MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Safety and Science/Pūtaiao:

Guidance for Aotearoa New Zealand Schools and Kura

New Zealand Government

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Contents

1 Introduction

1.1 MOE

> "Science is a way of investigating, understanding, and explaining our natural, physical world and the wider universe. It involves generating and testing ideas, gathering evidence – including by making observations, carrying out investigations and modelling, and communicating and debating with others – in order to develop scientific knowledge, understanding, and explanations. Scientific progress comes from logical, systematic work and from creative insight, built on a foundation of respect for evidence. Different cultures and periods of history have contributed to the development of science." (NZC 2007)

Science learning involves engaging with some of the ideas (Jonathon Osborne calls them "crazy ideas") about what exists, how it happens and how we know.

Along with reading, writing, representing and talking about these science ideas most teachers and ākonga want to be doing science.

Osborne says two particular reasons for practical science are an opportunity for ākonga to experience phenomena themselves, and to experience the activity of enquiry.

With any practical learning (and also any conceptual learning!) there is likely to be some risk.

Skilled teachers will know how to ensure learning experiences challenge without causing anxiety, using careful scaffolding and by minimising hazards. They will take into account the value of the learning being addressed as well as their ākonga and their own level of practical skills and understanding.

This Code provides a resource to help.

It covers the requirements of the Health and Safety at Work Act 2015 and its associated regulations, particularly the Health and Safety at Work (Hazardous Substances) Regulations 2017.

It has been developed by the New Zealand Association of Science Educators, The Science Technicians Association of New Zealand, Worksafe Mahi Haumaru Aotearoa and the Ministry of Education, Te Tāhuhu o Te Mātauranga.

Special thanks are due to staff from these organisations who have worked to ensure our ākonga have the best platform to learn science: knowing, understanding, doing.

1.2 WorkSafe NZ

Safety and Science/Pūtaiao: Guidance for Aotearoa New Zealand Schools and Kura provides a good resource for keeping teachers, students and others healthy and safe when using hazardous substances in teaching science. It is especially pleasing to see that the Ministry views teaching science as a way of developing a culture of safety in schools. This will help ensure that, when they enter the workforce, students will carry with them an awareness of the importance of taking care for their own health and safety and the health and safety of other people.

Safety in Science/Pūtaiao: Guidance for Aotearoa New Zealand Schools and Kura will provide Boards of Trustees, teachers, laboratory managers, laboratory technicians, whānau and others a valuable tool in managing the risks associated with the use of hazardous substances in school laboratories.

WorkSafe endorses *Safety and Science/Pūtaiao: Guidance for Aotearoa New Zealand Schools and Kura* as at 1 October 2021.

1.3 NZASE

The New Zealand Association of Science Educators (NZASE) are committed to supporting science teachers/kaiako, and technicians/taiwhanga kaimahi to provide students/ākonga with practical science learning experiences. We understand the valuable opportunities these activities give students as they learn about the discipline of science, and important ideas of science.

We would like to thank the Ministry of Education and WorkSafe NZ for their dedication to supporting a culture of safety in school laboratories. We trust that this manual will enable teachers and technicians to confidently carry out practical procedures and activities whilst ensuring the safety of all involved.

1.4 Acknowledgements

The Ministry of Education would like to thank:

- the New Zealand Association of Science Educators for their management of the writing of this document
- WorkSafe NZ for their guidance of this document
- the advisory group of Chris Arcus, Sabina Cleary, Arwen Heyworth, Noel McCardle and Colin North
- the writing team of Mairi Borthwick, Sabina Cleary, Sarah Hay, Arwen Heyworth, Carmen Kenton, Colin North and Pauline Waiti
- editorial work by Joan Gladwyn of Proper Words.

2 What is the purpose of this document?

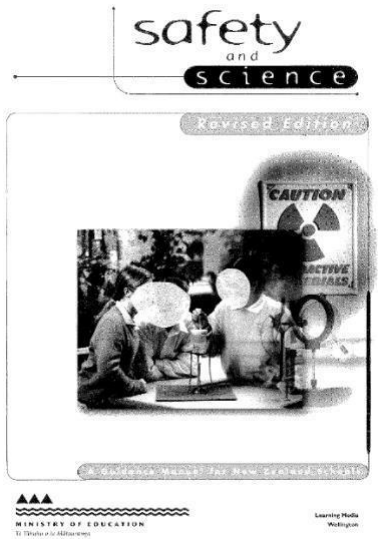
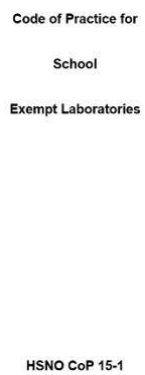
A science/pūtaiao programme has certain potential risks. Yet, with careful planning, most risks can be managed. It is essential for all involved in science teaching and learning to develop a positive approach to a safe and healthy environment in the laboratory. Health and safety in science classrooms and laboratories is the responsibility of the school boards, principals/tumuaki, teachers/kaiako, technicians/taiwhanga kaimahi, and students/ākonga – each assuming their roles and responsibilities. Health and safety should be an integral part of planning, preparing, implementing, and reviewing any science programme.

This document provides information and guidance to teachers and technicians to support them in developing a culture of safety and to ensure the safety of students, staff and others in schools.

The document intends to provide the most important information needed to ensure safety in relation to science in schools. For information about specific aspects not covered in this document, contact the Ministry of Education (MOE), WorkSafe New Zealand, or the New Zealand Association of Science Educators (NZASE).

This document has been prepared by a range of key stakeholders (NZASE, WorkSafe and the MOE) who are not responsible for the results of any action taken based on information in this guidance or for any errors or omissions.

This document replaces the following documents:

Safety and Science; a Guidance Manual for New Zealand Schools.	Code of Practice for School Exempt Laboratories.	Guidance to the Code of Practice for School Exempt Laboratories.
		
Ministry of Education, 2000.	The Environmental Risk Management Authority (ERMA), 2007.	Ministry of Education, 2016.

3 How does Safety in Science/Pūtaiao relate to the New Zealand Curriculum?

3.1 An opportunity to develop Key Competencies

The New Zealand Curriculum identifies five Key Competencies – capabilities for living and lifelong learning:

- thinking
- using language, symbols, and texts
- managing self
- relating to others
- participating and contributing.

Science laboratory experiences provide an opportunity to develop all of these competencies. The competencies are central to developing a student's personal responsibility for their safety and the safety of those around them.

Students/ākonga will adopt and adapt practices they see used and valued by their teachers/kaiako and peers, and they will make these practices part of their own identity and expertise.

A student attitude towards safety will be developed and shaped over time by their interactions in the science laboratory, and they will acquire habits of assessing hazards and risks. They will gain valuable capabilities that they can take into their personal lives and to future workplaces.

Teachers need to lead by example so that students learn that safe procedures are part of the way science must be done. This includes:

- wearing personal protective clothing and equipment
- following and enforcing safety rules, procedures, and practices
- demonstrating safety behaviour and promoting a culture of safety
- being proactive in every aspect of laboratory safety, making health and safety a priority.

Te Marautanga o Aotearoa describes Ngā Mātāpono Whānui:

- Te Āhua o ā Tātou Ākonga
- Ngā Uara, Ngā Waiaro

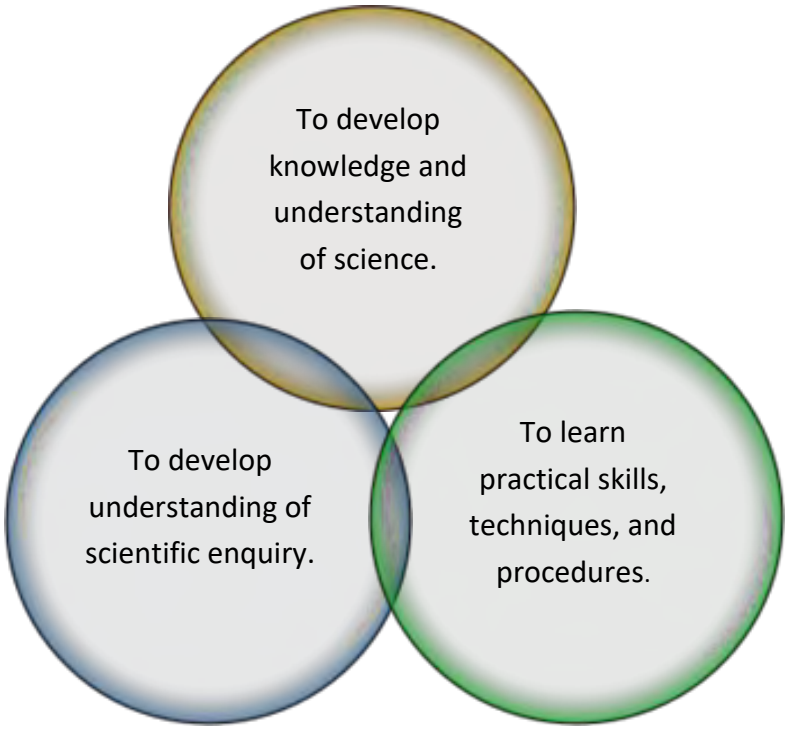
for ākonga to live fulfilling and aspirational lives, embracing care for other living beings and themselves.

3.2 An opportunity to develop effective pedagogy

Effective pedagogy in science has a strong component of practical experiences and is responsive to students' beliefs, values and prior experiences.

When planning practical experiences in science, it is important to consider whether they open up or shut down opportunities for students to engage in science learning and whether they address the range of diverse lived experiences through quality teaching and learning for all students.

Practical work is an important part of science education. The three core purposes of practical work are shown in the following figure:



An important conclusion drawn from research into practical work is that improving science education is not about doing more practical work; instead, it is about doing better practical work.

Two key questions that teachers need to ask themselves when planning practical work are:

- How am I going to ensure that my students are safe during this experience?

and

- How is this experience promoting and engaging scientific thinking and engagement with mātauranga Māori as appropriate in my students?

Student experiences of practical work may be through a demonstration or by student or class practical experiences. Student and practical classwork give students direct experience of phenomena. It is also important to consider whether a teacher demonstration is more suitable in certain circumstances. This might be more appropriate when demonstrating a particular principle, when space or equipment is limited, or for safety reasons.

4 Who has responsibility?

4.1 School and Kura viewpoint

Support for laboratory safety programmes is the responsibility of school Boards of Trustees and Principals. School Boards of Trustees and Principals should appreciate the need to establish safety and health instruction as a fundamental part of a science curriculum and operate their schools/kura in as safe a manner as possible.

The Health and Safety at Work Act 2015 requires persons conducting a business or undertaking (PCBUs) to provide health and safety protection for teachers, workers, students and other persons. The teacher, laboratory manager, and laboratory technician will follow all lawful employer health and safety rules and regulations and wear or use required personal protective equipment while working. They need to report hazards to their employer, report any work-related injury or illness to the employer, and promptly seek treatment.

All safety programmes must actively involve the school board, Principals, Senior Leaders, Health and Safety Committee, laboratory manager, technicians, teachers, students; all have the responsibility for the safety and health of every person in the laboratory and school.

4.2 Teacher/Kaiako viewpoint

Teachers have an obligation to instruct their students and ākonga in the basic safety practices required in science and pūtaiao laboratories. They also have an obligation to instruct them in the basic principles of health risks found in most middle and secondary school science laboratories. Teachers must provide health and safety information and training to the students for every stage of experiment planning and be there to observe, supervise, instruct, and correct during the experimentation. Teachers play the most important role in ensuring a safe and healthy learning environment for the students. The ideal time to impress on students' minds the need for caution and preparation is before and while working with hazardous substances in science laboratories.

4.3 Student/ākonga viewpoint

Students develop attitudes towards health and safety and acquire habits of assessing hazards and risks when they are young. Students come from diverse backgrounds and have various levels of preparation. Most of them have no previous hands-on training in handling hazardous substances or laboratory equipment; others may come well prepared to assume personal responsibility for risk assessment and safety planning in their experiments. The school science laboratory provides an opportunity to instill good attitudes and habits by allowing students to observe and select appropriate practices and perform laboratory operations safely. Safety and health training lays the foundation for acquiring these skills. The students should think through the implications and risks of experiments they observe or conduct to learn that safe procedures are part of the way science must be done.

Student motivation in any area of education is a critical factor in the learning process.

Emphasising the importance of safety and health considerations, ngā kaupapa haumaru,by devoting substantial class time to these areas, should help. The current attention to matters of workplace safety and health may also serve as motivation. Students may find a discussion of toxicology interesting, informative, and beneficial. The possibilities for working this material into the science curricula are innumerable and limited only by the imagination of the teacher.

5 What legislation is relevant?

5.1 WorkSafe NZ and the Environmental Protection Authority (EPA)

WorkSafe New Zealand (WorkSafe) regulates workplace health and safety under the Health and Safety at Work Act 2015 (HSWA).

WorkSafe is responsible for:

- enforcing the rules that are designed to protect people from harm arising from work-related activities involving hazardous substances
- enforcing the rules for the 'downstream' manufacture, use, handling and storage of hazardous substances in the workplace
- enforcing the Hazardous Substances and New Organisms (HSNO) Act ecotoxic and disposal requirements in the workplace.

