, such as a controlled pet food dispenser, and wish to trial its suitability with animals, schools should have an animal ethics policy that meets the requirements of the **Animal Welfare Act 1999** or any other legislation.

7.2 Additional safety in specialist areas

Control programmes in the specialist classroom may include various circuit-building technologies, such as soldering and PCB manufacture. Techniques such as these introduce hazards that must be controlled.

Burns

Small but painful burns can occur from contact with a hot soldering iron or, more rarely, from contact with a hot wire, such as during a short circuit. First-aid facilities must be available, including access to cold running water.

Soldering

If soldering is to be a common feature of the programme, the classroom should have a suitable soldering facility positioned away from taps, basins, gas outlets, and flammable materials such as curtains. The bench material should be heat and chemical resistant, with a place to store the hot iron. The hot iron needs to be rested in a soldering station isolated from anything that's flammable or that might be damaged by heat – and where students will not touch it accidentally.

Students should be taught to ensure the supply flexes of soldering irons are sound before switching them on and to report to the teacher any damage that occurs during use. The risks will be minimised if the non-burn variety of soldering iron flexes are fitted.

For most student work in electronics and control technology, soldering irons of less than 25 W should be used. Temperature-controlled units are more versatile.

After use, soldering irons should be unplugged and allowed to cool before being stored. The cooling process may require removing the irons to a safe area so that students do not touch them accidentally.

All students should be taught how to use a soldering iron safely, including the correct way to plug and unplug them without putting stress on the leads. Students should be made aware that the metal barrel of the iron is as hot as the tip. Most burns are caused by contact with the barrel. Another danger is flicking the iron to remove excess solder. This may cause burns to the clothing, the skin or, more seriously, the eye. All students using soldering irons should be taught how to remove excess solder without flicking or shaking the iron. Also, when using a soldering iron or when near another person using one, students should wear suitable safety glasses, preferably of the ventilated type with side protection.

Solder contains a mixture of metals, including lead, which is a cumulative poison. It is not absorbed easily through the skin, and it is not vaporised significantly when solder is melted. Lead can, however, be transferred to the fingers. From there, it may be transferred to food and swallowed, so facilities must be available for students to wash their hands after soldering.

The heated flux produces fumes, so there should be enough ventilation in the room to prevent fumes from building up. Fumes can cause allergic and asthmatic reactions in some students, and teachers should be aware of students who are at risk. Where natural ventilation is not sufficient, suitable extraction equipment should be used. This could include an extractor fan rated for the volume of the room, vacuum extractor equipment to draw fumes directly from the soldering iron, or portable extractor fans with active filters attached.

Printed circuit board (PCB) manufacture

Handling all chemicals for practical work in electronics should conform to Section 4 of *Safety and Science: A Guidance Manual for New Zealand Schools*. In particular, using strong ferric chloride or ammonium persulfate solutions in the manufacture of PCBs should be done only in a force-ventilated space, such as a fume cupboard. Students should wear safety glasses and protective clothing. Water should be available to dilute spillages, and waste solutions should be disposed of according to accepted environmental procedures.

When using Computer Numerical Control (CNC) routers and laser cutters in the production of PCBs, teachers and students must comply with the manufacturer's recommendations and school health and safety policies. Some overall safety approaches are as follows:

a) Always keep the area around CNC machines clear of obstacles.
b) Always stack material where you can reach it but keep it clear from the machine's moving parts.
c) Always check that tools are sharp and set correctly.
d) Always check that the correct tool data is entered into the CNC program.
e) Always make sure that guards are in position while the machine is operating.
f) Always make sure that all work and fixtures are clamped securely before starting the machine.
g) Always make sure the spindle direction is correct for right-hand or left-hand operation.
h) Always conduct a dry run to ensure the program is correct.
i) Always check that limit switches (micro) are working correctly.

Electricity

For electronic circuits, 15 V of direct current (DC) is generally an appropriate maximum voltage. Commercial appliances, such as soldering irons and oscilloscopes, can be operated from the mains with safeguards. Staff and students should know where the safety cut-out switch is and how to operate it so that all electrical power can be quickly turned off in an incident.

Teachers should ensure electrical equipment has an electrical certification. A carbon dioxide or dry powder fire extinguisher should be kept on hand for electrical fires.

Cuts and lacerations

Light bulbs produce sharp glass slivers when they are broken. Keep a soft brush and pan to clean up breakages, then completely remove all fragments with a vacuum cleaner. The teacher should personally screw light bulbs into their sockets rather than leave this to younger students, who may over tighten them and break the glass.

Allowing students to use sharp blades for cutting materials such as thick cardboard or Veroboard is not recommended unless they have been adequately trained. If the teacher has any doubt about students' abilities to carry out these tasks, alternative methods should be used

Compressed air and hydraulic fluids

Air and hydraulic fluids can be hazardous when under pressure. Air-pressure systems should be regulated and have a working pressure of not more than 320 kPa (kilopascals) = 46.4 psi. Never aim high-pressure air at any part of the body.

Compressed hydraulic fluids, such as oil and water, can cause harm if they escape under pressure.

Section 8
Safety in digital technology

8.1 Information for all teachers, including safety in non-specialist rooms

Each school is required to develop, implement, and manage health and safety policies and procedures that are approved by the Board of Trustees. These policies and procedures are expected to be adhered to in addition to implementing the recommendations in this manual. Schools will need to be mindful of safety in respect to e-learning and digital technology.

There are two key aspects of safety in digital technology and they are:

» safety online which stems from the use of digital technology; and

» safety in relation to equipment (physical aspect) and their layout in classrooms.

Teachers planning for and implementing safety in digital technology should have an understanding of health and safety and risk assessments in digital technology. Teachers can also seek advice from a specialist.

Before commencing work in digital technology, teachers need to do **risk analysis and hazards identification**.

This may include:

» the people involved, such as students, resource personnel, and the intended end users of the outcomes produced (including cultural and ethical considerations)
» the materials and equipment used, including power leads, power points, and energy sources
» the environment, for both the process and the location where the final outcome will be placed.

Students should also be made aware of the importance of identifying hazards. This process should become an integral part of their classroom practice. When hazards are identified, they can be eliminated, or minimised.

Digital technology and e-learning (learning supported by or facilitated by ICT) can expose students to a variety of risks. As a result, it is difficult to predict all of the risks that may impact on students.

All digital technologies have risks. To minimise these risks, schools need to develop safe practices that include the student body and involve raising community awareness. As new technologies appear, the ability to future-proof and be forward thinking is critical. An up-to-date e-learning strategic plan is an essential part of dealing with risks. The e-learning strategic plan should be aligned to the school's goals and vision and be implemented in planning throughout departments and syndicates. Teachers, students, and the community should be aware of safe practices online and be informed of the risks.

A policy for the use of digital technologies, which is signed by students and parents, needs to be more than just a signed piece of paper. The school community needs to be actively involved in the development of the policy content, and be aware of what it means for digital users at the school. A policy for the use of digital technologies needs to be co-constructed and be well-understood to be effective.

8.2 Safety online when using digital device to enable learning

See MoE **support material**

The deliberate teaching of digital citizenship is important at all levels of schooling. Students need to be aware of the safety aspects of their digital footprint and their actions when online. Schools need to have policies that deal with online safety, including but not limited to:

» working in an online context
» managing accessibility
» managing social media such as Facebook, Twitter, and online communities
» cyber bullying
» managing bring your own device (BYOD) to school
» community awareness and support
» copyright
» anti-virus protection and spam.

Schools can consult **Netsafe** for support in these areas, including policy templates, resources for schools, reporting incidents, and getting support if an incident occurs.

Using digital technologies

Global communication and growing networks means students need to be taught how to keep themselves safe online. Well-understood processes and procedures should be developed to suit the needs of the school. Schools need to ensure that any e-learning strategic documentation includes a policy that reduces risk to students but does not exclude them from deriving the benefits from the technology. If using images with recognisable faces, permission must be sought before using these images.

Restrictions

Agreeing on what is undesirable is not a simple task, because people's views are influenced by their cultural, religious, political, and moral perspectives. Schools will need to decide for themselves whether they are going to restrict material and, if so, on what basis. Students should be involved in any risk analysis – if students are determined, they will always find ways of accessing and sharing dubious information. Chat services give students access to people throughout the world. However, some of these contacts have led students into dangerous situations.

Schools need to consider this carefully and develop a policy that is well-understood by the students, the school, and the parent community. Educating the parent community plays an important role. Robust discussions need to happen to consider whether it is necessary to restrict or, alternatively, to educate.

Acceptable use policies

The purpose of an acceptable use policy is not to set restrictions but rather to set guidelines for exploring and using digital technologies. This is an agreement between the school, teachers, and students to adhere to guidelines when they use digital technologies. The school community needs to ensure that, alongside safety aspects, they consider other educational components to effectively use an online environment, such as:

» discriminating between information sources
» identifying information that is appropriate to age and developmental level
» evaluating and using information to meet educational needs.

The policy should include procedures that provide guidelines to deal with behaviours, such as:

» violation of privacy
» cyber bullying
» flaming (making or receiving emotional verbal attacks)
» addiction (excessive use of the Internet)
» sending or receiving objectionable material
» engaging in destructive or illegal behaviours
» making or coming into contact with undesirable people
» failing to respect property rights (copyright).

Consideration needs to be given to:

» the imposition of a specific code of morality or standards of behaviour on others
» the issue of intellectual freedom
» the freedom of the individual to make choices
» the rights of students to make informed choices
» the purpose of such facilities at school (which may well be different from that at home).

In developing this policy, schools need to determine their roles and responsibilities and those of parents, including:

a) What is the role of the teacher with regard to censorship and guidance?
b) Should the school have a role in consulting and advising parents?
c) What is the role of the school in developing responsibility among its students?

Positive management

Positive management of digital technologies within the school includes developing appropriate skills with students.

Discussions within the school community can identify the key skills that are considered essential, for example:

» effective searching skills
» netiquette
» discriminatory skills
» ability to reorganise and reuse information to meet a desired purpose.

Monitoring access online

With the introduction of BYOD (Bring Your Own Device) and mobile digital technologies policies, schools need to ensure that clear understandings and guidelines are given for accessibility and monitoring.

What procedures need to be put in place to ensure the safety of all students? Schools need to work out a system that functions best for them.