The EPA regulates hazardous substances under the HSNO (Hazardous Substances and New Organisms) Act. The EPA is responsible for:

- approving and classifying hazardous substances for use in New Zealand
- setting and enforcing the 'upstream' rules for importers, manufacturers and suppliers of hazardous substances
- setting the rules to protect the environment, and people in non-workplaces, from hazardous substances.

The following infographic from WorkSafe demonstrates the responsibilities of the EPA, WorkSafe and local councils relating to hazardous substances.

Hazardous Substances Reforms – the Role of WorkSafe and the Environmental Protection Authority

	Hazardous substance rules to PROTECT PEOPLE from WORKPLACE activities SET UNDER HSW ACT	Hazardous substance DISPOSAL rules and rules to protect the ENVIRONMENT in WORKPLACES* SET UNDER HSNO ACT	Hazardous substance rules at the IMPORTERS, MANUFACTURERS and SUPPLIERS** SET UNDER HSNO ACT	Hazardous substance rules to PROTECT PEOPLE and the ENVIRONMENT in NON-WORKPLACES SET UNDER HSNO ACT
Regulator	WORKSAFE	Environmental Protection Authority Te Mana Rauhī Taiao	Environmental Protection Authority Te Mana Rauhī Taiao	Environmental Protection Authority Te Mana Rauhī Taiao
Enforced by	WORKSAFE	WORKSAFE	Environmental Protection Authority Te Mana Rauhī Taiao	COUNCILS***

* There are other hazardous substance environmental and disposal rules set under the Resource Management Act and local council bylaws. These rules are enforced by local, district and regional councils.

** Such as the classification framework, labelling, packaging, safety data sheets and restrictions on ingredients in certain hazardous substance products.

*** City and district councils.

5.2 Health and Safety at Work Act (HSWA)

5.2.1 PCBU (Persons conducting a business or undertaking [the school board]) duties

A PCBU (in a school/kura, the school board) that manages or controls a laboratory must ensure, so far as is reasonably practicable, that the laboratory, the means of entering and exiting the laboratory, and anything arising from the laboratory is without risks to the health and safety of any person including students, workers, visitors and the general public.

5.2.2 Worker duties (staff/kaimahi)

While at work, a worker must:

- take reasonable care for their own health and safety
- take reasonable care that their acts or omissions do not adversely affect the health and safety of other persons
- comply, as far as the worker is reasonably able, with any reasonable instruction that is given by the PCBU to allow the PCBU to comply with HSWA or its regulations
- co-operate with any reasonable policy or procedure of the PCBU relating to health or safety at the workplace that has been notified to workers.

5.2.3 Other duties (students and other visitors/manuhiri)

A person at a workplace must:

- take reasonable care for their own health and safety
- take reasonable care that their acts or omissions do not adversely affect the health and safety of other persons
- comply, as far as they are reasonably able, with any reasonable instruction given by the PCBU.

5.2.4 Worker/kaimahi engagement, participation and representation regulations

HSWA requires that all PCBUs must involve their workers and health and safety representatives in workplace health and safety matters by:

- engaging with workers on health and safety matters that may directly affect them, so far as is reasonably practicable
- having worker participation practices that give workers reasonable opportunities to participate effectively in improving health and safety on an ongoing basis.

The Health and Safety at Work (Worker Engagement, Participation and Representation Regulations) 2016 ('WEPR Regulations') prescribe matters relating to work groups, health and safety committees, and health and safety representatives.

5.2.5 General risk and workplace management regulations

The Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 ('GRWM Regulations') apply to all workplaces and include provisions on risk

management processes, workplace facilities, emergency plans and personal protective equipment (PPE), and also prescribe health monitoring requirements.

5.3 Health and Safety at Work (Hazardous Substances) Regulations ("the Regulations"

The Regulations prescribe requirements for managing the risks associated with hazardous substances in the workplace.

Part 18 provides requirements for managing hazardous substances in laboratories used for teaching under certain circumstances.

These requirements cover:

- Laboratory design
- recording of hazardous substances
- handling, packaging, and storage of hazardous substances
- personnel requirements for laboratories
- emergency response plans.

Part 18 provides that substances must be handled, packaged and stored in a laboratory, usually in the way in which the substance would be managed under Parts 9 to 13 of the Regulations.

Parts 9 to 13 prescribe specific controls for explosive, flammable, oxidising, toxic and corrosive substances.

5.4 Hazardous Substances and New Organisms (HSNO) Act

The HSNO Act places requirements on:

- manufacturers, importers and suppliers of hazardous substances to ensure that they are:
    - classified and approved under the HSNO Act
    - packaged and labelled, and that they obtain or prepare a safety data sheet in accordance with the relevant EPA notice.
- the disposal of hazardous substances
- using and storing hazardous substances in non-workplaces
- using and storing ecotoxic substances in both workplaces and non-workplaces.

The EPA provides further information on the correlation between the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the New Zealand HSNO system of classification.

5.5 Standards

Standards New Zealand is a business unit within the Ministry of Business, Innovation and Employment. They are New Zealand's leading developer of standards and standards-based solutions.

The majority of the standards are developed in partnership with Standards Australia. New Zealand's representative for the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), Standards New Zealand, ensures that New Zealand has a voice in the international standards community.

The set of standards AS/NZS 2243 Safety in Laboratories provides recommendations to promote the safety of people and property in laboratories.

Standard AS/NZS 2982 provides guidance on the design and construction of laboratories. This standard can be used as guidance but cannot override the requirements in the regulations.

5.6 Other relevant acts and regulations that need to be considered

The Animal Welfare Act 1999

The Building Act 2004

The Education and Training Act 2020

The Electricity Act 1992

Fire Safety and Evacuation of Buildings Regulations 2006

The Gas Act 1992

The Health Act 1956

The Radiation Protection Act 1965

The Resource Management Act 1991

The Wildlife Act 1953

5.7 Local authorities

Some local authority by-laws made under the Local Government Act 1974 will also apply to health and safety issues in school science.

As these by-laws may vary from place to place, boards of trustees and teachers should consult their local authority for advice where necessary.

6 What school/kura policies and procedures need to be in place?

In 2023 most requirements from the National Education Goals and the National Administration Guidelines (NEGs and NAGs) have shifted into the Education and Training Act 2020, into new regulations, into the National Education and Learning Priorities (NELP), and into the National Curriculum (some of which will happen through the refresh).

Of particular relevance to Safety and Science/Pūtaiao are:

National Administration Guideline (now superseded)	From 2023
National Administration Guideline 5a (NAG 5a) Each school board is also required to: a. provide a safe physical and emotional environment for students	Education and Training Act 2020 Section 127(1)(b) A board's primary objectives in governing a school are to ensure that: b. the school: i. is a physically and emotionally safe place for all students and staff; and ii. gives effect to relevant student rights set out in this Act, the New Zealand Bill of Rights Act 1990, and the Human Rights Act 1993; iii. takes all reasonable steps to eliminate racism, stigma, bullying, and any other forms of discrimination within the school. National Education Learning Priorities (NELP) Priority 1 Ensure places of learning are safe, inclusive and free from racism, discrimination and bullying.
National Administration Guideline 5c (NAG 5c) Each school board is also required to comply in full with any legislation currently in force or that may be developed to ensure the safety of students and employees.	Requirements from NAG 5c have moved to, or are covered by, the following: Education and Training Act 2020 Health and Safety at Work Act 2015 Schools must comply with all legislation.

For further information please visit National Education Goals (NEGs) and National Administration Guidelines (NAGs) – Education in New Zealand.

School boards should have policies and practices in place to ensure the health and safety of staff and ākonga involved in science activities.

The Ministry of Education provides guides and tools intended as supplementary resources to support the people involved in governance and leadership at schools and kura to develop a clear understanding of what the Health and Safety at Work Act (HSWA) means for them.

The MOE guide provides an overview of the HSWA and outlines the responsibilities of school boards and school leaders under it. We recommend all schools and kura read this guide.

Key policies that relate to safety in school science laboratories should include:

- overarching health and safety policy
- worker engagement and participation policy
- risk management policy
- incident and injury reporting policy
- training and induction policy
- others in the workplace policy
- personal protective equipment policy.

This document has been prepared by a range of key stakeholders (NZASE, NZSTA, WorkSafe and the MoE) who are not responsible for the results of any action taken on the basis of information in this guidance, or for any errors or omissions.

7 Who is responsible for health and safety in school/kura laboratories?

Everyone has a role to play in keeping themselves and others healthy and safe. The person conducting a business or undertaking (PCBU) has a legal responsibility to make the workplace healthy and safe for workers, students and people visiting the school/kura. PCBUs are expected to identify hazards to manage risks by eliminating or minimising them in that order of preference.

If the PCBU cannot eliminate the risks associated with using a hazardous substance, they must minimise the risks so far as is reasonably practicable. This includes providing the correct personal protective equipment for the staff and students and training them about the risks associated with the hazardous substances and how to protect themselves.

Staff and students must take responsibility to look after themselves at school. Staff and students need to ask questions about the hazards of the hazardous substances they use and make sure they are not putting

themselves or their workmates or classmates at risk. Staff and students must also correctly use the personal protective equipment (PPE) provided at their school.

7.1 What are the duties and responsibilities of duty holders under the Health and Safety at Work Act 2015?

The Ministry of Education has information and guidance to help schools meet the requirements of the Health and Safety at Work Act 2015 (HSWA). The Ministry of Education website has several documents, factsheets and templates to assist schools.

The table on pages 10 and 11 of Health and Safety at Work Act 2015 - A practical guide for boards of trustees and school leaders outlines duty holders' responsibilities.

7.2 What are the responsibilities of the school board and Principal/Tumuaki?

It is important to note that the PCBU is responsible for ensuring that appropriate risk mitigation and controls are in place to manage the risks associated with hazardous substances, including providing controls to limit access to the laboratory to authorised individuals only.

The PCBU must ensure that:

- the requirements of Part 18 of the Regulations are met, which includes specific provisions of Parts 2 to 8 and all relevant provisions of Parts 9 to 13.
- they comply with their overarching responsibilities under HSWA, including the GRWM and WEPR Regulations.
- they designate at least one person as the laboratory manager for each laboratory.

See Section 8 for information on the appointment of laboratory managers.

See Appendix 1 for further guidance around PCBU duties and responsibilities

Health and Safety in Schools

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

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Duty Holder	Definition	School Role	Responsibilities
PCBU (Person conducting a Business or Undertaking)	The **PCBU** is usually a legal or corporate entity, including a self-employed 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.
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.

Online version of this document is available on the Ministry of Education website - Roles and responsibilities - duty holders.

7.3 What are the duties and responsibilities of the laboratory manager/taiwhanga kaiwhakahaere?

The laboratory manager's responsibilities should be clearly published along with the names of the laboratory manager(s) and their delegates. Where more than one person is designated as a laboratory manager, the PCBU must ensure that the terms and conditions of the designation are recorded in writing and ensure that, at any given time, only one person is to be in charge of the laboratory or part of the laboratory, and all hazardous substances contained within the laboratory or part of the laboratory.

A laboratory manager is responsible for a specified laboratory (or part thereof) and:

- is in charge of all hazardous substances contained within the laboratory or specified part of the laboratory and may nominate any other suitably qualified or appropriate person to be in charge in their absence (see Section 8.1 for a guide to the skills and knowledge required for laboratory managers or nominated persons).

Being in charge of the hazardous substances contained within the laboratory means that the laboratory manager has a responsibility to ensure that:

- any approved hazardous substance is handled, used and stored in accordance with applicable provisions of Parts 9 to 13 of the Regulations or a relevant Safe Work Instrument
- any unapproved hazardous substance is handled, used and stored in a way in which a similar quantity of an approved hazardous substance with similar hazardous properties and equivalent degrees of hazard would be under the applicable provisions of Parts 9 to 13
- there is an emergency response plan and inventory in place in accordance with Subpart 2 of Part 5 of the Regulations
- laboratory workers are provided with the following information before handling a substance:
    - procedures to prevent the contamination of any equipment, clothing, or part of the laboratory
    - if the substance is an approved hazardous substance, procedures to ensure that persons in the laboratory are not exposed to more than the prescribed exposure standard (if any) for that substance
    - if the substance is not an approved hazardous substance, the method of management required under regulations 18.10(1) and (3)
    - the disposal requirements for the substance set out in the Hazardous Substances (Disposal) Notice 2017.
    - the actions required under the laboratory's emergency response plan in the event of an accident or accidental exposure to the substance.

The laboratory manager should also ensure that:

- laboratory workers are trained in the correct use, storage and

maintenance of personal protective equipment (PPE) and respiratory protective equipment (RPE) (see Section 29 of these guidelines).
- laboratory workers are trained in the correct operation, storage and maintenance of equipment.
- procedures for the disposal of hazardous substances are included in a standard operating procedure (SOP) or safe method of use (SMU) or other appropriate documentation. These procedures must comply with the Hazardous Substances (Disposal) Notice 2017.
- information on hazardous substances is made available (that is, a safety data sheet (SDS), SOP, or SMU) and that all precautions are in place.
- regular checks of hazardous substances stocks are undertaken to ensure caps are tight and functioning, labeling is correct, and container material has not degraded.

A laboratory manager does not need to hold a controlled substance licence to possess a controlled substance, assuming the substance is only held within the laboratory. If the substance is held outside of the laboratory, for example, in a dedicated storage area, the full provisions of the Regulations apply.

The laboratory manager, or their delegate, should:

- approve hazardous substance activities, and the individuals concerned before use
- be present on-site and take control of the laboratory when any hazardous substance activities are being undertaken.

7.4 What are the teacher's/kaiako's responsibilities?

Teachers and teacher-aides should lead by example and wear appropriate PPE; follow and enforce health and safety rules, procedures, and practices; demonstrate healthy and safe behaviour and promote a culture of health and safety. They should be proactive in every aspect of laboratory safety, making health and safety a priority. The following is a checklist for teachers, highlighting essential information for working in a school laboratory. This is a general safety action checklist and should be regularly reviewed for updates.

7.4.1 Upkeep of a laboratory/taiwhanga and equipment

- Conduct regular inspections of safety and first-aid equipment as often as requested by the laboratory manager.
- Notify the laboratory manager, in writing, if a hazardous or possibly hazardous condition (for example, malfunctioning safety equipment or chemical hazard) is identified in the laboratory and follow through on the status.
- Never use defective equipment.

7.4.2 Safety and emergency procedures

- Educate students on the location and use of all safety and emergency equipment before laboratory activity.

- Identify safety procedures to follow in the event of an emergency or accident.
- Provide students with verbal and written safety procedures to follow in the event of an emergency or accident.
- Know the location of and how to use the cut-off switches and valves for the laboratory's water, gas, and electricity.
- Know the location of, and how to use, all safety and emergency equipment (that is, the safety shower, eyewash, first-aid kit, fire blanket, fire extinguishers and mercury-and other spill kits).
- Keep a list of emergency phone numbers.
- Conduct appropriate safety and evacuation drills regularly.
- Explain in detail to students the consequences of violating safety rules and procedures.
- Report all accidents and incidents to the Laboratory Manager.
- Ensure laboratories are secure at all times.

7.4.3 Maintenance of hazardous substances

- Do not store food and drink with any hazardous substances.
- Do not store hazardous substances in containers that have contained food or drink or could be mistakenly identified as containing food or drink.
- If possible, keep all hazardous substances in their original containers.
- Make sure all hazardous substances and reagents are labelled.
- Do not store hazardous substances on the laboratory bench, floor, or laboratory fume cupboard.
- Ensure hazardous substances not in use are stored in a locked facility with limited access.
- Know the use, storage, handling, and disposal requirements for each hazardous substance used.
- Ensure hazardous substances are disposed of properly. Consult the label and the SDS for disposal information and ensure procedures comply with the Hazardous Substances (Disposal) Notice 2017.

7.4.4 Preparing for laboratory/taiwhanga activities

- Before each activity in the laboratory, go through the Risk Assessment Process to weigh the potential risk factors against the educational value.
- Sign and date your Risk Assessment.
- Review your Risk Assessment regularly.
- Ensure that the procedures proposed are appropriate to the level of knowledge and skill of the students.
- Have an understanding of all the potential hazards of the substances, materials, the process, and the equipment involved in every laboratory activity.
- Inspect all equipment/apparatus in the laboratory before use.
- Go through a safe method of use (SMU) with students so that they are aware of all health and safety concerns and potential hazards related to the laboratory work and how to dispose of any hazardous substances or equipment.
- Ensure that the students and other users know where a paper copy of the SMU is.

- Ensure that the procedures for safe disposal of hazardous substances comply with the Hazardous Substances (Disposal) Notice 2017.

7.4.5 Ensuring appropriate laboratory/taiwhanga conduct

- Be a model of good safety conduct for students to follow.
- Make sure students are wearing the appropriate PPE (for example, safety glasses, laboratory aprons or coats, and gloves).
- Enforce all safety rules and procedures at all times.
- Never leave students unsupervised in the laboratory.
- Never allow unauthorised visitors to enter the laboratory.
- Never allow students to take hazardous substances or equipment out of the laboratory.
- Never allow smoking, vaping, food, beverages, or gum in the laboratory.

7.5 What are the technician's/taiwhanga kaimahi responsibilities?

Technicians support the laboratory manager and teachers in managing the practical requirements of science programmes. They typically prepare experiments and demonstrations, make up solutions, order equipment and hazardous substances, tidy up laboratories and support teachers in day-to-day teaching in school laboratories.

Technicians may also be appointed to the laboratory manager position or may work closely with the laboratory manager to support them in their duties.

7.5.1 General responsibilities

- Keep the prep room locked in the absence of teaching or technical staff.
- Keep an inventory of hazardous substances in each laboratory and storage area.
- Keep paper copies of safety data sheets for Category A and B (GHS Category 1 & 2) hazardous substances in a laboratory folder so that people can access the information.
- Ensure that flammable liquids are stored within a compliant flammable goods cabinet.
- Ensure that incompatible hazardous substances are segregated.
- Before each procedure in the prep area or laboratory, go through the Risk Assessment Process.
- Sign and date your Risk Assessment.
- Review your Risk Assessment regularly.
- Ensure that appropriate PPE is available and used, for example, safety glasses, laboratory aprons or coats, and gloves.
- Ensure that procedures for disposal of hazardous substances comply with Hazardous Substances (Disposal) Notice 2017.
- Follow school policy on reporting incidents and accidents.

7.6 What are the safety do's and don'ts?

Life-threatening injuries can happen in the laboratory. For that reason, students need to be informed about the correct way to behave and what to do in the laboratory. This includes appropriate tikanga Māori around personal safety and the safety of others.

Laboratory experiences also provide the opportunity to prepare students to have good health and safety practices at home and in the workplace.

The following is a safety checklist that could be used as a handout to students to familiarise them with the safety dos and don'ts in the laboratory.

7.6.1 Behaviour

- Do not engage in practical jokes or boisterous behaviour in the laboratory.
- Never run in the laboratory.
- The performance of unauthorised experiments is strictly forbidden.
- Do not sit on laboratory benches.

7.6.2 General work practices

- Know the emergency procedures.
- Never work in the laboratory without the supervision of a teacher.
- Always perform the experiments or work precisely as directed by the teacher.
- Immediately report any spills, accidents, or injuries to a teacher.
- Never leave experiments while in progress.
- Never attempt to catch a falling object.
- Be careful when handling hot glassware and apparatus in the laboratory. Hot glassware looks just like cold glassware.
- Never point the open end of a test tube containing a substance at yourself or others.
- Never fill a pipette using mouth suction. Always use a pipetting device.
- Make sure no flammable solvents are in the surrounding area when lighting a flame.
- Do not leave lit Bunsen burners unattended.
- Turn off all heating apparatus, gas valves, and water taps when not in use.
- Do not remove any equipment or hazardous substances from the laboratory.
- Coats, bags, and other personal items must be stored in designated areas, not on the bench tops or in the passageways.
- Notify your teacher of any sensitivities or allergies that you may have to particular hazardous substances if known.
- Keep the floor clear of all objects (for example, ice, small objects, spilled liquids).

7.6.3 Keeping the laboratory/taiwhanga clean

- Keep your work area neat and free of any unnecessary objects.
- Thoroughly clean your laboratory workspace at the end of the laboratory session.
- Do not block the sink drains with debris.
- Never block access to exits or emergency equipment.
- Inspect all equipment for damage (cracks, defects, etc.) prior to use; do not use damaged equipment.
- Dispose of hazardous substance waste as directed by your teacher.
- Properly dispose of broken glassware and other sharp objects immediately in designated containers.

- Properly dispose of gloves, filter paper, and paper towels in the laboratory.

7.6.4 Clothing in the laboratory/taiwhanga

- Always wear appropriate eye protection (that is, safety goggles/glasses) in the laboratory.
- Wear disposable gloves, as provided in the laboratory, when directed by the teacher. Remove and appropriately dispose of the gloves before exiting the laboratory.
- Wear a full-length, long-sleeved laboratory coat or chemical-resistant apron when directed by the teacher.
- Wear shoes that adequately cover the whole foot; low-heeled shoes with non-slip soles are preferable. Do not wear jandals, sandals, open-toed shoes, open-backed shoes or high-heeled shoes in the laboratory.
- Secure long hair and loose clothing (especially loose long sleeves, neck ties, or scarves).
- Head coverings should be cotton or flame-resistant material. The head covering must be secured so that the material cannot come into contact with any part of the bench, apparatus or substance.
- Remove jewellery especially dangling jewellery.
- Synthetic fingernails are not recommended in the laboratory; they are made of extremely flammable polymers that can burn to completion and are not easily extinguished.

7.6.5 Hygiene practices

- Keep your hands away from your face, eyes, mouth, and body while using hazardous substances.
- Whether open or closed, food and drink should never be brought into the laboratory or hazardous substance storage area.
- Never use laboratory glassware for eating or drinking purposes.
- Do not apply cosmetics while in the laboratory or storage area.
- Wash hands after removing gloves and before leaving the laboratory.
- Remove any protective equipment (that is, gloves, lab coat or apron, safety goggles/glasses) before leaving the laboratory.

7.6.6 Emergency procedures

- Know the location of all the exits in the laboratory and building.
- Know the location of and know how to operate the following:
    - fire extinguishers
    - spill kits
    - alarm systems with pull stations
    - fire blankets
    - eye washes
    - first-aid kits
    - deluge safety showers.

- In case of an emergency or accident, follow the established emergency plan as explained by the teacher and evacuate the building via the nearest exit.

7.6.7 Hazardous substance handling

- Check the label to verify it is the correct substance before using it.
- If you transfer hazardous substances from their original containers, label the containers with the contents, concentration, class of hazard, date, and initials.
- Always use a spatula to remove a solid reagent from a container.
- Do not directly touch any hazardous substance with your hands.
- Never use a metal spatula when working with peroxides. Metals will decompose explosively with peroxides.
- Hold containers away from the body when transferring a hazardous substance or solution from one container to another.
- Use a hot water bath to heat flammable liquids. Never heat directly with a flame.
- Add concentrated acid to water slowly. Never add water to concentrated acid.
- Weigh out or remove only the amount of hazardous substances you will need. Do not return the excess to its original container, but properly dispose of it in the appropriate waste container.
- Never touch, taste, or smell any reagents.
- Never place the container directly under your nose and inhale the vapours/gases.
- Never mix, use or handle hazardous substances unless directed by the teacher.
- Use the laboratory fume cupboard, if available, when there is a possibility of releasing toxic chemical vapours, dust, or gases. When using a fume cupboard, the sash opening should be kept at a minimum to protect the user and ensure the cupboard's efficient operation. Keep your head and body outside the hood face. Hazardous Substances and equipment should be placed at least 15 cm within the hood to ensure proper airflow.
- Clean up all spills properly and promptly as instructed by the teacher.
- Dispose of hazardous substances as instructed by the teacher.
- When transporting hazardous substances (especially 250 mL or more), place the immediate container in a secondary container or bucket (rubber, metal or plastic) designed to be carried and large enough to hold the entire contents of the substance if it should spill.
- Never handle bottles that are wet or too heavy for you.
- Use equipment (glassware, Bunsen burner, etc.) in the correct way, as shown by the teacher.

Relevant parts of the Regulations
This Section should be read in conjunction with • Parts 2 to 8 • Parts 9 to 13 • Part 18 particularly regulations 18.12 and 18.14

8 How is a laboratory manager/taiwhanga kaiwhakahaere appointed?

The person conducting a business or undertaking (PCBU) must ensure that at least one person is designated as a laboratory manager and record the terms and conditions of the designations in writing, including specifying the areas under the control of the laboratory manager(s).

The PCBU must ensure that only one person is in charge of the laboratory or part of a laboratory at any given time.

The PCBU should also ensure:

- the designations are made available to all staff
- all staff are aware of the delegated responsibilities and the people fulfilling the specified roles
- the published designations remain current.

8.1 What are the skills and knowledge required for laboratory managers?

The PCBU must ensure that the laboratory manager has:

- technical knowledge of the physical and chemical properties of all substances managed or used in the laboratory[1], including the likely hazardous properties of substances being synthesised, to prevent or manage the adverse effects of those substances
- knowledge of:
    - precautions for handling the hazardous substances managed or used in the laboratory
    - the disposal of those substances in accordance with the Hazardous Substances (Disposal) Notice 2017.
    - any relevant safe work instrument relating to laboratories.
- the specific knowledge and skill requirements set out in the laboratory's emergency response plan
- the ability to demonstrate the correct operation and maintenance of equipment, including personal protective clothing and equipment, necessary to manage the substances in the laboratory throughout their lifecycles.

[1] The following competencies may be used as a guide for demonstrating laboratory manager basic skills and knowledge:
NCEA Level 6, National Diploma in Science Level 5 or equivalent qualification where the course of study has included papers on physical, chemical, and toxic properties of chemicals would satisfy the requirement for 'a technical knowledge of the physical and chemical properties of all substances', or at least 5 years' laboratory experience would also satisfy this requirement.

These knowledge requirements should include an awareness of the legislative requirements that apply under the Regulations. Accordingly, the laboratory manager should be aware of which substances can be used or stored in the laboratories under their control, depending on the laboratory design and construction.

Detailed information (for example, the safety data sheet (SDS)) for each substance should be readily accessible to supplement the competency of the laboratory manager.

Relevant parts of the Regulations
This Section should be read in conjunction with regulation 18.12 and with regulation 18.13.

9 How do new and expectant mothers keep safe in school/kura laboratories/taiwhanga?

There are several hazards, including hazardous substances used in schools, which can have a detrimental effect on the reproductive health (prospective mother/pregnant/breastfeeding) and the child's health.