Consideration could be given to:

» password controls
» supervised use if students and devices are clearly visible to others – to encourage students to self-monitor the material
» restrictive programmes – such as screening software that will remove access to most undesirable material
» self-imposed restrictions – where students agree to follow guidelines for accessing unacceptable material, which is most effective when the guidelines have been developed with the students
» intranet/LMS/SMS – appropriate and relevant material is downloaded for use.

8.3 Classroom layout and design (physical environment)

In some schools, specialist rooms house digital devices, radio stations, television studios, and photographic darkrooms. Specialist equipment in these areas can present various safety concerns and hazards.

School documentation needs to include planning for the location of specialist equipment and safety procedures that cover each environment.

Considerations can include:

» classroom layout
» lighting
» headphones
» seating and workspaces
» ventilation
» workstations
» ergonomics
» security
» placement of devices, including location and adequate number of power and service outlets
» electrical safety
» surge protection.

Classroom layout

When setting up spaces, careful planning is needed to ensure consideration is given to the location of digital devices. Using experts in digital technology, teachers from other schools, and other specialists may be useful for guiding any decisions. These issues can be expensive to fix if they aren't right in the first instance.

The following should be considered:

a) Power points and service outlets should be located in convenient places – installing more than needed is wise.
b) Regular checks should be made on all electrical 240 volt cabling to check for fraying and other damage.
c) Mobile devices require a specific, convenient, and safe place for charging. Ensure power circuits and plugs are not overloaded. Also consider how digital devices can be safely recharged between work sessions.
d) Check for tripping hazards.
e) Check for possible overloading of power circuits. Instead of adding multi-boxes, get advice from a qualified electrician and upgrade the supply.
f) RCDs should be regularly tested using the test button.
» Ensure there is adequate WiFi coverage, in terms of their number and position.

Two other important issues are the need for enough space at each workstation to open books and folders and the need to avoid placing a screen on top of computer housing.

Lighting

Digital technology requires specific lighting considerations as glare on screens is not desirable. Reflections and screen glare can be prevented by:

- using down lights rather than fluorescent lights
- ensuring there is enough light for students to see any written work that they are using as source material
- ensuring that lights are not placed above ceiling fans, which can create a flickering effect
- locating digital equipment away from windows and other light sources that may reflect on the screen
- careful positioning of digital equipment to avoid the need for curtains or blinds.

Consider controlling lighting levels in rooms with projection equipment such as datashow projectors.

Headphones

The hazards associated with audio digital equipment depend on the situation and the equipment. Headphones should not be used in Technology workshops.

Prolonged use of headphones should be monitored, and students should be given guidance on appropriate volumes. Headphones are a potential health issue when shared by different students. One solution is to treat headphones as personal items and have students supply their own.

Computers, laptops, and mobile devices

Students who use digital equipment, especially for long periods of time, should be taught the basics of ergonomics. This is useful preparation for life beyond school. Considerations for ergonomics include:

- having mini-breaks – getting up and moving away from the device
- ensuring eyes periodically look away from the screen
- being aware of posture and position
- ensuring the correct chair height and the placement of keyboard and mouse
- having the desk at the right height
- setting the screen angle and brightness and avoiding reflection and glare.

If they are aware of these factors, students are more likely to avoid developing occupational overuse syndrome (OOS).

If schools encourage students to BYOD, a policy and practice document should be available for students and their families and whānau.

Seating and workspaces

Students need comfortable workspaces to use digital devices. Because students vary in size, ideal working positions will also vary. Furniture needs to be adjustable to allow for this. Properly constructed seats allow each user to adjust the height and angle positions. Purpose-built furniture is more likely to encourage good sitting positions. Ideally, both the seat and desktop should be adjustable. When buying devices, the cost of providing supporting equipment, comfortable seating, and workspaces needs to be taken into account.

The picture shows a starting position. Students should not be expected to copy it slavishly.

Advice about posture is difficult to give because each person varies. There is a sense that searching for a correct posture is fruitless because any posture held for a long time will end up causing soreness somewhere.

However, a safe piece of advice is ‘The best posture is the next posture’, so students should be encouraged to move and to avoid spending long periods looking at the screen.

Printers

Where possible, consider the recycling of print cartridges and ensure they are disposed of according to recommended guidelines.

Ventilation

Digital devices generate a lot of heat, and rooms containing several devices can become very warm. Extra ventilation should be considered in rooms with many computers and in rooms with specialist equipment.

Curtains installed to reduce backlighting and reflections on screens may restrict the air flow that normally comes from windows. Where a room has many windows facing north, options for reducing heat could include using sun filter screens that tape directly onto windows or using external shades over the windows.

Workstations

Enough space should be provided for students to look at resource material while they are working with a digital device, especially if it is located in a fixed space. Workspaces should enable students and teachers to work comfortably with other material alongside the device.

Students' bags should be stored well clear of workstations to avoid others tripping over them.

3 D Printers

Prior to installing and using a 3D printer a risk assessment should be carried out.

Thermoplastics and Photopolymers can be flammable, cause irritation and skin sensitivity.

The siting of the printer should be determined following an assessment of the risk using the Safety information and Material Safety Data Sheets supplied by the manufacturer of the tool.

Electrical safety

All electrical equipment and installations must comply with local authority and electrical safety regulations. A registered electrician must carry out all wiring and electrical maintenance except for replacing a fuse. The following defects must be corrected immediately by a registered electrician:

» machinery or equipment that gives electric shocks, however slight
» overheated switches or plugs
» sparking or spluttering from cords or plugs
» broken or frayed leads or cords
» broken switches.

Regulations require that all electrical appliances isolating transformers, and RCDs (Residual Current Devices) used in school are:

» inspected and tested before use
» inspected before being used after repair
» inspected at least every 12 months
» tagged at inspection – each piece of equipment should be tagged and all inspections should be carried out by a registered electrician or an approved person.
» recorded in a school register of all electrical equipment.

Teachers should encourage students to examine all electrical equipment before it is used, including all plugs, sockets, and extension leads. This also applies to any electrical equipment borrowed from various sources for short periods of time. Careful positioning of electrical extension leads and equipment within the classroom can minimise the potential for incidents.

Section 9
Safety in technology for resistant materials and textiles

9.1 Information for all teachers, including safety in non-specialist rooms

Teachers in resistant materials and textiles technology should have an understanding of health and safety and risk assessments in resistant materials and textiles. This includes knowledge of materials and their properties as well as production techniques and processes. If this is not the case, teachers should seek advice and training from a specialist. Each school is required to develop, implement, and manage health and safety policies and procedures that are approved by the Board of Trustees. These policies and procedures are expected to be adhered to in addition to implementing the recommendations in this manual.

Before working with students, teachers need to do a **risk analysis to identify any hazards** in relation to:

- the people involved, resource personnel, and the intended end users of the outcomes produced (including cultural and ethical considerations)
- the materials and equipment used, including energy sources and wastes associated with the process
- the environment, for both the production process and location where the final outcome will be placed.

Students should also be made aware of the importance of risk analysis. This should become an integral part of their classroom practice.

In the areas of resistant materials and textiles technology, the teacher's role in implementing safe practices is vital. Teachers should give careful instructions that are supported by clear, practical demonstrations.

Teachers need to be fully aware of the dangers associated with each piece of machinery and the materials, know and use safe practices, and be able to plan ahead for the safety of students.

Full safety instructions must be given before any student uses any machine. This should include demonstrating any safety equipment and modelling safe working practices.

Only one person at a time should use a machine, including starting and stopping it. The only exception to this is when another person is needed to help with heavy objects. As a guide, other students should stay a minimum of 1 metre away from a machine when it is operating.

Students need to be taught how to prepare for work by:

» working out the correct order of operations before they begin
» deciding on the correct machine to do the task
» stacking or storing the required material in a convenient, safe place
» checking materials for any potential handling hazards.

Animal-related products

If students are involved in technological activities that develop products for animals, such as a pet food containers or animal activity products, and wish to trial its suitability with animals, schools should have an animal ethics policy that meets the legal requirements of the **Animal Welfare Act 1999** or any other legislation.

Using machinery

All machines, whether used with resistant materials or textiles, can seriously injure the operator if used incorrectly, so they must be correctly installed, safely guarded, and maintained. All permanently wired machines should be anchored to the floor, and electrical machines must be correctly earthed.

Note: In years 7–10 in particular, teachers must check the set-up of machines at regular intervals..

Outsourcing

In some areas of technology education, it is difficult to predict what outcomes students will want to develop. Students should not have to limit their choice because the school does not have the facilities. For one-off projects, teachers should consider outsourcing. The issues of safety, cost and choice should always be considered, as well as the availability of a reputable supplier.

In some situations, the safety of the end user relies on the quality of the workmanship of a product during its development. If teachers are not confident that students have all the skills needed to manufacture a product that is safe for the end user, outsourcing should be encouraged, for example:

» for any equipment where personal safety depends on the manufacture or repair of a product and/or part
» for any repair to bicycles or cars. In this case, a reputable and qualified agent should be sought. This also applies to the modification of parts.

Classroom requirements

The school's materials technology room should be large enough to ensure that workers and others are safe. Bench layout should enable the easy flow of students around the room, with aisles, entries, and exits kept free of obstructions. Machine bay areas need to have enough space so that bulk materials from storage can be broken down for student use.

It is difficult to ensure that benches and machines will be at a suitable working height for all students. Some ergonomic consideration needs to be given to varying the heights of benches and machines. If necessary to facilitate comfortable use (without the need to reach or strain) students can stand on stable platforms to operate machines.

The risk of incidents increases in rooms with poor heating and ventilation. Students should be able to work in a comfortable temperature without having to wear extra clothing. Ventilation must distribute fresh air without creating draughts. This may not be enough to remove dust and fumes, so exhaust equipment should be positioned to remove polluted air from hot-metal bay areas, finishing areas, and spray booths.

Floors should have non-slip surfaces, be maintained in good condition, be free of tripping hazards with distinguishable walkways and working areas.

Materials that are forbidden in all classrooms

The *Code of Practice for School Exempt Laboratories* lists substances forbidden in New Zealand schools.

Materials and equipment that can be used in all classrooms

The following materials are the ones most likely to be found in schools. For comprehensive details about their safe use, teachers will need to do their own research on the correct way to handle them before deciding whether they are appropriate to use in the classroom.

All materials used in classrooms must be stored safely. For safe use, storage and disposal of chemicals consult the *Code of Practice for School Exempt Laboratories*.

For chemicals, the manufacturers' Material Safety Data Sheet must be obtained (preferably prior to bringing the chemical on site), a hard copy retained within the classroom hazard register for easy retrieval in the case of emergency, with the hazards and recommended precautions listed in the classroom Hazard Register document; the recommendations for handling and use must be adopted and complied with, and students trained in safe practice, before student use.