These may affect both staff and students.

Normally, these substances are not as widely used as hydrochloric acid, but they are present in the school environment. Additional measures may need to be taken to assess and minimise the risks.

9.1 Known hazards

Physical risks:

- movement and postures
- manual handling
- shocks and vibrations
- noise
- radiation (ionising and non-ionising)
- compressed air

Working conditions:

- facilities (including toilets)
- mental and physical fatigue and working hours
- stress (including postnatal depression)
- temperature
- working alone
- working at heights
- working with personal protective equipment (PPE)

Biological agents:

- infectious diseases, for example, Brucella, Chlamydia, TB, herpes simplex, hepatitis virus, HIV, mumps, measles, parvovirus, rubella

Chemical agents, including:

- toxic chemicals
- mercury
- antimitotic (cytotoxic) drugs
- pesticides
- carbon monoxide
- lead and lead compounds
- boron and boron compounds such as sodium borate, boric acid, borax
- acetaldehyde
- chromium and chromium containing compounds

- cobalt and cobalt compounds
- copper
- ethanol
- chlorine
- ammonia
- lithium
- manganese
- selenium
- toluene
- zinc chromates
- petrol, diesel or oils

9.2 General considerations

It is advisable for workers who are planning a pregnancy or who are pregnant to:

- discuss the pregnancy or planned pregnancy with the Laboratory Manager and/or Principal
- discuss the work situation with a relevant doctor(s)

9.3 Preparing for laboratory/taiwhanga activities

Before carrying out laboratory activities, workers who are planning a pregnancy or who are pregnant need to:

- pay careful attention to relevant information in Safety Data Sheets (SDSs) when completing a risk assessment for procedures to be carried out in class or the prep room
- be aware of the classifications of substances that indicate potential harm to the mother and/or baby, in particular, those substances that are classified as a reproductive toxicant: Category 1, (6.8A), Category 2 (6.8B) or reproductive toxicant: effects on or via lactation (6.8C) and take measures to eliminate exposure
- use hazardous substances in reduced concentrations where possible
- consider alternative substances that are less hazardous
- consider using videos for hazardous substances activities where possible
- negotiate for a colleague to step in to run a practical activity or prepare solutions for you
- wear appropriate personal protective equipment (PPE)
- pay particular attention to personal hygiene, such as washing hands thoroughly at the end of the practical or procedure, before eating/drinking/using the bathroom/leaving the lab/prep room
- avoid touching areas of the body such as face/mouth/eyes while doing a practical or procedure, while wearing contaminated gloves, or before washing hands.

9.4 Keeping babies safe while breastfeeding

Younger babies are at higher risk of contaminants in breast milk, as they consume more than toddlers. Some hazardous substances can enter the mother's body and cross the

blood barrier into breast milk. Chances of this occurring in a secondary school environment are considered low.

However, anyone working with hazardous substances while breastfeeding can:

- ensure they are wearing personal protective equipment (PPE) when working with hazardous substances
- wash their hands thoroughly at the end of the practical, before eating/drinking/using the bathroom/leaving the laboratory
- avoid touching their face/mouth/eyes while doing the practical, while wearing contaminated gloves or before washing hands
- ensure that they do not wear any contaminated PPE outside the laboratory or take it home
- change clothes before handling children
- consider not breastfeeding for a period of time if exposed to a chemical spill while at work, to allow the contaminants to leave their system
- consult their doctor.

Links to useful documents/information:

Royal Society of Chemistry - Health and safety essentials for new and expectant mothers

Example Expectant mothers risk assessment form (Word doc)

Example Breastfeeding mothers risk assessment form (Word doc)

10 How do we keep all students/ākonga safe?

Schools have a duty of care to ensure that all students in the school are kept safe, irrespective of their special educational needs, religious or cultural needs.

10.1 How do we keep students/ākonga with special education needs safe in the laboratory/taiwhanga?

The Education and Training Act 2020 states that "students who have special educational needs (whether because of disability or otherwise) have the same rights to enrol, attend and receive education at State schools as people who do not".

New Zealand schools/also have binding obligations under the New Zealand Disability Strategy and United Nations Convention on the Rights of Persons with Disabilities to include and provide a quality education for all learners.

Students with disabilities face access challenges to typical science activities in laboratories. This may prevent a student from gaining knowledge, demonstrating knowledge, and fully participating in science activities. With careful consideration and design, students can be included safely in many circumstances.

10.1.1 General considerations

- Know your class, understand their medical notes, talk to their dean or person with an equivalent role, and be informed about the issues that are present in each class.
- Talk to a student about special learning needs and accommodation alternatives.
- Provide a laboratory partner.
- Where possible, use plastic instead of glass.
- Allow extra time for set up and completion of laboratory work.
- Provide students with more space to work in.

10.1.2 Blindness

Students who are blind can be assisted by providing:

- verbal descriptions of demonstrations and visual aids
- braille text and raised-line images
- braille or tactile ruler, compass, set square, protractor
- braille equipment labels, notches, staples, fabric paint, and braille at regular increments on tactile ruler, glassware, syringe, beam balance, stove, other science equipment
- different textures (for example, sandpaper) to label areas on items
- noise-generating laboratory warning signals.

10.1.3 Low vision

Students who have low vision can be assisted by:

- verbal descriptions of demonstrations and visual aids
- preferential seating to ensure visual access to demonstrations

- large-print, high-contrast instructions and illustrations
- raised-line drawings or tactile models for illustrations
- large-print laboratory signs and equipment labels
- video camera, computer or TV monitor to enlarge microscope images
- hand-held magnifier, binoculars
- noise generating laboratory warning signals
- large-print calculator
- magnifier app on mobile phone
- colour-coded lids on dropper bottles: for example, red lids = acids, blue lids = bases, yellow lids = toxins, green lids are indicators, etc.

10.1.4 Mobility impairments

Students who have mobility impairments can be assisted by providing:

- wheelchair-accessible field trip sites
- uncluttered laboratory; clear, wide aisles
- preferential seating to avoid physical barriers and ensure visual access to demonstrations
- mirrors above the instructor giving a demonstration
- an enlarged screen
- wheelchair-accessible, adjustable-height work surface
- non-slip mat
- utility and equipment controls within easy reach from a seated position
- electric stirrer, container filler
- support stand, beaker and object clamp; test tube rack
- handles on beakers, objects, and equipment
- surgical gloves to handle wet or slippery items
- modified procedures to use larger weights and volumes
- extended eyepieces so students who use wheelchairs can use microscopes
- flexible connections to electrical, water, and gas lines
- single-action lever controls in place of knobs
- PVC apron as part of personal protective equipment (PPE)
- lower sink for washing hands
- extendable eyewash.

10.1.5 Deaf and hard of hearing

Students who are deaf or hard of hearing can be assisted by providing:

- preferential seating to view demos and watch teacher
- captioning for video presentations
- written instructions prior to practical activities
- visual laboratory warning signals.

10.1.6 Learning and attention disabilities

Students who have learning attention disabilities can be assisted by providing:

- combination of written, verbal, and pictorial instructions with scaffolding
- repeated demonstration of procedure and support practice
- frequent, brief breaks

- preferential seating to avoid distractions and minimise extraneous stimuli
- opportunity to work with another student
- instructions with pictures
- model practicals first for the students.

10.1.7 Health impairments

- Identify students who have allergies.
- For latex allergy – provide alternative forms of gloves, for example, plastic, vinyl, nitrile.
- Peanut/nut allergy – avoid using nuts in food-based practicals; for example, in the food burning practical used to model respiration, burn potato crisps or Burger rings or Twisties, instead of peanuts. Provide gloves for students if in doubt of nut content.
- Check that the students in question have access to medication in case of accidental exposure.
- For students with diabetes – ensure access to medication. Discuss their needs.
- Adopt a flexible schedule and time allocation.
- For students with epilepsy – speak to the student one-on-one and discuss their needs. Ensure any possible triggers like strobe lights/flickering lights, etc., are removed/turned off.

10.1.7.1 For students/ākonga with asthma

- Use a fume cupboard for activities likely to evolve vapour, gases or smoke.
- Grow fungal cultures in Petri dishes (or, if larger samples are envisaged, in plastic bags) to contain the spores that are produced.
- Carry out all dust-raising activities (such as cleaning out animal cages) when it will have the least effect on the room where the student works.
- Advise asthmatics to use their inhalers before they start any studies of the effects of exercise on the body.
- Avoid activities such as exercise that bring children into contact with their sensitisers, such as cold air, smoke, dust, pollen or fungal spores.

10.2 How can students/ ākonga with religious and specific ethnic identity needs be kept safe during practical work?

Ensure headscarves worn in the laboratory are made of natural materials such as cotton.

Ensure headscarves are worn tucked in with no trailing ends.

Ensure long flowing sleeves and clothing are secured with hair ties or rubber bands.

10.3 Universal design

Applications of universal design in science laboratories use proactive steps to create equipment and environments which are accessible to students with a wide range of characteristics, including disabilities.

Links to useful documents/information are below:

Ministry of Education information on inclusive education

TKI: Inclusive Education

Other links will be added to this document as they become available.

11 How do we keep safe when working alone?

Lone working is working in physical isolation, for example, as the only person in a laboratory or no one else in the vicinity – within a short, direct range or earshot. It may be possible to be on the same floor of a building or even in the same general area as others, and yet be working alone. Lone working can occur during normal school hours and in the morning, evening, night, or weekends.

As part of the risk assessment for an activity being undertaken, the teacher or technician will need to take into account whether the activity will involve lone working and determine how best to control the risks. Where a risk is identified, the steps that need to be taken to manage them will involve:

- avoiding lone working where reasonably practicable
- minimising the need for lone working, for example, by reducing its duration and/or frequency
- providing equipment and procedures to control the risks.

Where there is no alternative to lone working, periodic reviews should be undertaken to determine whether it is still necessary and, if so, to re-evaluate the risk assessment.

The consequences of an accident or incident involving a lone worker may be significantly greater than those of two or more people working together when at least one person should be in a position to get help.

Schools should develop a system to identify when lone working occurs and enable efficient and reliable communication between the teacher or technician and others (such as the laboratory manager, the Head of Department (HOD)) and emergency services.

Systems could include scheduled contact by phone call or text (when the solo work starts and when it finishes) so that if a lone worker fails to make contact as expected, the alarm is automatically raised.

12 How do we keep visitors/manuhiri safe during open days or nights?

It is important to consider how visitors will be kept informed and safe when visiting laboratory spaces during open days or nights.

Suppose demonstrations involving hazardous substances or any other activity or demonstration that might pose a risk to visitors and manuhiri are planned. In that case, risk assessments need to be carried out and appropriate steps to manage the risk and ensure everyone's safety.

Things that need to be considered include:

- availability of personal protective equipment (PPE) such as safety goggles/glasses
- wearing appropriate footwear
- safe methods of use
- steps to ensure no food or drink is taken into the laboratory
- safety of young children
- visitors know what to do in the event of an emergency.

Alternatives to 'live' demonstrations involving hazardous substances could include images, posters or digital recordings of students carrying out practical activities.

13 What is a laboratory/taiwhanga?

A laboratory is defined in the Hazardous Substances and New Organisms (HSNO) Act, Part 1, as being a vehicle, room, building, or any other structure set aside and equipped for scientific experiments or research, for teaching science, or the development of chemical or medicinal products. In a kura or wharekura, a taiwhanga pūtaiao may be a multi-functional space, including as defined above. It will, therefore, still be required to follow the requirements of the appropriate regulations.

This definition includes any structure that:

- can meet the design requirements for a laboratory
- is used for teaching
- uses hazardous substances.

The person conducting a business or understanding (PCBU) should define the vehicle, room, building or structure that meets the definition of a laboratory and therefore is subject to the Regulations on management, storage, security and other controls.

Part 18 of the Regulations, Laboratories, applies to a laboratory if the laboratory uses hazardous substances in research and development, analytical testing, or teaching: and none of the substances, or any substance created from their use, is sold by the laboratory, except under certain circumstances.

In schools, hazardous substances may be used in art or technology rooms, horticulture classes, farm pens, or wherever teaching uses small quantities of hazardous substances; they would not be considered laboratories and are not covered under Part 18 of the Regulations. If the quantity of hazardous substances being used outside of a laboratory is not small, or if the hazardous substances are being stored, then Part 18 of the Regulations may apply.

Note: Part 18 of the Regulations does not apply to dedicated storage areas used to store and use hazardous substances, fuels or agricultural chemicals for grounds maintenance or a school's operational purposes.

13.1 General design requirements

Where a school has a laboratory that meets the criteria set down in regulation 18.2 for a laboratory they are subject to specific design requirements.

The laboratory must be designed to ensure that the people working inside it, the environment, and people outside the laboratory are protected from any hazardous substances contained within the laboratory.

See Appendix 2 for a list of standards relating to the design of laboratories.

The key requirements are that:

- all parts of the laboratory that may come into contact with hazardous substances either during normal use of the substances or as the result of a spillage must either:

- be incapable of absorbing or retaining the substances; or
- be covered by disposable material that is capable of absorbing or retaining the substances.

- the laboratory must be designed and operated so that the hazardous substances cannot escape and enter the environment.
- the laboratory design complies with any relevant requirements, including construction (workrooms), separation, fire-resistance rating, segregation, ventilation, and access set out in Parts 9 to 13 of the Regulations.

Relevant parts of the Regulations
This Section should be read in conjunction with: • regulation 18.2 • regulation 18.3 • regulation 18.4 • regulation18.5 • Parts 9 to 13 of the Regulations. Certain general design requirements for laboratories are set out in: • regulation 18.3 • regulation 18.4 • regulation 18.5 Parts 9 to 13 of the Regulations specify controls on the handling, use and storage of hazardous substances according to their hazard classifications. These controls may affect the design of a laboratory using hazardous substances.

14 What signage is required in and around laboratories/taiwhanga?

All entrances to the laboratory (which may be a building or an individual room) must be clearly marked with the following (or similar) sign:

RESTRICTED ENTRY
Authorised Personnel Only

HE URUNGA WHAI HERE
Tāngata Whaimana Anake

14.1 What to put on the sign

The sign should be bilingual where at all possible:

- be in English and te reo Māori or pictograms
- be readily understandable
- not use abbreviations and acronyms unless they are in common English or Te Reo Māori usage and the term described by the abbreviation or acronym is used at least once on the signage
- be clearly visible and legible at a distance of not less than 10 m under varying conditions (for example, rain or poor light)
- be made of materials that are durable, resistant to sunlight and require minimal maintenance.

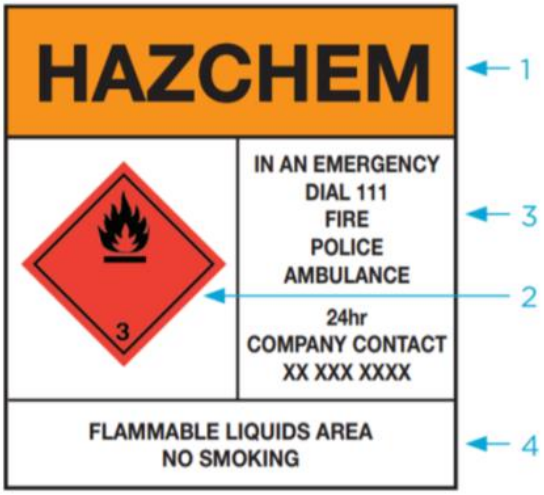
14.2 Other signage

- Should be bilingual in te reo Māori and English where practicable.
- Signs are required when you have hazardous substances over certain limits.
- Use the Hazardous Substances Calculator to help you work out whether you are required to have signs in place.
- Even if you aren't required to have signs, it is best practice always to have them, as they warn visitors and emergency services that hazardous substances are present.
- Emergency services, when they respond, rely on signs to decide on the course of action they will take and the protective equipment they will wear.
- Although sign content can vary depending on the substances present, the quantity, and the storage location, the sign below is an example of the key information you may see on a sign:

1. HAZCHEM.
2. The hazardous property (i.e. the class) of the substance and the type of hazard (i.e. the subclass) of each substance are present using pictograms and/or hazard statements.

If you have multiple hazardous substance classifications present at your workplace in amounts over the threshold for signage, you need to show multiple hazards on your sign.

For more on classifications, see Section 17.2. To see examples of the pictograms for different substances, see Appendix 13.



3. Emergency actions such as "Call Emergency Services – Dial 111", or for ecotoxic substances, "In an emergency, protect waterways".
4. For flammable or oxidising substances, precautions such as "**keep away**" or "**no smoking**" to prevent unintended ignition, combustion, or thermal decomposition.

14.3 Where to put signs in a school/kura

- Signs need to be placed close to where the hazardous substances are stored, but not too close because people need to know that the danger is there before it's too late.
- Don't put signs:
    - where they may be hidden
    - beside doors or gates that cover the sign when the doors or gates are opened
    - above doors, or where smoke may conceal the sign.
- The location of your signs will depend on which hazardous substances you have and where you store them.
- You must ensure that:
    - when hazardous substances are stored inside a building, signs must be placed at all vehicular and pedestrian entrances to the building
    - if hazardous substances are stored in a particular room or compartment within a building, signs must be placed at each entrance to the room or compartment
    - a sign is placed at the entrance to the land where the building is located
    - if the hazardous substances are located outdoors, a sign must be positioned immediately next to that area.
- To be sure that your signs are correctly placed, take a look outside the building and inside near where hazardous substances are stored (around storage cabinets or dangerous goods stores) and ask 'How will emergency services know about the hazards they will face?'

A person conducting business or understanding (PCBU) should define their laboratory footprint and site boundaries to ensure signage is in appropriate locations, including all entrances to the laboratory.

Note: For information on what the signage must state. See regulation 2.6.

14.3 Where to get a sign

Safety equipment suppliers can provide you with the right signs. Check the internet for safety equipment suppliers in your area.

Further information: WorkSafe Quick Guide – Hazardous substances signage. (PDF)

Relevant parts of the Regulations
This Section should be read in conjunction with regulation 18.5(1).

15 Who can enter the laboratory/taiwhanga?

The following conditions apply to all laboratories:

- Entry must be restricted to authorised people (that is, a person who has been inducted into the laboratory and has permission to enter) and clearly marked by signage.
- The laboratory must be locked when not under the supervision of the laboratory manager or the person nominated to be in charge (delegate) by the laboratory manager.

The laboratory manager or their delegate needs to be present on-site and take control of the laboratory when any hazardous substance activities are being undertaken. The laboratory manager or their delegate should approve the activities and the individuals concerned.

Activities with hazardous substances should be restricted to normal work hours in order to comply with the requirement to have a laboratory manager or delegate present to inspect and approve individuals and activities.

The person conducting a business or undertaking (PCBU) should establish controls to protect cleaning and maintenance personnel from harm associated with the hazardous substances.

PCBUs should develop a competency framework for authorised persons to access a laboratory without the direct supervision of a laboratory manager or their delegate. This competency framework needs to be commensurate with the activities they will be undertaking, and the skills required (for example, cleaners, trainee teachers, contractors).

Non-laboratory workers (such as cleaners, maintenance workers) may enter the laboratory without supervision provided:

- they are given written approval and instructions on their permissible actions within the laboratory. For example, the written instructions to cleaners would clearly state the cleaning duties required and the times they may access the laboratory, and forbid entry to specified areas within the laboratory
- all such persons are made aware of the hazards associated with the hazardous substances that are in the area where they are to perform their functions
- they have been instructed in and understand the emergency procedures to follow.

Relevant parts of the Regulations
This Section should be read in conjunction with regulation 18.5.

16 What knowledge is required for persons handling hazardous substances?

While persons handling hazardous substances in a laboratory (including students) do not need to be certified handlers, they must be provided with training and knowledge appropriate to the activities they will be undertaking and to the laboratory itself.

The person conducting a business or undertaking (PCBU) must ensure that every person handling a hazardous substance in the laboratory is provided with the following information before handling the substance:

- procedures to prevent the contamination of any equipment, clothing, or part of the laboratory
- if the substance is approved, procedures to ensure people in the laboratory are not exposed to more than any prescribed exposure standard (if any) for that substance
- the laboratory's method of management of the substance as required under regulation 18.10(1) and (3) of the Regulations, if it is not approved
- the disposal requirements for the substance in accordance with the Hazardous Substances (Disposal) Notice 2017.
- the actions required under the laboratory's emergency response plan (ERP) in the event of an accident or accidental exposure to the substance.

This information may be included in relevant safe operating procedures (SOPs) and safe methods of use (SMUs).

An induction should include, at a minimum:

- laboratory manager and laboratory users responsibilities
- laboratory practices for labelling of containers
- how to read and use safety data sheets (SDSs) and their location
- types of hazardous substances and their risks
- precautions for the hazardous substances handled or used in the laboratory
- SOPs/SMUs
- storage locations, uses and requirements for segregation and control
- use, storage and maintenance of personal protective equipment (PPE)
- familiarisation with the ERP
- emergency response equipment and procedures
- disposal requirements, equipment and procedures.

Training and induction should include the requirement to notify the laboratory manager prior to introducing any new procedure, process, equipment or hazardous substance to the laboratory.

A laboratory user may cease, or refuse to carry out, a procedure if the user believes that carrying out the procedure would expose the user, or any other person, to a serious risk to the user's or other person's health or safety arising from an immediate or imminent exposure to a hazard.

Relevant parts of the Regulations
This Section should be read in conjunction with regulation 18.14.

17 What is a hazardous substance?

It is important to realise and accept that we are constantly in contact with hazardous substances in our daily lives. Our bodies, the food we eat, and the air we breathe are all composed of 'chemicals'. In addition, there is no such thing as a totally safe hazardous substance. Ensuring the safe use/handling of a hazardous substance is the responsibility of the person conducting a business or undertaking (PCBU).

People tend to continue to use substances and procedures that either they or others have used over a period of time, sometimes using hazardous substances for which a less hazardous substance could be substituted without adversely affecting the process or its results.

Particularly in teaching situations, every effort should be made to reduce the risks to staff and students; substitute with health and safety in mind.

Some risks from hazardous substances are obvious. For example, highly flammable substances like petrol, acetone or methylated spirits must be kept away from open flames or a source of ignition to prevent a fire or an explosion. Serious accidents involving these hazardous substances do happen, but it is important to also be aware of the less obvious harm caused by exposure to hazardous substances.

A hazardous substance is defined under the Hazardous Substances and New Organisms (HSNO) Act 1996 as being a substance with one or more of the following intrinsic properties:

- explosiveness
- flammability
- capacity to oxidise
- corrosiveness
- toxicity
- ecotoxicity.

It could also be a substance that, on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased), generates a substance with any one or more of the properties specified in the definition above.

In the Regulations, "a hazardous substance" has the same meaning as in the HSNO Act; however, it does not include ecotoxicity.

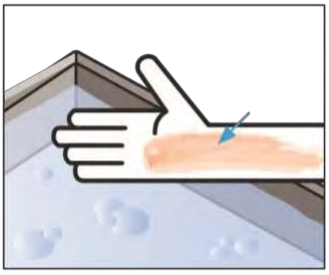
The Hazardous Substances (Hazard Classification) Notice 2020 defines what constitutes a hazardous substance for each hazardous property. There is a level below which a substance is not considered hazardous under this legislation. While that substance is not considered a hazardous substance as defined by legislation it could still be a substance hazardous to health.

17.1 How does a hazardous substance enter the body?

A hazardous substance can enter the body through different routes.

- These different routes of exposure and the types of exposure (acute or chronic) can affect the toxicity of the hazardous substance.
- The most probable (primary) route(s) of exposure to a chemical will be identified in the safety data sheet (SDS).
- Three principal routes of exposure include dermal (skin), inhalation, and ingestion (oral).

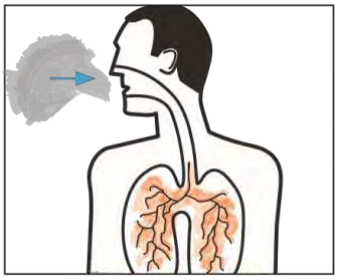
17.1.1 Dermal



Although the skin is an effective barrier for many chemicals, it is a common route of exposure. The toxicity of a chemical depends on the degree of absorption that occurs once it penetrates the skin. Once the skin is penetrated, the chemical enters the blood stream and is carried to all parts of the body. Chemicals are absorbed much more readily through injured, chapped, or cracked skin, or through needle sticks than through intact skin. Generally, organic chemicals are much more likely to penetrate the skin than inorganic chemicals.

Dermal exposure to various substances can also cause irritation and damage to the skin and eyes. Depending on the substance and length of exposure, effects of dermal exposures can range from mild temporary discomfort to permanent damage.

17.1.2 Inhalation



Inhalation is another route of chemical exposure. Chemicals in the form of gases, vapours, mists, fumes, and dusts entering through the nose or mouth can be absorbed through the mucous membranes of the nose, trachea, bronchi, and lungs. Unlike the skin, lung tissue is not a very protective barrier against the access of chemicals into the body. Chemicals, especially organic chemicals, enter the blood stream quickly. Chemicals can also damage the internal lung surface.

17.1.3 Ingestion

Ingestion involves chemicals entering the body through the mouth. Chemical dusts, particles and mists may be inhaled through the mouth and swallowed.

They may also enter through contaminated objects, such as hands or food that come into contact with the mouth. Absorption of the chemicals into the bloodstream can occur anywhere along the length of the gastrointestinal (GI) tract.

17.2 How are hazardous substances classified?

The classification of hazardous substances should be listed in the Hazards Identification section of the Safety Data Sheet (SDS), usually Section 2. Section 15 of the SDS may also have information specific to Hazardous Substances and New Organisms (HSNO).

New Zealand has adopted the seventh revised edition of the Globally Harmonised System (GHS 7) as its official hazard classification system. It took effect from 30 April 2021.

However, as suppliers have until 2025 to update labelling, safety data sheets and packaging for hazardous substances approved before 30 April 2021, many products may be classified according to the HSNO hazard classification system.

A correlation table for HSNO and GHS classifications is available at the Environmental Protection Authority website.

17.2.1 Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

The GHS 7 is an international hazard classification system for chemicals created by the United Nations. The classifications are communicated on labels and safety data sheets including the safe way to store, use and dispose of chemicals.

See Appendix 13B for further guidance on GHS labelling.

17.2.2 Hazardous Substances and New Organisms (HSNO) classification system

The HSNO classification system was used in New Zealand from 2001 to 2020 to classify hazardous substances. However, importers, manufacturers and suppliers have until 2025 to update the classification information on labels, safety data sheets and packaging.