Adhesives (glues)

Always follow the manufacturer's recommendations for adhesives. Restrict access to glues that could be used for solvent abuse. Whenever handling resins, solvents, and a number of adhesives, wear appropriate personal protective equipment and ensure adequate ventilation. Treat resins with respect because many adhesives are chemically active or are activated when a catalyst is added. After working with resins and adhesives, always wash hands to avoid the risk of dermatitis or chemical sensitivity. Store adhesives in clearly labelled containers in lockable cupboards.

Cleaning agents

Store all cleaning agents (including solvents such as turpentine and methylated spirits), close to the floor in a lockable cupboard labelled with a hazard warning. For storage of hazardous substances refer the *Code of Practice for School Exempt Laboratories*.

Plastic

The term 'plastic' can describe a wide range of synthetic, composite, and natural resin materials. Many of these materials are worked by moulding, by heating, or by chemical treatment. They can also be worked with most hand tools, but sanding by hand is preferable. When working plastic or bending it with heat, handle it with cotton or leather (not rubber) gloves to prevent cuts and burns. Because solvents, cements, resins, and catalysts used with plastics can give off toxic fumes, students should use as little of the material as possible. Provide adequate ventilation and always follow the manufacturer's instructions.

Polystyrene

When polystyrene is cut with a hot wire, dangerous fumes are given off. It is recommended that polystyrene is cold cut with saws. If a hot wire is used, it must be carried out in a well-ventilated space and students must use a half-mask respirator. Hot-wire cutters must be operated from a battery source or through a transformer.

Recycled materials

A variety of reused or recycled materials can be useful in technology education. All recycled material should be safe to use, clean and hygienic. When using aluminium or tin cans, steps must be taken to prevent cuts from sharp edges.

Craft knives

These should be issued by the teacher and used under supervision. Students should be discouraged from using their own craft knives in class.

Place a board under the object to be cut to prevent the knife from slipping and injuring the student and damaging the work surface. If cutting using a straight edge, students should use a safety ruler, never an ordinary plastic ruler. Before students use craft knives, they must be taught how to use them correctly and safely. The teacher should carry out the snapping of blades in order to expose new blade edges and dispose of fragments in appropriate metal recycling bins.

Guillotine (paper type)

Because these cannot be fully guarded, students need to be fully instructed in their use. If there is any doubt about a student's ability to use this device safely, an older student, parent helper, or teacher should do the cutting.

Hot-glue gun

Use these with care as the molten glue and nozzle of the gun are extremely hot. Teachers who are concerned about their students' ability should encourage them to wear a glove on the hand that holds the work or have an adult or senior student help them. Use safety holders for glue guns when they're not in use.

Scissors

Carry scissors by the blades down or shut, and pass them to another person handle first. Store scissors safely with handles readily available and blades pointing away.

Electrical safety

Black-heat appliances, soldering irons, and electric irons should have a red indicator light to indicate when they are switched on and warming up. All machine switches shall comply with electrical Regulations. Emergency machine-stop systems must be regularly checked – the use of foot or knee-stop buttons on machinery is an effective safety device.

All electrical equipment and installations must comply with local authority and safety Regulations. A registered electrician must carry out all wiring and electrical maintenance except for replacing a fuse or resetting a circuit breaker. The following defects must be investigated immediately and corrected by a registered electrician:

- machinery or equipment that gives electric shocks, however slight
- overheated switches or plugs
- sparking or spluttering from cords or plugs
- broken or frayed leads or cords
- broken or faulty switches.

Regulations require that all electrical appliances including portable power tools, isolating transformers, and RCDs (Residual Current Devices) used in schools are:

- inspected and tested before use
- inspected before being used after repair
- inspected at least every 12 months
- tagged at inspection – each piece of equipment should be tagged, and all inspections should be carried out by a registered electrician or by an approved power tool agent
- recorded in a school register of all electrical equipment.

9.2 Safety for resistant materials and equipment in specialist areas

The tools, materials, machinery, and processes used in schools' workshop facilities are similar to those found in industry. If used correctly, this equipment is safe, but there is always potential for harm.

Teachers employed in this area must be fully trained in the safe use of this equipment. This includes having an understanding of the equipment's maintenance. Users of these machines must wear protective clothing, safety glasses, and, earmuffs or earplugs in accordance with manufacturers recommendations. They should also use correctly designed push sticks where necessary.

No machine should be left unattended when it's running.

When operating machines, follow all the safety guidelines mentioned above for supervising students, using correct operating procedures, and carrying out safety requirements.

The **Health and Safety at Work Act 2015** does not set qualifying ages for the use of machinery and equipment. The Act states that a person may use a particular machine providing they have adequate training. However, in the interests of student safety, teachers should restrict students' access to some machines and equipment until they are old enough to understand the need to adhere to safety procedures and/or are physically capable of using the equipment.

A list of recommended minimum year levels for using machinery and equipment is provided in Appendix 5.

Resistant materials used in specialist rooms

Aluminium/ Brass/ Copper/Steel

In sheet form, metal has sharp edges. Therefore, care needs to be taken when handling metals in and around the classroom.

Bone

When bone is worked, it gives off fine dust that can be carcinogenic. Adequate ventilation is required, and each student should wear a dust mask that covers the nose and mouth. Teachers must apply cultural considerations when using bone.

Fibreboard

Fibreboard, such as medium density fibreboard (MDF), has sharp edges. Take care when shifting large sheets. **Dust** from fibreboard can be a fire danger when it is held in a waste extraction system because heat can build up, with explosive results. Students should not use a sanding machine with fibreboard without active dust extraction due to the fine dust particles produces being potentially harmful.

Surface finishing materials

Surface finishing materials, such as enamel paints, varnishes, thinners, and solvents, are **highly flammable**. Store these products securely and away from heat. See cleaning agents above for information on storing large amounts of flammable materials.

Fluxes

Fluxes are used in conjunction with solder and give off poisonous fumes. Use them only in a well-ventilated space and when wearing protective clothing. If spattering occurs, wash the flux off immediately.

Glass

Where glass has been cut, take special care to clean up the workbenches. Glass is a hazardous waste and should be placed in a separate waste bin. Safety glasses is must be worn when using and processing glass.

Glass-reinforced plastics (GRP)

Conditions for working with GRP are similar to those for plastics. Use safety glasses, aprons, gloves, and face masks. Because resins and catalysts require careful handling, follow the manufacturer's instructions at all times. Although glass fibre is non-combustible, most other materials used in GRP are. Store GRP in a lockable cupboard.

Lead

Do not breathe lead dust because the effects are cumulative and may have serious consequences. Lead is one of only two metals that may be cast in school workshops.

Oils

Clean up any oil spillage immediately. Oily rags should be laid out flat until they are dry and fumes have evaporated. They can then be put into a rubbish bin. Scrunched up oily rags can self-ignite if left in a rubbish bin.

Solder

Some solder contains flux, which is a potential irritant and can trigger reactions in some students, especially asthmatics, so ventilation is required. Simple ventilation systems can be set up in a dedicated area using a range hood and extractor fan arrangement, with soldering activity limited to this area. Active carbon filter fans are another option. These can be purchased from an electronics supplier. A further protection for students is for the teacher to roll solder into coils and insert them into small plastic containers with a hole in the lid so students can avoid handling the material.

Solvents

Keep solvents away from heat and store them in cool conditions. Label containers of solvents clearly. Do not mix unknown materials. When wiping up spills, take care to use clean rags so that materials are not accidentally mixed during the cleaning process.

Tanalised timber

Where students are designing and manufacturing wooden products, they should be aware of the chemicals used during tanalising to ensure the product is safe to use.

Timber

Timber should be racked in secure storage away from work areas, with heavy timbers stored close to the floor.

Take care when shifting long lengths of timber. Watch for handling defects, such as splinters and sharp edges, and cut out loose knots, which are a danger when passing timber through a thicknesser.

Storage of resistant materials

In specialist areas, a major safety concern is the storage of large amounts of bulky materials.

An adequate rack system, away from work areas, needs to be in place to store sheet materials – wood, metal, plastics, and long lengths of timber and steel.

Chemicals should be stored in accordance with the hazardous substances requirements **Code of Practice Schools Exempt Laboratories.**

When large quantities of materials are being shaped or joined, dust or fumes can build up. Adequate **ventilation** as well as dust extraction is important, and classroom spaces must be set up to accommodate this.

Machine installation and maintenance

Machines must be installed in locations where accidentally ejected material will not injure students.

Because of the danger of flying material, students should not be able to stand in line with work coming off a machine. This applies, in particular, to circular saws, planers, and lathes. Students should also not look directly into the openings of a thicknesser in operation.

Regular maintenance and overhauling of machines is an essential part of safety. Unsafe equipment must be identified, and the head of department or teacher in charge must be notified about it. Unsafe equipment must be labelled and prevented from inadvertent operation by effective electrical isolation procedures or taken out of service.

Using machines safely

The main rules for using machines safely are as follows:

- Never wear loose clothing, including loose sleeves, ties, or scarves, when working with machinery.
- Tie back and cover long hair.
- Wear fully enclosed footwear, not sandals, jandals, or open-toed shoes.
- Remove rings, and all loose jewellery.
- Where processes have a particular hazard, use protective clothing, safety glasses, or noise protection as required
- Plan and prepare correctly before operating a machine. This includes having a full knowledge of the machine, its hazards, and safe procedures for operating and stopping it.
- Use machinery for only the purpose that it was designed for.
- Check that all guards are in place.
- Check constantly for any defects. If you find any, isolate the machine and notify the person responsible for maintaining it.
- Obtain and use correct machine safety tooling and equipment.

Note: All metals, when drilled mechanically or turned, leave waste called swarf. This is dangerous to handle because it has sharp edges. Clean up swarf with a brush and shovel or similar retrieval device.

Examples of potentially dangerous parts of machines are:

- revolving shafts, spindles, mandrels, bars, machine shafts, drilling machine parts, drills, and chucks
- revolving gears
- belts and pulleys
- chains and gears
- connecting rods, links and rotating wheels
- reciprocating fixed parts
- control handles and fixed parts
- projections on revolving shafts, keys, set screws, and cotter pins
- rotating parts and open pulleys
- revolving cutting tools and saws
- reciprocating knives and guillotines
- abrasive wheels
- endless cutting machines.