See Appendix 13A for further guidance on HSNO labelling.

17.2.3 Important points to consider

- Most hazardous substances will have more than one hazardous property. For example, hydrochloric acid:
    - Acute toxicity: inhalation (category 2) (6.1B)
    - Acute toxicity: oral (category 4) (6.1D)
    - Acute toxicity: skin (category 4) (6.1D)
    - Corrosive to metals: (category 1) (8.1A)
    - Skin corrosion: (category 1B) (8.2B)
    - Serious eye damage (category 1) (8.3A)
- Occasionally, two of the properties may be incompatible. For example, nitric acid has a corrosive to metals (category 1) classification (8.1A), which might suggest storing it in with the other corrosives; however, it also has an oxidising liquid (category 3) classification (5.1.1C), which is incompatible with corrosives. Its corrosives classification also makes it incompatible with other oxidisers, and thus nitric acid should be stored by itself, ideally in another corrosives cabinet away from other oxidisers and organic materials like wood and so on.
- See Appendix 10 for incompatible substances and materials and section 20.4.1 for hazardous substances segregation.
- See Appendix 3 for examples of the classification for different aqueous solutions of corrosives.

The Environmental Protection Authority (EPA) provides useful databases on their website with guidance for the control of hazardous substances.

- Chemical Classification and Information Database (CCID)
- Approved hazardous substances with controls

17.3 Which hazardous substances can be used in schools/kura?

17.3.1 Prohibited substances

Specific substances are prohibited for use in schools due to the nature of their properties; see Appendix 4 for the list of these substances.

17.3.2 Substances with greater hazardous nature than educational utility

Substances used in the laboratory are hazardous because of the following:

- safety risks (that is, highly flammable or explosive material)
- capacity to oxidise
- acute and chronic health hazards
- corrosivity
- environmental harm
- impairment of indoor air quality.

Assessment of the prohibited substances list indicates that their hazardous nature is greater than their potential usefulness in school programmes. The evaluation included physical hazards (that is, flammability, explosivity, combustible, self-reactive, oxidising) and health hazards (toxicity, carcinogenicity, corrosivity to skin, eye).

Appendix 5 lists substances with greater hazardous nature than the educational utility.

17.3.3 Substances with a hazardous nature but with potential educational utility

Substances that may have educational utility but have a hazardous nature should be removed from the school if alternatives can be used.

For those that must be retained, amounts should be kept to a minimum. These are appropriate for advanced-level secondary school classes only.

Appendix 6 lists substances that have a hazardous nature, but have potential educational utility.

Note: A current copy of the SDS for any hazardous substance being considered for use in school should be referred to regularly, as updated information may be provided that might affect decisions about whether the substance is safe for use in schools.

Relevant parts of the Regulations
This Section should be read in conjunction with regulation 4 and regulation 18.

18 What should be considered when purchasing hazardous substances?

Schools and Kura should work with suppliers and manufacturers, applying good procurement management and monitoring practices to ensure that they meet the regulatory requirements. An approved hazardous substance must comply with the controls assigned by Parts 2 to 13 and 19 of the Regulations to that substance until it enters the laboratory.

18.1 General considerations

- Establish a procurement plan for hazardous substances.
- Consider using a centralised purchasing programme in which one person, knowledgeable about all the substances on hand, does all the purchasing or links purchasing requests into an inventory tracking system so that excess substances in stock can be used before buying more.
- Train reception staff in the proper methods of receiving and handling of hazardous substances.

18.2 Before ordering hazardous substances

- Check that the substance is allowable for use in schools. See Appendices 4, 5 and 6 for lists of substances that are not permitted or could be substituted.
- Assess all the physical, health and environmental hazards of the substance using the safety data sheet (SDS) and label; evaluate both short- and long-term risks.
- Consider the worst-case scenario(s) in the event that the substance is mismanaged, spilled, or causes personal injury.
- Make sure the hazardous properties of the substance do not exceed the educational utility of the experiment (refer to Appendix 5 Substances with greater hazardous nature than educational utility).
- Determine whether a safer, less hazardous substance or a lesser amount/concentration can be used to conduct an experiment (refer to Appendix 7 Strategies to Reduce the Amount and/or Toxicity of Hazardous Substance Waste Generated in the Laboratory).
- Determine whether the appropriate facilities are available for the proper storage of the substance and the ventilation is sufficient.
- Determine whether the proper personal protective equipment (PPE) and safety equipment is on hand for using the substance.
- Consider the appropriate disposal of the substance or its end product.
- Ensure that the budget will allow for the appropriate disposal of the substance and/or its end product.
- Have a mechanism in place to appropriately dispose of the substance and/or its end product.

18.3 When ordering hazardous substances

- Order minimum quantities that are consistent with the rate of use.
- Order the minimum amount that is reasonably practicable considering projected use.

- If possible, order reagents in polyethylene bottles or plastic-coated glass bottles to minimise breakage, corrosion, and rust.

18.4 What is required to transport hazardous substances?

Persons transporting dangerous goods on land must comply with the requirements of Land Transport Rule: Dangerous Goods 2005: Rule 45001/1 and Health and Safety at Work (Hazardous Substances) Regulations 2017.

These include requirements for packing, marking and labelling the substance as well as requirements for the driver of a vehicle carrying dangerous goods, who may need a dangerous goods (D) endorsement on their driver's licence.

Further information on the transport of dangerous goods can be found in Factsheet 68 on the NZ Transport Agency website.

Relevant parts of the Regulations
This Section should be read in conjunction with Parts 2 to 13 of the Regulations

19 What is a safety data sheet (SDS)?

A safety data sheet (SDS) (previously known as a material safety data sheet, MSDS) provides important information about our hazardous substances.

It is mandatory to have a current SDS for each of the hazardous substances in your school regardless of the quantity you hold.

An SDS provides comprehensive information about the properties of a hazardous substance, how it affects health and safety in the workplace, and how to manage these risks. An SDS explains how the substance should be safely used, stored, transported and disposed of. It provides first-aid information, information about the personal protective equipment (PPE) that the person handling the substance should wear, and what to do in the event of an emergency, such as a spill or fire.

19.1 Obtaining SDSs

- The supplier of hazardous substances to a workplace must provide a compliant SDS with their products.
- There is also a duty on the Person Conducting a Business or Undertaking PCBU that is being supplied with a hazardous substance to obtain a current SDS:
    - when the hazardous substance is first supplied; this includes if it is the first time it has been supplied to the workplace in five years
    - when the hazardous substance is first supplied after the SDS has been amended.

19.2 Using SDSs

- A current SDS for each hazardous substance (or a condensed version of the key information from the safety data sheet, for example, a product safety card) must be kept with your inventory (see Section 21 for details about keeping an inventory).
- SDSs must be read, the hazards posed by the substance understood, and the appropriate requirements put in place to manage the substances.
- The full SDS, or the condensed version, must be readily accessible[2] to people who may handle, or be exposed to, the hazardous substance, such as workers, emergency services personnel and anyone else likely to be exposed.
- Workers also need to be trained in and made aware of the dangers associated with a new hazardous substance, or with an existing substance when the SDS changes.
- Use the SDSs to carry out risk assessments.

Contact the HS compliance team at EPA if you find an SDS, labelling or packaging that is not compliant with a relevant EPA notice.

[2] Readily accessible means that the document is capable of being accessed without difficulty in hard copy, electronic, or other form.

19.2.1 Further information

For more information see:

- Appendix 8 – Understanding SDS headings
- WorkSafe's Quick Guide – Safety data sheets in the workplace (PDF)
- other information and guidance on the WorkSafe page on Safety Data Sheets

20 How should hazardous substances be stored?

20.1 General storage requirements within the laboratory/taiwhanga

Provision must be made for the storage of hazardous substances within the laboratory/taiwhanga. In particular:

- Quantities of hazardous substances in the laboratory must be kept to a minimum and be appropriate for needs and shelf life.
- Quantities stored must not exceed the total quantities listed in Appendix 9.
- The quantity of hazardous substances stored on bench tops or shelves should be kept to a minimum. Storage cabinets should be used where practical, and hazardous substances not in regular use should be stored in them.
- All hazardous substances must be stored on surfaces which are:
    - impervious (such as having several coats of good quality acrylic (non-latex) paint, plastic coating or other impervious coating) or
    - covered by a disposable material that is capable of absorbing or retaining the substance.
- Shelves should have a lip or other means (such as thin plastic sheet turned up 12–20 mm at the edges of the shelf) to reduce the likelihood of containers 'marching' off shelves. Trays used for secondary containment may also serve this purpose, but may need some additional securing.
- Shelving and cabinets should be secured to the wall or floor to prevent toppling during an earthquake.
- Ventilate storage areas adequately.

20.2 Storage don'ts

- Do not place heavy materials, liquid hazardous substances, and large containers on high shelves.
- Do not store substances on top of cabinets.
- Do not store substances on the floor, even temporarily.
- Do not store items on bench tops and in laboratory fume cupboards.
- Do not store substances on shelves above eye level.
- Do not store substances in personal staff refrigerators, even temporarily.
- Do not expose stored substances to direct heat or sunlight or highly variable temperatures.

20.3 Secondary containment

Containers of liquids need to be stored as near to ground level as practicable. Secondary containment should be provided:

- use plastic trays underneath corrosive substances
- use metal trays under organic solvents
- trays should be capable of containing at least 25% of the largest container
- secondary containment is required at specific thresholds for certain classifications of substances if the substance is a pooling substance (that is, hazardous liquids and substances that may liquefy in a fire) ensuring that they will be contained if they escape from the container and can, subject to unavoidable wastage, be recovered.

For further information see the WorkSafe website.

20.4 Organisation

- Organise hazardous substances first by COMPATIBILITY – not alphabetical succession.
- Store alphabetically within compatible groups.

20.4.1 Hazardous substances segregation

Not all hazardous substances can be stored together safely. Different types of substances can cause a fire or explosion if they come into contact with each other. These substances are described as 'incompatible', and it is important that they are stored separately to prevent the substances from mixing if a leak or spill were to occur. The SDS for a hazardous substance will tell you which substances and materials should be kept segregated.

- Store acids in a dedicated acid cabinet. Nitric acid should be stored alone unless the cabinet provides a separate compartment for nitric acid storage.
- Store highly toxic substances in a dedicated, appropriate lockable cabinet that has been labelled with a highly visible sign.
- Store volatile and odoriferous substances in a ventilated cabinet.
- Store flammable liquids in an approved flammable liquid storage cabinet.
- Store water-sensitive substances in a watertight cabinet in a cool and dry location, segregated from all other substances in the laboratory.

Take note of extra requirements:

- Oxidisers or organic peroxides must be stored separately in the laboratory with particular care taken to ensure segregation from incompatible substances and materials and, in some cases, provision of temperature control.
- In addition to meeting these regulatory requirements, PCBUs should refer to the substance's SDS for further information on incompatibilities and safe storage requirements.
- Relevant SOPs/SMUs should include details of incompatibilities.

Refer to Appendix 10 for a list of hazard classes that are incompatible under the regulations.

20.4.2 Temperature control

Substances unstable at room temperature may require controlled temperatures or other specific storage requirements. The regulations have specific requirements for some classifications of substances requiring temperature control.

For information on temperature requirements for oxidising substances (classes 5.1.1 and 5.1.2 see regulation 12.5.

For information on temperature requirements for flammable solids (class 4.1.1 substances) see regulation 10.22.

20.4.3 Storage of hazardous substances in refrigerators

- The storage of flammable liquids in refrigerators is not specifically addressed in the Regulations but doing so safely would be a part of the general PCBU duty of care.
- Any fridge or freezer in a hazardous area must meet the requirements of the Electricity (Safety) Regulations 2010 (see regulation 10.7).
- PCBUs should ensure that any fridge or freezer used does not have any potential ignition sources within the interior, such as lights and automatic defrost mechanisms.
- Fridges or other storage cabinets should be clearly marked and labelled with hazardous property of contents and not stored near incompatible substances, biological samples, food/growth media, etc.
- Any storage unit, including fridges, should have adequate spill containment or secondary containment as appropriate to the risk of the largest single container (for example, drip trays).
- Refrigerators should be kept in well-ventilated spaces so that there is no build-up of flammable liquid vapours in their vicinity due to the presence of flammable liquids or gases.
- Solvent containers should be securely capped with appropriate lids, or beakers containing such solvents should be properly covered. Do not cover with aluminium foil or plastic sheet cover. On exceeding the lower flammability limit and due to excessive pressure build-up, the door latch can fail leading to dangerous explosion on exposure to any ignition source outside.
- Hazardous substances stored inside the refrigerator should be compatible. Spillages, if any, should be attended to immediately. Clean up spills in accordance with any requirements in SDS. Strong solvents can result in damage to the plastic parts of the interior compartment.
- Laboratory refrigerators require more frequent cleaning and defrosting than domestic refrigerators. Take adequate precautions and wear disposable gloves and any other PPE necessary to manage risk during clean-up operations.
- Power failures can result in the formation of dangerous levels of flammable or toxic vapours inside the closed space. Care should be exercised when opening the door after power failures.