Some methods of minimising risk when using machines

Using colour coding

Workshop equipment should be colour coded according to **NZS 5807:1980 Code of practice for industrial identification by colour, wording or other coding** to identify the dangerous aspects of machines.

Colour name	Colour paint reference number	Meaning
Safety red	BS 5252 Colour number: 04	Stop/danger – to indicate firefighting equipment and its location
Safety yellow	*13S 5252 Colour number: 08*	*Caution – warning of danger*
Safety green	*BS 5252 Colour number: 14*	*Safety – to identify the location of safety equipment, emergency escape routes, and medical/first-aid equipment*
Safety blue (auxiliary blue)	BS 5252 Colour number: 18	Mandatory action or information – for example, "Wear safety goggles" or telephone location

Note: Blue is used only as a component of a sign and considered a safety colour only if used in conjunction with a circle.

Machine guards

NZS 5801:1974 Specification for the construction and fitting of machinery guards states that:

- Fixed guards on machines that are occasionally removed only for repairing or maintaining the machine may be painted the same colour as the machine.
- Movable guards, such as saw guards and thicknesser guards, which must be adjusted for each particular job, should be painted safety yellow.
- However, the inside of all guards, whether fixed or moveable, should be painted safety yellow.

Isolating switches should be fitted to all machines so that they cannot be switched on accidentally. Because the basic principle in guarding machinery is that all moving or dangerous parts need to be covered, appropriate guards should be fitted to all machines.

Band saw and scroll saw

Carry out adjustments with the machine turned off. Before students use a band or a scroll saw, teachers must:

» fit and adjust the blades to the correct tension
» adjust tool guides and guards to be just clear of work
» warn students to keep their hands well clear of the cut line and to take care with sharp corners or curves so as not to jam the blade.

CNC machinery

CNC (Computer Numerical Control) machines include lathes, routers, laser cutters and milling machines. Each machine is different, and it is essential that students receive quality instruction before attempting to use any CNC equipment (even though most modern CNC machines are designed so that the cutting tool will not start unless the guard is in position). Many CNC machines automatically lock the guard in position whilst the cutter is shaping material. The guard can only be opened if the cutter has stopped. This means that the student cannot be hurt by flying pieces of material.

Never operate a CNC machine without correct training or without consulting the operator's manual for that machine and control type.

Never attempt to program a CNC machine without correct training or without consulting the programmer's manual for that machine and control type.

CNC routers used for shaping materials such as woods and plastics should have built in extraction. Dust can be very dangerous if inhaled and can also cause eye irritation. If a CNC router is fully enclosed, dust cannot escape. If an extraction unit is attached, the dust is removed automatically. CNC routers often have a single phase electrical supply. A single phase electrical supply can be plugged in to any available electrical supply socket that includes an RCD. These are the most important considerations when operating CNC machines:

» Keep the area around CNC machines clear of obstacles.
» Stack material where you can reach it but where it is clear of the moving parts of the machine.
» Check that tools are sharp and set correctly.
» Check that the correct tool data is entered into the CNC program.
» Make sure that all guards are in position while the machine is in operation.
» Make sure that all work and fixtures are clamped securely before starting the machine.
» Make sure the spindle direction is correct for right-hand or left-hand operation.
» Conduct a dry run to ensure the program is correct.
» Check that limit switches (micro) are working correctly.

Laser cutters

Always follow manufacturer's instructions for setting and using laser cutters. Identify any potential hazards, put in place precautions, and teach students safe practices.

Potential hazards include serious eye and skin damage from direct exposure to the beam, from laser reflections, from secondary emissions from incandescence and plasma. Most industrial lasers are far infrared (IR-C) carbon-dioxide lasers and near infrared (IR-A) neodymium-YAG lasers. The IR-C lasers pose hazards to the cornea of the eye and to the skin, whereas the IR-A lasers pose a potential retinal burn hazard and thermal skin burn hazard. These potential hazards diminish if filtered view-ports are used.

Use of laser cutters that have the following three components enclosed will ensure students cannot gain access to the laser beam. These components are the laser, the pipe that carries the beam, and the enclosure where the beam acts on the work.

Drill Press (bench mounted and pedestal)

Wear safety glasses at all times. An additional concern when using drilling machines is the production of swarf. When metals are drilled, swarf comes off as a long curl. Break it by stopping the feed momentarily. Swarf is a waste from the drilling process, and it must never be handled without gloves. Clean it up with a small brush and shovel.

Before students use drilling machines, teachers must remind them to:

- use safety glasses
- choose the correct speed for the job
- keep their hands clear of the revolving chuck or drill bit
- ensure that only one person at a time is operating the drill
- remove the chuck key after tightening or removing the drill piece
- carefully secure work – large pieces of material having small holes drilled may be safely held by hand, and small work must be held in a vice or be clamped to the table.

Electric welding (ARC, MIG, TIG, Plasma cutting)

Electric arc welding equipment may be used by year 10 students and above following risk assessment. Students must take care when welding because a fault in the weld may cause an incident when using the finished product.

Students should wear safety glasses or shields with the correct shade of filter glass (according to **AS/NZS 1338.1:2012 Filters for eye protectors – Part 1: Filters for protection against radiation generated in welding and allied operations**, **AS/NZS 1338.2:2012 Filters for eye protectors – Part 2: Filters for protection against ultraviolet radiation,** and **AS/NZS 1338.3:2012 Filters for eye protectors – Part 3: Filters for Protection against infra-red radiation**) to protect the eyes from infrared and ultraviolet radiation and from high-intensity light. An extra shield needs to be available for the teacher to use when supervising students. All shields must be kept in good condition. Do not use oxyacetylene goggles for electric welding because the filter shade is not dark enough.

Special welding curtains should be installed around welding bays to protect other students. Do not allow anyone to watch, because when the arc is struck, the flash can damage eyesight.

Keep all equipment in good condition and use suitable safety equipment. Cover hands and forearms because arc welding has a sunburn effect and gives off sparks that can burn. The work and electrodes will also be hot and can cause burns.

Always use safety glasses when chipping slag. Ensure that the area is ventilated to remove fumes.

Electric spot welding

After demonstration, this is a simple and safe operation for students, but they should always use safety glasses or a face shield/visor.

Gas welding and cutting

Oxyacetylene equipment is not to be used by students under year 10. Acetylene is a highly flammable gas, and under some conditions, will explode. Take particular care to prevent acetylene gas from escaping because it might create an explosion. Oxygen leaks are as dangerous as acetylene leaks.

Gas equipment can be tested for leaks by:

» immersing hoses in water and checking for bubbles
» immersing the tip of the torch in water to test the valves
» Spraying with soapy water with any resulting bubbles indicating leaks.

Gas-welding hazards include the following.

a) Damage to the eyes from radiant energy, spatter, and chipping, or from cleaning operations (correct filter shades must be fitted to welding goggles – brazing shade 3-4, gas cutting shade 3-6, gas welding shade 4-8).
b) Burns from hot metals and sparks (These can be prevented by wearing gloves and suitable clothing.)
c) Fumes from materials that have been galvanised or similarly treated
d) Explosions and fire from gases – and explosions caused through build up of unburnt gasses leaking into the workshop or from gas welding in confined spaces (ensure that there is adequate ventilation). Relieve gas pressure from hoses after use.
e) The ignition of flammable materials (Remove such material before welding or cutting starts.)
» Strains caused by lifting or moving heavy cylinders (Only move cylinders on their trolleys.)

In the event of a fire from a cylinder or pipe outlet, teachers should leave the gas burning, set off the fire alarm, evacuate students, call the fire brigade.

Grinder (bench/pedestal)

Although grinders are fitted with shields, safety glasses and ear defenders should always be worn. Grinders should not be used for wood, plastics or non-ferrous metals such as brass, pewter, or aluminium

When using the grinder, set the work rest at a maximum distance of 3 millimetres from the wheel to minimise the risk of the work being wedged between the grinding wheel and the rest. Do not use the side of the grinding wheel for grinding. Regularly assess the condition of the grinding wheel and dress/shape accordingly. Under certain conditions, flaws can cause the wheel to shatter. The user should check for cracks and ensure that the wheel is balanced. When replacing worn grinding wheels, follow the manufacturer's instructions.

Grinder (Angle / Disc Grinder)

Specialist eye protection must be worn e.g. grinding goggles. It is recommended that two layers of eye protection be worn such as safety glasses and a full face shield as per industry best practice.

Guillotine (sheet metal)

A sheet-metal guillotine is normally fitted with a fixed guard to protect the user's fingers. Check that a foot-operated guillotine cannot trap the user's foot. A lock pin should be fitted to the treadle. Do not feed materials into a guillotine from the back. Ensure hands are well clear of the blade at the front and rear of the blade before operating.

Horizontal-boring machine

Horizontal-boring machines have similar safety issues to bench-type drills. However, for many of these machines, the work is hand held and fed onto the drill. Keep hands well clear of the drill bit and ensure that the material being drilled is firmly secured. Wear safety glasses.

Internal combustion engine

If the technological activities require students to modify, adapt, and work with internal combustion engines, full supervision is required at all times.

Ventilation is required, and the engine must be exhausted to the open air. Because this equipment uses petrol, full consideration must be given to the availability of fire-safety equipment, including fire extinguishers.

Lathe (metal)

In operating a lathe, students must:

- wear safety glasses
- tie back or net long hair and cover
- not wear loose clothing
- remove the chuck key after tightening
- use "steadies" and/or the tail stock to support work
- set the correct speed and feed before starting the lathe and not change speeds while the machine is running
- guard protruding work if it is so long that it protrudes past the end of the machine.

Students should not:

- handle swarf without gloves
- touch revolving work
- apply cloth or cotton waste to rotating work.

Lathes should have:

- chuck guards that prevent starting if open
- automatic feed screw covers
- multiple ways of stopping

Lathe (wood)

Constant supervision of students is required, particularly when they begin a piece of work. Always wear safety glasses or a face shield.

In operating this machine:

- keep other students 1 metre away
- use knot- and defect-free timber where possible, and ensure that any glued-up work is well-fitted
- reduce squared-off timber to an octagonal shape by planning or cutting the corners
- select a safe cutting speed to suit the bulk of the wood to be turned and the type of timber
- balance the wood to avoid vibration
- make sure the work is secure by adjusting the tool rest and turning the work over by hand before starting the machine to ensure all adjustments are set correctly
- if a brake is fitted, apply it steadily and cautiously
- keep hands well away from the work
- ensure that the handles of woodturning tools are firmly fitted
- do not use tools made of old files
- remove the tool rest when sanding.

Metal plating (by electroplating and anodising)

If this equipment is installed in the school workshop, a full understanding of the **Health and Safety in Employment Regulations 1995** is required. If only a few projects require metal plating, it is advisable to outsource this work because many plating solutions use cyanide, which is prohibited in schools.

Shaping machine (metal)

Always wear safety glasses. Firmly secure both the work and the cutting tool. Before operating this machine, set the correct speeds and operate the ram by hand for a full forward and backward stroke, making sure that the tool is clear of the work and the head slide is clear of the main housing.

Operate the machine from the side to avoid cuttings that are ejected from the front of the machine. The back of the ram must be enclosed, and there should be a minimum clearance of 500 millimetres between its furthermost backward position and any fixed objects behind it.

PCB etching

(refer to Section **7.2 PCB manufacture**)

Plastics

When working with plastics, read and follow the supplier's instructions for all equipment and materials because these will differ between products. Ensure that any materials are safe to use for educational purposes and are the correct type for the operation. Some plastics can emit dangerous fumes or become flammable if incorrectly processed. Reputable suppliers will provide plastics that are safe for educational use and provide training programmes for their products.

Using a hotplate system

As the working surface of a hotplate system can reach very high temperatures, the main hazard is burns. The hotplate must be positioned on a heat-resistant surface at an appropriate height for the students. Ensure that the electrical supply lead cannot be snagged, causing the unit to move unexpectedly.

Injection moulding machine and thermoplastics thermoforming machine

Ensure that the heaters in these machines are turned off when they are not in use, and never use these machines without the heater guards in place. Follow any other instructions supplied with the machines. Ensure that any materials used in these machines are safe to use for educational purposes and that they are of the correct type.

Never use an oven when working with plastic materials.

Polishing machine

Students should always wear safety glasses or a face shield when operating polishing machines. Guards to prevent polishing mops being used above the lower quarter of the mop must be in place. Stop the machine before adjusting it. The piece of work being polished must be securely held in both hands. Do not hold the work in a cloth or apron.

Power hacksaw/bandsaw

Clamp the work firmly, and securely support long pieces of metal to be cut. Do not manually assist the saw. Adjust the flow of coolant for each job to maximise cooling and minimise spillage.
Wear safety glasses.

Hand tools and equipment used in specialist rooms

When tools and equipment are not in use, place them in the well of the bench or in the centre of a table or store in racks with their sharp edges facing downwards. Do not leave a tool on the floor or in a position where it can roll off a bench.

Careful instruction must be given in the safe use of hand tools, and each tool should be used only for its correct purpose. Safety glasses must be worn when cutting or chipping some materials.

Tools that are used with wood or metal are safer when they are sharp. Students should know when a hand tool needs to be sharpened and understand the need to inform the teacher. Before year 10, students are not expected to learn how to sharpen tools. However, students who are year 10 and over may be taught how to carry out minor maintenance and how to sharpen some tools. Metalworking tools are often subjected to hard, heavy use and need more frequent attention.

All files, with the exception of needle files, should have handles fitted to the tangs.

Chisels

Immobilise the material being chiselled or carved and always use chisels with both hands behind the cutting edge.

Handsaws

Students should use a vice with all handsaws, such as a coping saw, a hacksaw or a wood saw. This holds the work piece firmly and keeps the student's hands away from the blade. Bench hooks can be used for light cutting of material.

Portable power tools (corded)

Electrically powered hand tools should be of an industrial type, be of robust construction, and be double insulated as indicated by this symbol.

When working with power tools, observe the following safety rules:

a) Use cordless power tools where possible.
b) Use an isolating transformer or RCD at all times.
c) Ensure that the lead between the transformer and the power source is as short as possible.
d) Use only one tool for each transformer or RCD.
e) Do not use power tools in wet conditions.
f) Ensure that tools and leads are regularly maintained.
g) When tools are not in use, turn them off and remove the plug from the socket.
h) Do not put any power tool down or release from your grip until it has completely stopped.
i) Make sure there are no trailing leads.
j) Use safety glasses at all times and, in most cases, earmuffs for noise protection.

9.3 Safety in textiles specialist rooms

Classroom requirements

The school's textiles technology room should be large enough to ensure students work safely. Table and bench layout should be designed to enable the easy flow of students around the room, with aisles, entries, and exits kept free of obstructions.

It is difficult to ensure that benches and machines will be at a suitable height for all students. Some ergonomic consideration needs to be given to varying the heights of benches and machines so that they can be operated safely.

The risk of incidents increases in a room that has poor heating and ventilation. Students should be able to work in a comfortable temperature without having to wear extra clothing. Ventilation must distribute fresh air without creating draughts.

Floors should have non-slip surfaces, be maintained in good condition and be free of tripping hazards.

Machine hazards

Examples of dangerous parts of machines are:

» needles on sewing machines
» bobbins spinning.

Textiles

A range of textiles can be used; these should all be clean and hygienic. Teachers should ensure students do not have allergies to any textiles they will use.

Bolts of textiles can be bulky and should be stored in racks away from work areas.

Irons

General iron use and safety:

a) Always disconnect the iron from the electrical outlet when filling or emptying water.
b) To avoid risk of electric shock, do not operate an iron with a damaged cord or if the iron has been dropped or damaged in any way.
c) Burns can occur from touching hot metal parts, hot water, or steam. Hot water may leak from the iron. Use caution when filling or turning the steam iron upside down.
d) Never leave the iron's electrical cord hanging over a trafficked area.
e) To protect against burns or injury, do not direct steam toward the body when ironing.
f) The iron must be used on a stable surface. When placing the iron on its stand, ensure that the surface is stable.

» Minimise risk by ensuring one student at a time is using an iron.

When an iron is not in use:

» turn it off and unplug it from the outlet
» never tug the cord to unplug the iron – instead, grasp the plug
» empty any remaining water – do not store the iron with water in it as it may allow sediment and minerals to settle, possibly clogging the steam nozzles
» once it's completely cool, store the iron vertically in a safe place. Set it on the heel rest to protect the soleplate from scratches, corrosion, or stains.

Overlocker

Overlockers are fitted with a cutting blade, so take care when using this device. If using industrial machines with a mechanically driven cutting blade, ensure that this blade is guarded. Students need to be competent to use an industrial machine.

Blades should be regularly sharpened, and any pins in material should be removed prior to using an overlocker.

Sewing machine – domestic/industrial/CNC

Before students replace a needle or fit a bobbin, the sewing machine should be turned off. If students are to maintain and oil the machine, it should also be turned off.

The electrical cord needs to be checked regularly for wear, and students should be instructed on how to unplug the machine without putting stress on the cord.

If students are to use the sewing machine for an extended period, an ergonomically designed workstation should be provided, with the seating position and desk height adjusted for each student.

For advice on the safe use of CNC (Computer Numerical Control) sewing machines, see CNC machinery.

Constant supervision is required when students use pins and needles. No students should hold pins in their mouths. A pincushion or other holding device can minimise the risk of pins being dropped and causing harm. Needles should also be secured in a piece of fabric or a pincushion when not in use.

If a pin or needle is dropped, it should be found immediately – a magnet is effective for this. Students should wear covered footwear in a textiles-based workspace.

Section 10
If an incident happens – guidelines for what to do

10.1 What events need to be notified in the Education Sector?

WorkSafe New Zealand must be notified when certain work-related events (notifiable events) occur. Notifiable events include fatalities, serious injuries and illnesses, and unplanned or uncontrolled workplace incidents that could put people at risk of serious injury or illness. These notifiable events are described in detail within this section.

Notifiable events include those that relate to children and not just teaching staff in the education setting, as schools/ECEs are workplaces.

What must a PCBU (Boards/ECE) do?

1. Contact WorkSafe

Boards/ECEs must ensure that WorkSafe is notified as soon as possible after becoming aware that a notifiable event arising out of the conduct of the school/ECE has occurred. You can notify WorkSafe by calling 0800 030 040 or by filling in a notifiable event form on WorkSafe's website **http://forms.worksafe.govt.nz/notifiable-event-notification**

Why?

This allows WorkSafe to decide whether they will investigate or follow up on the events that caused the death, serious injury or illness; or the situation that had the potential to cause a death or serious injury or illness. Investigating is one of a range of responses WorkSafe could take to a notifiable event. WorkSafe does not investigate all notifiable events.

2. Preserve the site

You must take all reasonable steps to ensure that the site of the notifiable event is preserved and not disturbed until a WorkSafe Inspector authorises you to do so.

The site may only be disturbed if:

- you need to assist the injured person
- it's essential to make the site safe or minimise the risk of someone else being hurt or killed
- you are directed to do so by the Police
- you are permitted by a WorkSafe Inspector.

3. Keep records

You must keep records of all notifiable events for at least five years from the date of the event.

If in doubt the best action is to notify WorkSafe by calling 0800 030 040

What is a notifiable illness or injury?

These are **serious** work-related illnesses or injuries, including:

» Injuries or illnesses that require a person to be admitted to hospital for immediate treatment. Admitted to hospital means being admitted as in in-patient for any length of time.

» Other types of serious injuries and illnesses that are notifiable are set out in the following table with examples. For the purposes of the table:

  › 'Medical treatment' is considered to be treatment by a registered medical practitioner e.g. a doctor.

  › 'Immediate treatment' is urgent treatment, and includes treatment by a registered medical practitioner, registered nurse or paramedic.

  › If immediate treatment is not readily available (eg because the person became seriously ill at a remote site), the notification must still be made.

What is not a notifiable illness or injury?

You **do not** need to notify WorkSafe about illnesses or injuries that only require first aid to treat them. Examples are set out within the following table.

Deaths, injuries or illness that are unrelated to work are not notifiable e.g.:

» a diabetic worker slipping into a coma at work

» a worker being injured driving to work in his or her private car when the driving is not done as part of their work

» injuries to people triggered by a medical reason

» a worker fainting from a non-work related cause

What is a notifiable incident?

A notifiable incident is an unplanned or uncontrolled work-related incident that **seriously endangers or threatens someone's health or safety**. Note that people may be put at serious risk even if they were some distance from the incident (e.g. from a gas leak or explosion).

A notifiable incident also covers incidents which may have only resulted in minor (non-notifiable) injuries but had the potential to cause serious injury, illness or death. E.g. a bus with children on it blows over causing minor injuries, but no one is seriously injured.