20.5 Dedicated storage areas

PCBUs, laboratory managers and laboratory workers need to be aware of the requirements for dedicated storage areas that are used for the storage of hazardous substances in closed containers. These dedicated storage areas, which are not laboratories, are subject to the requirements of Parts 2 to 19 of the Regulations (excluding Part 18).

20.6 Hazardous substance location

The controls required in a hazardous substance location can vary depending on a number of factors; the classification of the substance, the quantity, whether a substance is in storage or use, whether substances are in containers that are open or closed, etc. If a school stores substances in a dedicated storage area and determines the area is a

hazardous substance location it may require certification, see WorkSafe's website for information on hazardous substance locations.

The threshold quantities of substances that determine whether a laboratory/taiwhanga or dedicated storage area is a hazardous substance location are listed in Appendix 11.

Further information

- AS/NZS 2243.10:2004 Safety in laboratories – Storage of chemicals specifies procedures and guidance for the segregation and storage of chemicals in laboratories and stores associated with laboratories.
- AS/NZ 2982:2010 Laboratory design and construction provides guidance for the design and construction of laboratories.
- Flinn Scientific provides guidance on a suggested Shelf Storage Pattern.

Relevant parts of the Regulations
This Section should be read in conjunction with: • Part 18 • Schedule 15 • Part 10 • Schedule 9 • Part 12 • Schedule 10 • Schedule 11 • Part 13 • Schedule 16

21 Where does an inventory need to be kept?

An inventory of all hazardous substances on-site (including those in the laboratories and in any dedicated storage areas) must be established to meet the requirements of the emergency response plans. The inventory must meet the requirements of regulation 3.1.

A form of this inventory must be readily accessible to emergency service workers in the event of an emergency, together with the safety data sheet (SDS) for each hazardous substance on-site.

21.1 What must be in the inventory?

For each hazardous substance used, handled, manufactured or stored in the laboratory or designated storage areas, an inventory must include:

- the product or chemical name and United Nations (UN) number (if available). If there is a UN number, it will be in section 14 of the SDS
- the maximum amount likely to be at the workplace
- its location
- any specific storage and segregation requirements. See the following sections of the SDS for this information:
    - section 7: Handling and Storage
    - section 10: Stability and Reactivity. This section also has information on any incompatible materials or substances.
- an SDS or a condensed version of the key information from the SDS
- any hazardous waste

In relation to hazardous waste, the inventory must include:

- an identifier that describes the nature of the waste as closely as possible
- the maximum quantity
- the location
- any specific storage or segregation requirements.

It is recommended that:

- a unique identifier, such as the Chemical Abstracts Service Number (CAS), is recorded for laboratory substances
- the hazard classification of the substance is recorded, if known

An example inventory is attached as Appendix 12.

Also, see the WorkSafe guidance Working Safely with Hazardous Substances, which gives information and an inventory template you can use to create a hazardous substances inventory, or use the Hazardous Substances Calculator.

For information on hazardous substances inventories see the WorkSafe Quick Guide on inventory requirements for hazardous substances. (PDF)

Relevant parts of the Regulations
This Section should be read in conjunction with: • regulation 18.6 • regulation 5.7(3)(d)(i) • regulation 3.1.

22 How can flammable substances be managed safely?

Flammable substances release vapour or gas, which can cause an explosion or fire if accidentally ignited. When using or storing flammable gases or liquids, adequate ventilation is required to prevent flammable gases or vapours build-up.

22.1 Using flammable liquids

- The opening and decanting of all flammable liquids should be carried out in a suitable fume cupboard
- If the fume cupboard is not available, the teacher must ensure that all flammable liquids are only opened and poured:
    - in a well-ventilated location where flammable vapours do not accumulate
    - where potential ignition sources are controlled.
- Containers should be opened for as short a time as possible and never near any source of ignition.
- In any one place, the duration of any container of flammable liquid being open must not exceed 10 minutes, and the volume should not exceed 1500 mL decanted volume of any flammable liquid of category 1, 2 or 3 (class 3.1A to 3.1C).

See Section 20 for further guidance around storage of flammable substances.

Relevant parts of the Regulations
This Section should be read in conjunction with parts 10 to 13 of the Regulations.

23 How do you manage hazardous areas?

A person conducting a business or undertaking (PCBU) has responsibility for establishing and appropriately managing hazardous areas where class 2 or 3 substances are being used (other than flammable liquids: category 4 (3.1D)) in accordance with AS/NZ 60079.10.1:2009, and the extent of the hazardous area must be reflected in the site plan. There are no quantity thresholds for this requirement in the Regulations.

23.1 What is a hazardous area?

A hazardous area is an area in which an explosive gas atmosphere is or maybe expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical equipment. Hazardous areas are classified into zones based on the frequency of the occurrence and duration of an explosive gas atmosphere.

Zone 0 - an area in which an explosive gas atmosphere is present continuously, or for long periods, or frequently.

Zone 1 - an area in which an explosive gas atmosphere is likely to occur in normal operation occasionally.

Zone 2 - an area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, it will exist for a short period only.

23.1.1 Hazardous areas in laboratories

AS/NZS 60079.10.1 (Annex ZA 7.3.2.3) provides the following example of a hazardous area in laboratories:

A Zone 2 hazardous area exists covering the entire floor level of the laboratory including the area underneath the benches up to 30 cm above floor level.

23.1.2 Hazardous areas around fume cupboards

Fume cupboards should be designed so that safe containment of flammable gases and vapours is achieved, AS/NZS 2243.8 Safety in Laboratories, Part 8: Fume cupboards provides guidance.

AS/NZS 60079.10.1 (Annexes ZA 7.3.2.1 and ZA 7.3.2.2) provides the following examples of hazardous areas around fume cupboards:

- If a fume cupboard complies with the requirements of AS/NZS 2243.8, a Zone 2 hazardous area exists from floor level to 30 cm above floor level and around the exhaust duct. The interior of the cupboard is a non-hazardous area.
- For fume cupboards that do not comply with AS/NZS 2243.8, the following classifications apply:

Zone 1 – the interior of the fume cupboard, including any exhaust duct.

Zone 2 – the entire area outside the cupboard within 0.6 m in all directions from the opening and extending down to floor level including the area directly below the cupboard

but excluding the area vertically upward from the top of the opening into the fume cupboard.

Zone 2 – the space within 1.5 m in all directions from the top of the exhaust duct outlet.

23.1.3 Managing hazardous areas

Hazardous areas must be managed to prevent the risk of fire or explosion.

Ignition sources are not permitted in any hazardous area.

The Electricity (Safety) Regulations 2010 require:

- any electrical device or instrument installed in a hazardous area to be correctly rated for the zone
- a verification dossier to be kept for the electrical equipment. The dossier must include periodic re-inspection reports from the four-yearly inspections by a licensed electrical inspector
- any electrical fittings to comply with relevant Electricity (Safety) Regulations 2010.

For more information about the requirements of the Electricity (Safety) Regulations 2010, see the Energy Safety page on the WorkSafe website.

Relevant parts of the Regulations
This Section should be read in conjunction with regulation 10.6.

24 What are the requirements for fume cupboards?

- Fume cupboards should:
  - be designed, constructed, maintained and tested to AS/NZS 2243.8
  - have a means to indicate they are operating (such as a 'tell-tale').
- It is strongly recommended that fume cupboards intended to extract airborne contaminants from hazardous substances while unattended should have a monitored alarm that is activated if the airflow stops or drops by more than 20%.
- Ductless fume cupboards should be avoided wherever possible.
- Local ventilation systems should be professionally designed to recognised standards and regularly tested to ensure effectiveness.
- Fume cupboards and local ventilation systems intended for use with a limited range of hazardous substances should be clearly marked as to their limitations.
- All discharges to air or sewer must be considered under the Resource Management Act 1991 and assessed with consideration for the limits of the applicable consents
- Fume cupboards should be operated long enough, after the hazardous substances have been removed from the cupboard, to flush the hazardous substances substantially from the exhaust ducting.
- Fume cupboards should NOT be used to store closed containers of hazardous substances. However, small bottles of toxic gases or any compound specifically named in a standard operating procedure (SOP) or safe method of use (SMU) for substances or procedures of higher risk may be stored in a fume cupboard.

See Section 23.1.2 of this guide for guidance on hazardous areas around fume cupboards.

25 What labels are needed on hazardous substances?

Labels are a source of information that warn workers and others (such as teachers, technicians and students) about the risks of the hazardous substances in the laboratory/taiwhanga and designated storage areas.

There are different requirements for labels on containers depending on the circumstances.

- Manufacturers and suppliers must sell you products that are correctly labelled.
- You must make sure that the label:
    - stays on the container
    - continues to be readable.
- If a hazardous substance held in a designated storage area is decanted from one container into another and the container is 40 L or less and the substance will not be supplied to a person outside the workplace, the receiving container must also be labelled. The label must include the product name or chemical name and a hazard pictogram and statement. This does not apply if the substance is used so soon after being put in the container that it is impracticable to do so, and the container is thoroughly cleaned immediately after use, so no residue remains.
- If the label on a container in a designated storage area becomes illegible, it must be relabelled.
- It is never safe to have hazardous substances in unlabeled containers because people may become confused about what hazardous substance they are using and not take the necessary safety precautions.
- Never put hazardous substances in food or drink containers because people may eat or drink them by mistake.
- Technicians, teachers and students must always read the label before using a hazardous substance, so they know what they are dealing with.

25.1 Symbols on labels

Whether a substance is imported, or supplied or manufactured in New Zealand, it will use the Globally Harmonised System (GHS) for labelling. This system uses symbols (pictograms) to immediately warn people about the hazards of the substance.

Learn what these symbols mean so that you can immediately recognise the hazards of the substances you use.

The symbols to look out for are shown in Appendix 13.

Overleaf is an example of a GHS label for mineral turpentine.

The label must contain the following information (but is not limited to):

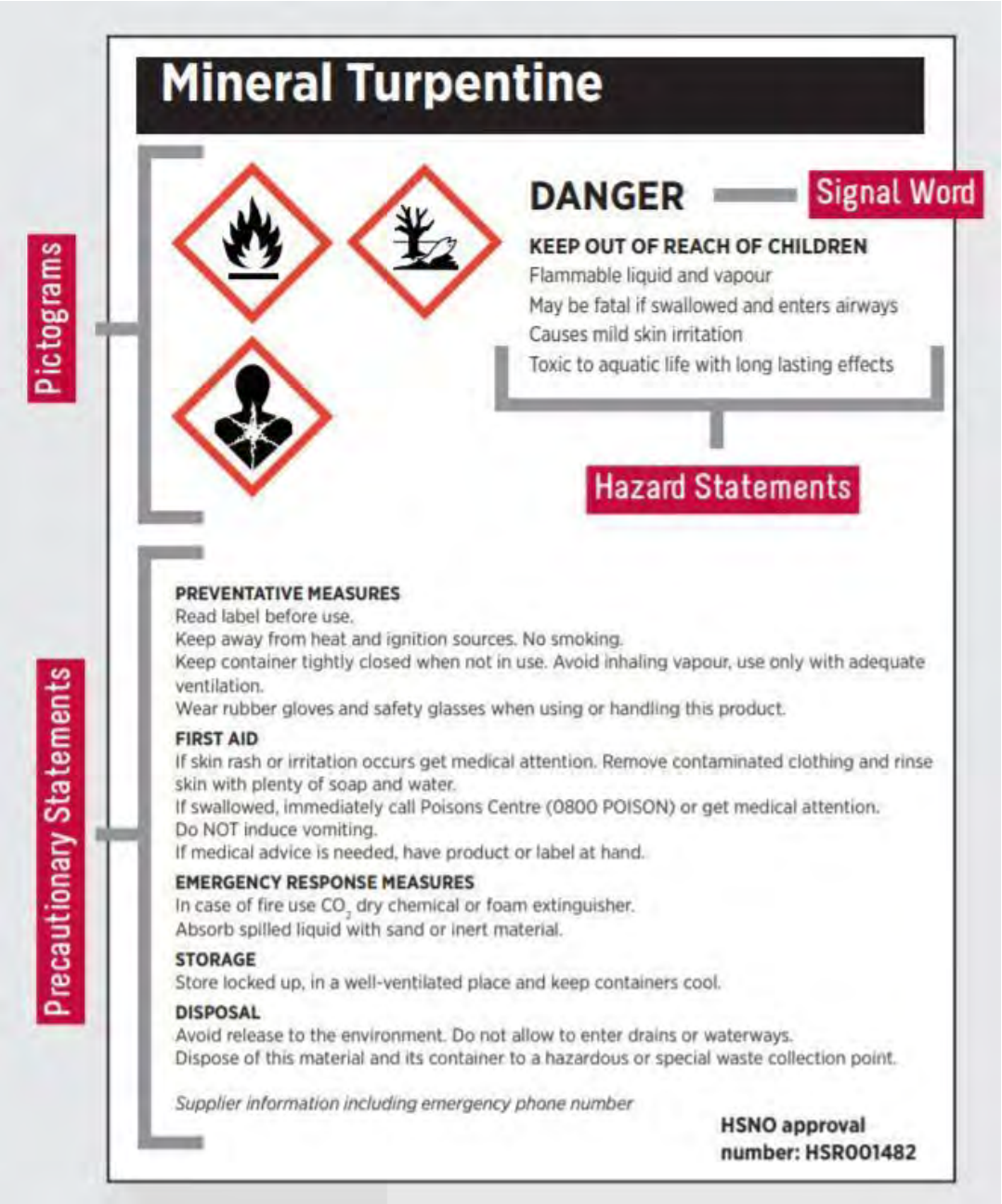
- product identifier (as it appears on the safety data sheet (SDS)
- contact and emergency contact details
- relevant pictograms, signal words, hazard statements and precautionary statements

- disposal method.