Specifically, a notifiable incident includes **serious risk arising from immediate or imminent exposure to**:

» a substance escaping, spilling, or leaking hazardous chemicals (subject to storage regulations) eg a spill of a hazardous substance in a caretaker's shed or science lab that could have placed workers or children at risk of serious injury or illness

» an implosion, explosion or fire e.g. a school boiler explodes placing workers or children at risk of serious injury

» gas or steam escaping e.g. during a science lab, placing workers or children at risk of serious injury

» a pressurised substance escaping

» electric shock (from anything that could cause a lethal or serious shock. It would not include shocks due to static electricity, from extra low voltage equipment or from defibrillators used for medical reasons)

» the fall or release from height of any plant, substance, or thing e.g. an object falls from a wall that could have caused a serious injury if it hit a person

» damage to or collapse, overturning, failing or malfunctioning of any plant that is required to be authorised for use under regulations e.g. in a technology laboratory. See Code of Practice for Exempt School Laboratories.

» the collapse or partial collapse of a structure e.g. a school/ECE fence blows over or a wall collapses in the vicinity of children and they were put at risk of serious injury

» the collapse or failure of an excavation or any shoring supporting an excavation

» any other incident declared in regulation to be a notifiable incident, for example those listed in: regulation 6 of the Health and Safety At Work (Asbestos) Regulations 2016

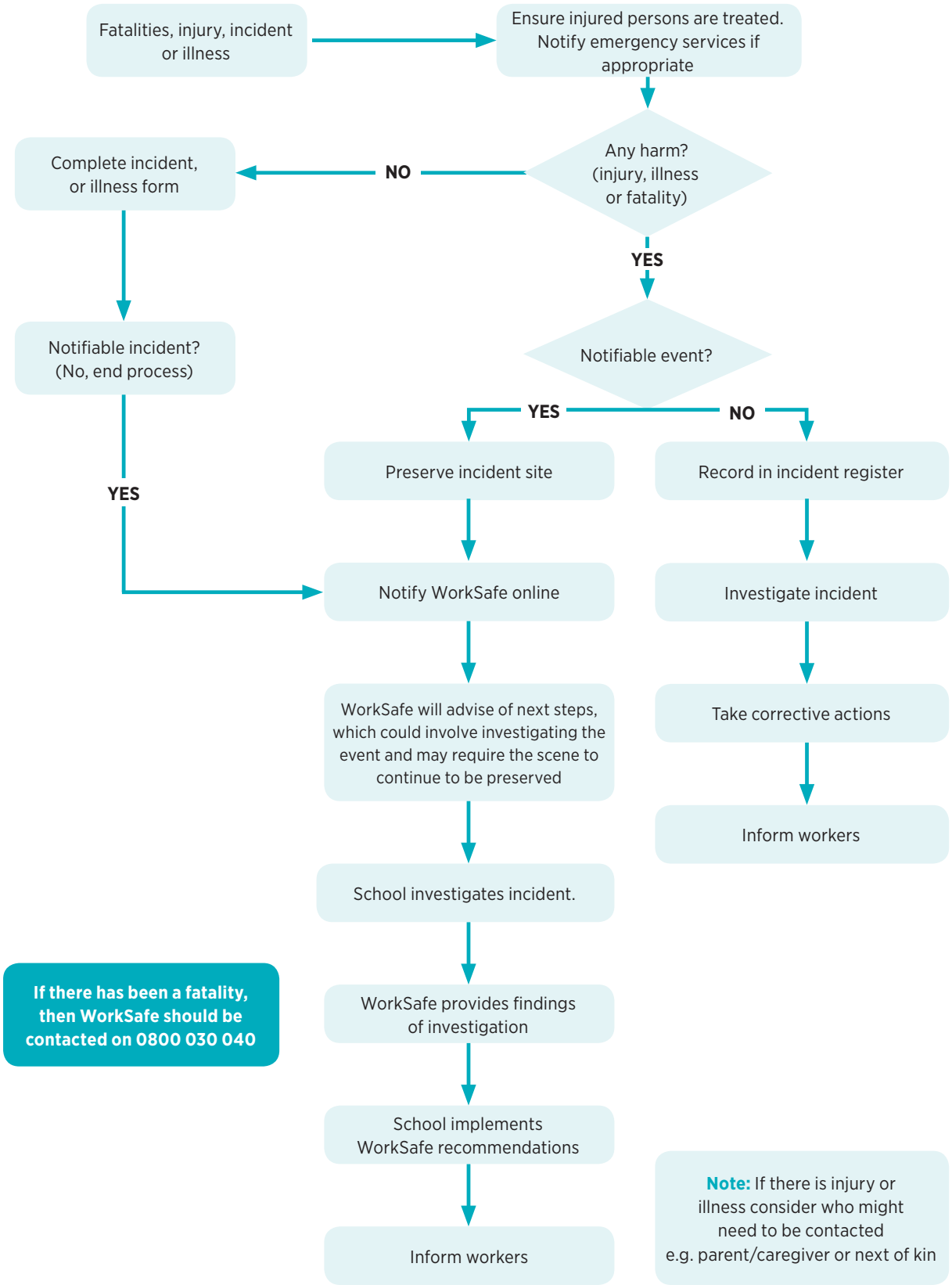
What is not a notifiable incident?

Notifiable incidents do not include controlled activities that form part of the business or undertaking (eg the controlled release of water from a dam).

Reason to notify	Notify	Don't Notify
An **injury or illness** that requires (or would usually require) the person to be admitted to hospital for immediate treatment	'Admitted to a hospital' means being admitted to hospital as an in-patient for any length of time For example: » A child falls from a tree at lunch time and breaks a bone and requires surgery and/or admission to hospital » A teacher falls from a step ladder while putting up Christmas decorations and breaks a bone and requires admission to hospital	Being taken to the hospital for out-patient treatment by a hospital's A&E department, or for corrective surgery at a later time, such as straightening a broken nose. Illnesses, sprains, breaks and fractures treated in A + E and not admitted to hospital For example: » A child falls from a tree at lunch time and breaks a bone requiring a cast, but not admission to hospital » A group of children are playing at lunch time, one falls over and breaks a bone, but not admitted to hospital » Someone slips over on a school camp, and breaks an ankle but is not admitted to hospital » A person receives a human bite and requires a doctor's visit but no further medical treatment
A serious **eye** injury that requires immediate treatment (other than first aid)	» Injury that results in, or is likely to result in, the loss of an eye or vision (total or partial) » Injury caused by an object entering the eye (e.g. metal fragment, wood chip) » Contact with any substance that could cause serious eye damage. For example: » A child gets a fragment in their eye during woodworking class and requires hospitalisation	Exposure to a substance or object that only causes discomfort to the eye. For example: » A child getting sand in their eye causing discomfort, but the sand is washed out.
A serious **burn** that requires immediate treatment (other than first aid)	A burn that needs intensive or critical care such as a compression garment or skin graft. For example: » Someone is badly burnt on a school camp and requires a skin graft	A burn treatable by washing the wound and applying a dressing. For example: » A child receives a minor burn to the hand but only requires first aid
A **spinal injury** that requires immediate treatment (other than first aid)	Injury to the cervical, thoracic, lumbar or sacral vertebrae, including discs and spinal cord.	Back strains or bruising

Reason to notify	Notify	Don't Notify
Loss of a **bodily function** that requires immediate treatment (other than first aid) (e.g. through electric shock or acute reaction to a substance used at work)	Loss of: » consciousness (includes fainting due to a work-related cause e.g. from exposure to a harmful substance or heat) » speech » movement of a limb (e.g. long bone fractures) » function of an internal organ » senses (e.g. smell, touch, taste, sight or hearing).	A sprain, strain or fracture that does not require hospitalisation (except for skull and spinal fractures). For example: » A student or teacher fainting not due to a work-related cause
Serious **lacerations** that require immediate treatment (other than first aid)	» Serious deep cuts that cause muscle, tendon, nerve or blood vessel damage, or permanent impairment » Tears to flesh or tissue – this may include stitching or other treatment to prevent loss of blood or bodily function and/or the wound getting infected.	» Superficial cuts treatable by cleaning the wound and applying a dressing » Lacerations that only require a few stitches from a GP's office » Minor tears to flesh or tissue.
The **amputation** of any part of the body that requires immediate treatment (other than first aid)	Amputation of: » a limb (e.g. an arm or leg) » other parts of the body (e.g. hand, foot, finger, toe, nose, ear). For example: » a technology teacher cuts off fingers in a bandsaw	
A serious **head** injury that requires immediate treatment (other than first aid)	» Fractured skull » A head injury that results in losing consciousness e.g. two students collide at inter school sports and one loses consciousness » Blood clot or bleeding in the brain » Damage to the skull that may affect organ or facial function » A head injury that results in temporary or permanent memory loss.	
Skin separating from an underlying tissue (degloving or scalping) that requires immediate treatment (other than first aid)	Skin separating from underlying tissue where the tendons, bones, or muscles are exposed	
Contracting a **serious infection** (including occupational zoonoses) to which the carrying out of work is a significant contributing factor including any infection due to carrying out work: » with micro-organisms » that involves providing treatment or care to a person » that involves contact with human blood or bodily substances	Diseases caught from animals (e.g. leptospirosis) or E. coli infections Legionnaire's Disease caught from working with soil, compost or potting mix.	

FATALITY, INJURY, INCIDENT OR ILLNESS PROCEDURE - SCHOOLS



Section 11
School, tertiary, and ITO safety planning

Some secondary schools are running technology programmes alongside tertiary institutions. The **Health and Safety at Work Act** and its Amendments, Regulations, and Codes of Practice also apply to students working through a tertiary institute while enrolled in a school. The Ministry of Education web page on **Students on Work Experiences** provides guidance on procedures that schools are required to follow when students attend a workplace (including a tertiary provider) to undertake work-based learning or work experience.

Where students are having off-site experiences with commercial companies and/or tertiary providers, Boards of Trustees should work with the tertiary provider to develop a Memorandum of Understanding (MOU) that sets out procedures to ensure the health and safety of students. Schools can obtain an example of an MOU from the **Competenz** website.

11.1 Safety resources

The Accident Compensation Corporation (ACC) has developed a safety resource for teachers and students who are working to complete NZQA Unit Standard 497 Version 7: Demonstrate Knowledge of Workplace Health and Safety. The resource is called *Start Safe; Stay Safe* and contains information, resources, a CD-ROM, activities, and assessment tasks and is free to schools.

The guide is for use by Gateway coordinators and for teachers in other subject areas. The resource is a flexible toolkit so that Gateway coordinators and teachers can meet the specific needs of their students.

Competenz has part of their website dedicated to the safe use of tools – the **Tools 4 Work resource centre**. To access the information, schools have to set up a login (at no cost).

MBIE – Labour Group and ACC have developed an interactive learning package free to schools: **Metal Industry Interactive Guidelines for Safe Work.** This resource is available as a USB pendrive, CD-ROM or PDF.

Industry training organisations that support schools include:

- **Competenz**
- **The Skills Organisation**
- **Service IQ**

Appendices

Appendix 1

Template for safety planning in technology education

Due to the nature of technology teaching this planning sheet has been developed to assess risk in a room where students could be carrying out a range of activities. If teachers wish to risk assess a unit of work then this template could be adapted.

School: _____

Teacher: _____ Date: _____

Room/unit _____

Student(s) Level: _____

Physical safety

Classroom/teaching environment

In this room/unit, the following aspects of the teaching environment and specialist equipment have been considered when planning for the safety of students and staff. Staff and students have been made aware of the safety aspects of this room/unit.

	TICK OR N/A	DETAILS
Incident register checked for incident patterns?		
Dust collection organised?		
Electrical equipment checked?		
First-aid assistance available?		
Hand-washing facilities available?		
Hygiene considered?		

	TICK OR N/A	DETAILS
Lighting checked?		
Noise levels considered?		
Management of numbers in rooms considered?		
Raised objects secured?		
Students with special needs planned for?		
Telephone/emergency contact(s) available?		
Tripping hazards minimised?		
Ventilation organised?		
Cultural aspects identified?		
Any special jigs/safety aids identified?		

Personal protective equipment

NEEDED	AVAILABILITY

Assessing hazards and managing risk

The following potential hazards have been identified in this room/unit, and safety has been planned for in the following ways.

Equipment

Item:	
Location:	
Recommended year level refer Appendix 5:	
Hazard elimination/minimisation (highlight which) by:	
Emergency procedures:	

Item:	
Location:	
Recommended year level refer Appendix 5:	
Hazard elimination/minimisation (highlight which) by:	
Emergency procedures:	

Item:	
Location:	
Recommended year level refer Appendix 5:	
Hazard elimination/minimisation (highlight which) by:	
Emergency procedures:	

Materials

Item:	
Hazard elimination/minimisation (highlight which) by:	
Emergency procedures:	

Item:	
Hazard elimination/minimisation (highlight which) by:	
Emergency procedures:	

Item:	
Hazard elimination/minimisation (highlight which) by:	
Emergency procedures:	

Environmental Safety

General waste disposal

Hazardous waste disposal:

Approvals obtained

	Tick or N/A		Tick or N/A
DNA transformations: EPA		**Animals: Animal ethics advisory committee**	

Links to NZC Vision, Key Competencies and Values requirements

Cultural safety

Enterprise and community visits

Health and Safety in Employment Regulations 1995, Regulation 59

Presence of young person's family/whānau on a worksite

Allowance under sub clause 2

a	b	c	d	e

Health and Safety in Employment Act 1992, Section 16 (as amended in 1998)

Duties of persons with control of places of work

Warning of significant hazards in the workplace given

by:

to:

Consumer safety

Health and Safety in Employment Regulations 1995, Regulations 66 and 67

Duties of designers, manufacturers, and suppliers of plant

Appendix 2

Completing the safety planning template – notes and examples

Classroom/teaching environment

All staff (teachers, teacher aids, technicians) and students are made aware of the safety aspects for this room/unit, including working in unobservable areas. Health and safety checks include, but are not limited to, those listed in the following table.

Working in unobservable areas

Teachers and their students should not work in spaces where they cannot be observed. Video surveillance may be considered in some situations where areas cannot be made physically observable.

Physical safety

Classroom/teaching environment

In this unit, the following aspects of the teaching environment have been considered when planning for the safety of students and staff. Staff and students have been made aware of the safety aspects of this unit.

Have you looked at the incident register to see whether any patterns of injury are associated with the activities you are planning? Only tick when you have done this. If there is a pattern, note this here and adjust your programme to avoid the activities associated with them.	Incident register checked for incident patterns?
If students are involved in cutting or shaping materials, how have you arranged to collect dust so that students do not breathe it in?	Dust collection organised?
Has the mains-powered electrical equipment to be used in these activities been checked for wear and for loose or exposed wires?	Electrical equipment checked?
See Regulation 4. Note the location of the nearest first aid kit and whether you have checked its contents. If first aid is normally carried out by the school nurse, note this here and the times the nurse is available.	First aid assistance available?
See Regulation 4. Where are these facilities for staff and students located?	Hand washing facilities available?
If the activities (such as in food technology or biotechnology) require hygienic conditions with no contamination, how have you planned for this?	Hygiene considered?
See Regulation 4. What lighting has been arranged for students working with small or intricate objects? Are computer screens sited to minimise glare?	Lighting checked?
See Regulation 11. In the event of loud noise, how will you protect your own and your students' hearing?	Noise levels considered?
See Regulation 13. If the space is inadequate for the number of students involved, how will you organise for all students to undertake the activity safely?	Management of numbers in rooms considered?
See Regulation 16. If students or staff are working under heavy objects, how have you secured these objects?	Raised objects secured?
Are there any students who, for whatever reason, cannot participate easily or safely in the planned activities? (This includes students for whom English is a second language.) If so, how do you plan to provide for their participation?	Students with special needs planned for?

Note the location of the nearest phone and the names and numbers of appropriate emergency assistance. If no phone is available, note how you will get help in an emergency.	Telephone/emergency contacts(s) available?
If electrical leads or bulky materials are needed, how will you minimise the risk of students tripping on them?	Tripping hazards minimised?
If students are working with materials that produce toxic or unpleasant fumes, what ventilation arrangements have you made?	Ventilation organised?
Have you allowed for multiple cultural expectations or limitations to ensure your students remain culturally safe? Codes of practice that relate to accepted protocols that should be adhered to set out in relevant documents from Te Whāriki, Te Marautanga o Aotearoa and the Treaty of Waitangi especially when teaching and learning about early technologies	Cultural aspects identified?
If you have developed any specialist equipment, does it meet expected safety requirements or has it been checked by an expert?	Any special jigs/safety aids identified?

Student personal safety equipment

Needed: List what equipment is required, such as earmuffs, safety glasses, dust coats, shoes, hand protection, masks.

Availability: Note where each of these items is kept, particularly if the equipment is not stored in the same area where the students will be working in.

Personal protective equipment

NEEDED	AVAILABILITY

Assessing hazards and managing risk

This section is in two parts. The first part is to help teachers identify hazards associated with the equipment students may use. The second is to help teachers identify hazards with the materials students may use.

Item: Name the item of equipment or material that presents a hazard, for example, a hot-glue gun, a food processor, a bench grinder, or a restricted enzyme

Hazard elimination/minimisation (highlight which) by: In this section, note how you will deal with this hazard.

- Will you eliminate it by substituting an alternative method or piece of equipment or material?
- Will you isolate it by using adults or more senior students who are competent to use this equipment or material?
- Will you minimise risk by undertaking a skills-teaching sequence with students to ensure that they all understand and can apply the necessary protocols of use, including the use and purpose of personal safety equipment, before using the equipment or material?
- If the hazard cannot be eliminated, isolated, or minimised, have you reported this in writing to the Board of Trustees?

Emergency procedures: Even when hazards are identified and carefully planned for, an incident can happen. If an incident occurs with this hazard, what procedures will you take? What are the school policies and procedures for dealing with incidents? Make sure that any resources needed to carry out these procedures are available.

Assessing hazards and managing risk

The following potential hazards have been identified in this room/unit, and safety has been planned for in the following ways.

Equipment

Item:	
Hazard elimination/ minimisation (highlight which) by:	
Emergency procedures:	

Materials

Item:	
Hazard elimination/ minimisation (highlight which) by:	
Emergency procedures:	

Environmental safety

General waste disposal: How will you dispose of waste material from your activities? Can you reduce, reuse, recycle, or recover any waste? If so, how will you do this?

Hazardous waste disposal: This includes chemical and biological waste. How will you dispose of hazardous wastes, ensuring that you do not adversely affect the environment or people and their cultural practices/ expectations?

Environmental Safety

General waste disposal

Hazardous waste disposal:

Approvals obtained

If you are using animals in your activities or are involved in producing genetically modified organisms, you require approvals from national bodies. Have you obtained these approvals?

Approvals obtained

	Tick or N/A		Tick or N/A
DNA transformations: EPA		Animals: Animal ethics advisory committee	

Psychological and emotional safety

This is particularly important when students are dealing with people outside the school environment, such as when they communicate with people in industry, search the Internet, or communicate through social media. What procedures have you put in place to safeguard your students?

Cultural safety

Have you considered the cultural aspects around your planned activities? Would any students, their families, whānau, iwi, or communities consider some of these activities inappropriate? If so, how will you manage the activities to take these cultural expectations into account?

Cultural safety

Enterprise and community visits

This section is designed to ensure that teachers comply with the legislation relevant to such visits.

Enterprise and community visits

Health and Safety in Employment Regulations 1995, Regulation 59

Presence of young person's family/whānau on a worksite

Allowance under sub clause 2 | a | b | c | d | e |

Health and Safety in Employment Act 1992, Section 16 (as amended in 1998)

Duties of persons with control of places of work

Warning of significant hazards in the workplace given

by:

to:

Consumer safety

Health and Safety in Employment Regulations 1995, Regulations 66 and 67

Duties of designers, manufacturers, and suppliers of plant

Example 1:
Safety inspection audit for specialist resistant materials (wood) – technology room

			Date checked (DD/MM/YYYY)
1.	Floors, aisles, and passageways (aisles minimum 750 mm width)	Clean and unobstructed	
		No wood scraps and shavings	
2.	Exits/egress (at least 760 mm wide)	Route clearly marked and unobstructed	
		Sufficient for occupancy level	
		Doors outward opening	
		No locks or fastenings preventing exit	
		If used after dark, exits illuminated	
		Emergency lighting	
3.	Emergency escape route and assembly points	Clearly marked	
		Assembly points and procedures displayed	
		Assembly practice last held	
		Emergency instructions clearly identified	
4.	Ventilation dust control (dust extraction plant located outside work room)	Adequate for occupancy level	
		Hoods provided for dust extraction	
		Fresh-air inlets – adequate and maintained	
		Duct work maintained free from leaks	
		Air flow adequate for dust removal	
5.	Lighting (natural lighting supplemented by appropriate artificial lighting) (light level ... lux)	Windows in clean condition	
		Lighting fixtures working and clean	
		Working areas have sufficient illumination	
		Access ways and exits adequately lighted	
		Emergency lighting of exit routes (after dark)	
6.	Noise exposure	Machinery with hazardous noise levels identified by signs	
		Ear protection is available where required	
7.	Storage areas	Access ways unobstructed	
		Storage shelves/racks correctly loaded	
		Adequate means of reaching higher storage areas	
		Flammable/non-flammable areas identified	
8.	Waste disposal	Adequate number of disposal bins (wood/metal separate disposal)	
		Separate disposal for paints/varnishes and liquid waste	
		Disposal stations marked	
9.	Paint and varnish area	Adequate ventilation for safe use	
		Provision of ventilated spray booth for aerosol sprays	
		Flammable storage control of location/quantities	

			Date checked (DD/MM/YYYY)
10.	Portable power tools	Electric – check condition for electrical safety	
		Power leads – condition check	
		Mechanical guarding attached and operational	
		Sufficient RCDs for safe working	
11.	Machine tool safety – general	Hold card system – operational	
		Permanently wired isolators with lock-outs	
		Machine guarding attached and operational	
12.	Warning signs	Signs at agreed locations, warning of local hazards	
		'Restricted area' sign displayed at entrances	
13.	Operator safety equipment	Signs identifying hazardous type of protection required	
		Correct footwear identified	
		Safety glasses/goggles, adequate number and condition	
		Hearing protection – adequate number and condition	
		Dust masks – type and availability	
14.	First-aid equipment	First-aid station (including eye-washes)	
		First aiders nominated and listed	
		Incident report book – check	
15.	Fire-fighting equipment	Hose reel locations clearly marked	
		Portable extinguisher – CO2	
		Portable extinguisher – water or dry powder	
		Dates tested	
		Instructions/training for use	
16.	Electrical supply	Cabinets secure	
		Circuits clearly identified	
		Isolating switch – lockable (cabinet)	
		Isolating switch – lockable (in workshop area)	
		Emergency stop	
		System and earth checks	
17.	Specific machine tools		
17.1	Band saw	Electrical controls	
		Guards	
		Push stick	
17.2	Bench grinder	ON/OFF switch	
		Wheel enclosures	
		Wheel condition	
		Work rests adjusted	
		Top guard (wheels)	
		Safety glass shields	

		Date checked (DD/MM/YYYY)
17.3 Buzzer	Electrical controls	
	Front guard (blade)	
	Rear guard (blade)	
	Fence	
	Other guards	
17.4 Drilling machine – horiz #1	ON/OFF switch	
	Bolt guard	
	Spindle guard	
	Table adjusted	
17.5 Drilling Machine – horiz #2	Other guards	
	ON/OFF switch	
	Bolt guard	
	Spindle guard	
	Table adjusted	
17.6 Drilling machine – vert.	ON/OFF switch	
	Belt guard	
	Chuck key	
17.7 Lathe #1	Electrical controls	
	Motor drive and belt	
	Belt guards	
	Accessories stored	
	Spindle ext. cover	
17.8 Lathe #2	Electrical controls	
	Motor drive and belt	
	Belt guards	
	Accessories stored	
	Spindle ext. cover	
17.9 Laser cutter	Electrical controls	
	Heat extractor	
	Guards	
	Accessories stored	
	Limit and cut off switches working	
	Computer connectors and cables controlled	
17.10 Saw – radial arm (cross cut only)	Electrical controls	
	OA and carriage – locks and clamps	
	Blade guarding	
	Dust extraction	
	Blade condition	

		Date checked (DD/MM/YYYY)
17.11 Saw table – rip sawing	Electrical controls	
	Riving knife	
	Table insert in place	
	Motor bracket clamps/locks	
	Blade guard – top	
	Push stick	
	Work supports – front/rear (long work pieces)	
	Dust extraction	
	Blade condition	
17.12 Spindle moulder	ON/OFF switch	
	Spindle guard	
	Fence	
	Drive guards	
	Cutter condition	
	Table clamps/locks	
	Dust extraction	
	Push stick	
17.13 Thicknesser	ON/OFF switch	
	Driver rollers/kickback	
	Belt/chain guards	
	Spindle/knives	
	Dust extraction	
	Work supports front/rear (long work pieces)	
	Head clamps/locks	
	Push stick	
CNC machines	ON/OFF switch	
	Limit and cut off switches working	
	Dust extraction	
	Blade condition	
	Guards and hoods	

Example 2:
Identifying hazards in food production using HACCP

Safe systems

Identifying hazards in food production and saying how to avoid or prevent them is **vital** in food safety. Manufacturers of food must identify points where hazards may occur and take action to stop these hazards. This is called HACCP – Hazard Analysis, Critical Control Point.

How do these safe systems work?

We all expect our food to be safe to eat – we don't expect to get food poisoning from food that has not been stored, prepared, cooked, or served properly. Manufacturers of food products need to assess the risk of all the ingredients used in making a product, including where the ingredients have come from. Problems need to be resolved so that ingredients, time, and money are not wasted. No food manufacturer wants to use contaminated food ingredients or receive complaints from consumers or the Ministry of Health about 'bad' food.

There are four parts to making a successful HACCP plan.

1. Risk analysis

This means thinking about what could happen, when it could happen, and taking steps to prevent it from happening.

2. Hazards

This is anything that may cause harm to the consumer, which could be:

» biological harm – such as salmonella in chicken
» physical harm – such as glass in food
» chemical harm – such as exposing food to cleaning chemicals.

These hazards can occur at any stage in food production – harvesting of raw materials, production of materials, transport to the processing plant, storage of ingredients, distribution to the shop where the product is to be sold.

3. Hazard analysis and identification of critical control points

This is the assessment of the risks in making the product, which will:

» identify points where hazards may happen
» decide which points are critical
» arrange that food products are checked at these critical points
» set out a plan.

4. Application of HACCP

This is the way of doing the hazard analysis. It is important that the project team looks at setting up the HACCP plan for each stage in the production, for example:

Steps in producing	Possible hazards	Action needed
Storage of required food products for completion of activity	Contamination of raw food	Keep meat separate in fridge and store below cooked foods

Appendix 3

Protective devices for woodworking and abrasive machinery

These machines require the following protective devices regardless of whether they are used by teachers or students – refer to Appendix 5: Recommended Year Levels for Using Machines.

Machine	Protective Device Required
Circular saw (bench)	Blade safety guard, parallel and right angle cutting guides, dust extract Push stick
Edger	Anti-kickback device
Hand-held abrasive grinding machine	A control switch that requires constant pressure by the operator
Power hand tool circular saw – teacher only	A control switch that requires constant pressure by the operator
Routing machine (router) – hand held	A control switch that requires constant pressure by the operator. Jig or routing board
Thicknessing machine (thicknesser) – teacher only	Anti-kickback device
Vertical spindle-moulding machine – teacher only	Push stick or jig
Any machine operated by a foot-control pedal	Cover or locking device

Appendix 4

Micro-organisms suitable for use in schools

- Vinegar-producing micro-organisms
- Baker's yeast
- Mildew and rust from plants
- Yoghurt bacteria
- Bacteria and fungi used to produce cheese
- Some fungal diseases on plants and rotting fruit
- Potato blight
- Black spot on roses
- Yeasts from grapes
- Fungi from jams and jellies
- Known non-pathogenic strains from reputable suppliers

Appendix 5

Recommended year levels for using machinery

Teachers are expected to carry out risk assessments before using any machinery.

Machinery and equipment	Year	Machinery and equipment	Year
Aluminium casting moulding stage	10	**Jigsaw**	11
Aluminium casting pouring stage	13	Kettle	5
Arc welding equipment	10	Laser cutters	7
Band saw	9	Lathe **(CNC)**	9
Battery operated drill	7	**Lathe** (wood and metal)	9
Hand held belt sander	11	**Linisher**	11
		Microwave	1
Bench drill above 10 mm chuck	10	Milling machine	9
Bench drill up to 10 mm chuck	7	Needles and thread	2
Bench grinder	11	**Nibbler**	11
Bread maker	6	Orbital sander - hand held	9
Circular saw	Never	Oven	4
Mitre/Compound/Sliding saw	Never	Overlocker	8
Deep fryer	10	**Oxyacetylene equipment**	10
Dehydrator	7	**Polishing machine**	10
Disk grinder - metal	10	Popcorn maker	5
Disk sander - wood	7	Rice cooker	5
Cut-off saw – metal disc	10	Router – hand held	11
Electric drill – portable only	7	**Sanding disk** on lathe (with guards)	10
Electric frying pan	7	Scroll saw	7
Food mixer	4	Sewing machine	5
Food processor	5	Shaper	10
Hand-held precision grinder	10	Soldering iron	7
Hand shears	7	Spot welder	8
Horizontal borer	9	Steam press	8
Hot-air gun	8	Stove top	7
Hot-glue gun low temperature < 120 oC	2	**Surface planer**	Never
Hot-glue gun high temperature > 120 oC	7	**Thicknesser**	Never
Industrial coffee machine	11	Vacuum former	7
Industrial sewing machine	10	Vertical spindle moulder, including bench mounted router	Never
Iron	7	3D CNC routers	9
3D printers	4	2D CNC routers/cutters	9

Consultative group for 2016 update

The Ministry of Education would like to thank the following organisations consulted during the development and updating of these guidelines:

- NZACDITT
- HETTANZ
- TENZ
- Ministry of Business, Innovation and Employment (incorporating Occupational Safety and Health Service, Department of Labour)
- New Zealand Graphics and Technology Teachers Association (NZGTTA)
- New Zealand School Trustees Association
- Royal Society
- Service IQ
- The Skills Organisation
- The University of Auckland, Faculty of Education
- The University of Auckland, Team Solutions
- University of Canterbury College of Education
- University of Otago College of Education

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- Victoria University of Wellington, School of Chemical and Physical Sciences
- Weymouth Primary School
- Baradene College
- Cognition Education Ltd
- Competenz
- Marcellin College
- Remuera Intermediate School
- Responsible Care New Zealand (previously New Zealand Chemical Industry Council Inc)
- Rossmini College
- St Cuthbert's School for Girls

Glossary

For descriptions of terms used in this manual, please refer to the **technology glossary** on Te Kete Ipurangi (TKI).

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