Where a substance is in a laboratory, you should add:

- date received
- date first opened
- expiration or 'use by' date (if one is not present) particularly with chemicals that are prone to aging and oxidation - either the substance themselves or their containers.

NB: Setting an expiry date is not an explicit HS Regulations requirement but we advise that checking the substance and container forms part of the risk assessment to ensure teachers use substances that are fit for purpose only.



Example of a Globally Harmonised System (GHS) label (source: WorkSafe).

25.2 Labels on secondary containers and prepared solutions

Secondary containers and prepared solutions of hazardous substances held in a laboratory need to be labelled with:

- the identity of the substance
- the concentration of the substance if diluted with a non-hazardous substance
- a pictogram indicating the hazardous properties of the substance if the substance is classified as:
    - a flammable gas (cat 1) (2.1.1)
    - a flammable liquid (cat 1) (3.1A)
    - a pyrophoric liquid (cat 1) (4.2A)
    - a substances which in contact with water emits flammable gases (cat 1) (4.3A)
    - an oxidising liquid (cat 1) (5.1.1A)
    - an oxidising gas (cat 1) (5.1.2A)
    - acutely toxic (cat 1, 2 or 3) (6.1A-C)
    - a skin corrosive (cat 1A) (8.2A)
    - causing serious eye damage (cat 1) (8.3A)
- and, if possible, an indication of the precautions required when handling the substance.

An example of a container label is shown below.

Further information on pictograms can be found on the website of the United Nations Economic Commission for Europe (UNECE), and labelling information is provided on the EPA website: Labelling of hazardous substances Hazard and precautionary information.

25.3 Containers for immediate use (small containers)

For substances to be used or available for use within a laboratory session, held in small containers label in accordance with Part 18.9 of the regulations:

- the identity of the substance
- the concentration of the substance if diluted with a non-hazardous substance
- a warning of the hazardous properties (pictogram) if the substance is classified as:
    - a flammable gas (cat 1) (2.1.1)
    - a flammable liquid (cat 1) (3.1A)

- a pyrophoric liquid (cat 1) (4.2A)
- a substances which in contact with water, emits flammable gases (cat 1) (4.3A)
- an oxidising liquid (cat 1) (5.1.1A)
- an oxidising gas (cat 1) (5.1.2A)
- acutely toxic (cat 1, 2 or 3) (6.1A-C)
- a skin corrosive (cat 1A) (8.2A)
- causing serious eye damage (cat 1) (8.3A)

Vials and test tubes may have hazard labels affixed to the rack or container in which they are held, rather than on each vial or test tube, as long as every vial or test tube in the rack or container presents the same hazard.

If the small containers (including reaction vessels) will be left unattended, the contents should be readily identifiable using direct labelling, sample coding, rack identification, or other means.

As soon as no longer required, the hazardous substance must be either disposed of or labelled and the containers considered as storage containers.

25.4 Hazardous substance waste containers

All containers of hazardous substance waste at the school are required to be labelled with the following information in English:

- 'WASTE'
- identification of the waste – for example, chemical name (as it appears on the safety data sheet (SDS)) or flammable waste
- name, address and business telephone number of the school
- accumulation start date
- hazard pictogram and hazard statement consistent with the classification of the waste (if known) or likely constituents.

25.5 How can students/ākonga be kept safe when working with 'unknown' substances?

If students are required to determine the identity of an 'unknown substance', the container needs to be labelled with necessary handling and hazard information.

The product or chemical name and concentration of the substance needs to be readily accessible in case of an incident. The container could be labelled with a code that can be readily cross-referenced to provide information on the identity and concentration of the contents by a student, if necessary.

See Appendix 14 for information about determining hazards of substances.

Relevant parts of the Regulations
This Section should be read in conjunction with regulations 18.9(4).

26 What are the basic safety requirements?

Basic safety requirements include:

- safety documentation for all laboratories covering:
    - inventory of hazardous substances in the laboratory
    - site plan
    - Safe operating procedures (SOPs) and safe methods of use (SMUs) personal protective equipment (PPE) and respiratory protective equipment (RPE) guidelines/procedures (including ways to determine what PPE/RPE should be worn)
    - emergency response plans
    - any activities in the worker's work area where hazardous substances are present; and
    - the location and availability of known reference material on the hazards, safe handling, and storage of the hazardous substances found in the workplace, including (without limitation) safety data sheets (SDSs).
- a safety site-specific induction programme for all authorised persons before starting work in the laboratory, and ongoing training including refresher training, supervision and instruction where relevant.
- records of training and instruction provided kept.

27 What is the difference between a hazard and a risk?

27.1 Hazard

A hazard is a situation or thing with the potential to cause harm to a person (death, injury, illness) or the environment.

For example:

- broken glass could potentially lead to a cut
- sodium hydroxide could cause blistering of the skin
- a Bunsen burner could cause a burn
- a wet floor could cause someone to slip or fall.

27.2 Risk

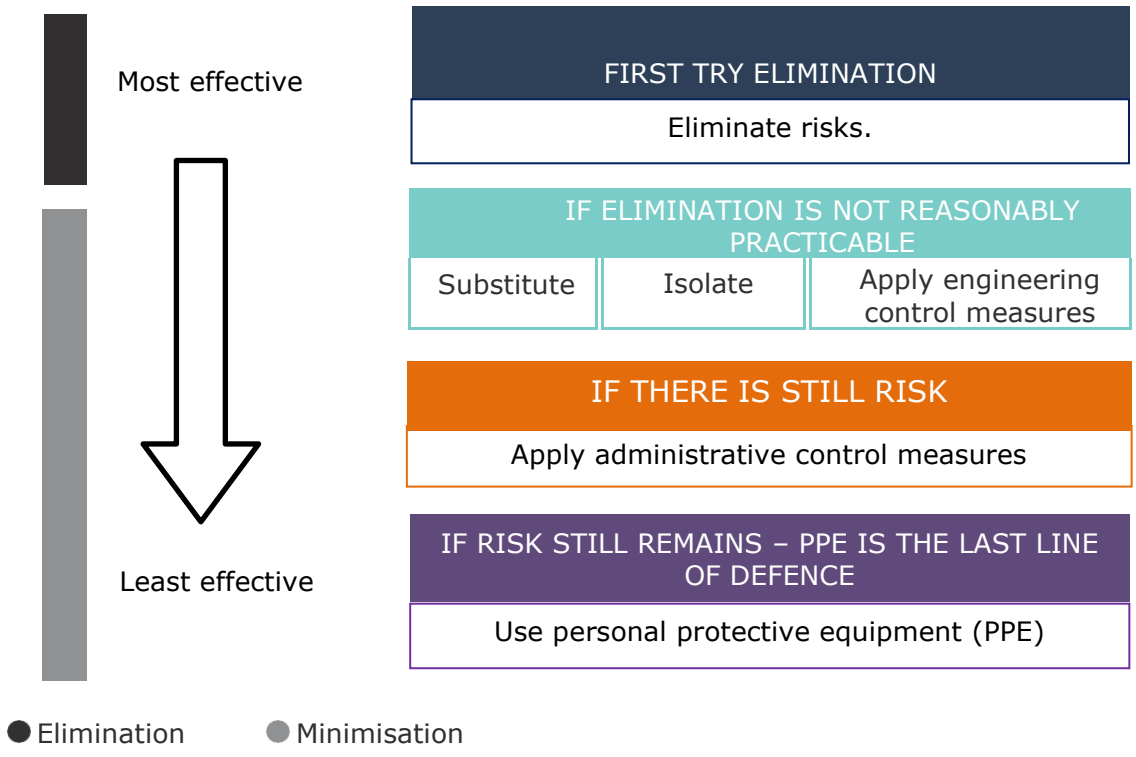
Risk has two components:

- the likelihood that it will occur, and
- the consequences if it happens.

For example:

- There is a risk that someone might be harmed by slipping and falling on a wet floor.

Risk can be eliminated or minimised by using the hierarchy of controls.



For example:

- **Eliminate** the risk of using a hazardous substance by not carrying out the experiment.
- **Substitute** by using a less hazardous substance.
- **Isolate** by blocking access to where the hazard exists.
- Apply an **engineering control** by providing adequate ventilation.
- Apply an **administrative control** by placing signs warning of a wet floor.

27.3 What is risk management?

A person conducting a business or undertaking (PCBU) must ensure, so far as is reasonably practicable, the health and safety of workers and others who may be affected by the work. Risks to health and safety arise when people are exposed to hazards. Hazards are anything that can result in harm.

It is important to know and manage the risks associated with hazardous substances and to regularly review the effectiveness of, and if necessary, revise, the controls that are in place. Focus on the most critical risks first before managing less serious risks.

Risk management is about:

- ensuring that teachers, technicians, students and others are, so far as is reasonably practicable, protected from harm
- ensuring that risks are managed effectively
- reviewing on an ongoing basis to identify any new risks that need to be managed, and revising controls if necessary
- involving workers.

27.4 Risk management steps for hazardous substances

1. Identify the hazardous substances present in the laboratory.
2. Consider whether the substances are needed or are there any that can be eliminated or substituted with substances with a lower risk profile.
3. For the remaining substances, put the necessary controls in place from the relevant parts of the Regulations.
4. Assess the laboratory and identify if any risks remain that need to managed.
5. Determine the most effective control measures to minimise those risks.
6. Monitor the performance of the control measures.
7. Maintain, review and, where necessary, revise the control measures.

27.5 Guidance

Most regulatory controls for hazardous substances can be found by entering the substance in the Hazardous Substances Calculator available in the Hazardous Substances Toolbox.

Schools/Kura need to be aware that the Calculator is unable to determine requirements specifically for a laboratory/taiwhanga. For instance, while location compliance certificates are not required for laboratories, the Calculator may suggest that a certificate is required, as that would normally be the case.

Also, the Calculator will not provide information on storage requirements.

The safety data sheet (SDS) can also be referred to manage the risk associated with the substance.

27.6 How should risk assessments be carried out?

A risk assessment is a structured and systematic examination of the site, processes (for example, chemical reactions, distillations, extractions) and work activities to identify what could cause harm to people to enable decisions to be made as to whether sufficient precautions have already been taken and therefore whether further controls are needed.

Risk assessment is a subjective process based on experience, opinions, observations and guidance from many sources: it is not a 'perfect science'.

The key is to develop a proportionate response to the risk that requires control, neither overly burdensome nor too inadequate to achieve the desired control.

Risk assessment can be seen as a logical way of asking questions to produce enough information for sensible conclusions to be drawn.

Risk assessment is a process, not a form.

What do you have to consider when you are assessing the risks with hazardous substances?

- The number of hazardous substances in the laboratory.
- What are the health and physico-chemical hazards associated with the substances?
- Are there any potential chemical or physical reactions that may occur?
- Are there any sources of ignition?
- Are there any structures, plant or systems of work involved?
- What is the nature of work, what/how will the substances be used?
- When are the circumstances likely to arise?
- Who are the people who might be at risk?
- Are some of the people likely to be at particular risk (for example, pregnant workers, young workers, workers with disabilities and lone workers)?
- What is the severity of the outcome (degree of harm) likely to be in terms of injury or ill health to those at risk?
- What are the natures and the extents of the risk(s)?
- What are the existing precautions/controls and are they appropriate and adequate?
- Are all relevant Acts and regulations and notices being complied with?
- If not, what action is required to comply and manage the risks?

27.7 When should a risk assessment be carried out?

Risk assessments are not "one-off" and for all time.

Details of risk assessments must be reviewed regularly to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.

Risk assessments are to be undertaken at regular intervals and/or when:

- changes occur that may invalidate the original assessment
- there has been a change to the process, plant or hazardous substance
- new information on the hazards of the substance becomes available
- monitoring indicates inadequate exposure control
- the installation of new or improved control measures becomes reasonably practicable
- there is reason to believe that the last assessment is no longer valid
- an unacceptable level of exposure to a hazardous substance occurs
- an accident or incident has occurred, or new information has come to light
- circumstances change for vulnerable individuals, for example, consider pregnancy, disabilities/illnesses such as epilepsy and those inexperienced in the working environment
- there is a significant change to an SDS
- there is a significant change to the information about a substance in the inventory

27.7.1 When do you review controls measures?

Every five years, or after:

- there is a significant change to a safety data sheet (SDS)
- there is a significant change to the information about a substance in the inventory
- if there is a notifiable event involving a hazardous substance.
- a significant event (not notifiable but warrants review of control measures)

27.7.2 Risk assessment records

Details of risk assessments should be kept in a risk register.

Where it has been determined that there is a risk to health and safety, the record should include:

- the health risk to workers for each operation involving a hazardous substance that is a human health risk
- the training, supervision and/or information required for workers
- the control measures required
- whether health monitoring is necessary
- the names and positions of those making the assessment.

The assessments should be signed and dated by the individuals who are completing the assessment, and the laboratory manager and/or technician.

For further guidance and templates, see:

Appendix 15: Example Risk Factor Calculation Table

Appendix 16: Example Risk Factor Calculation Worksheet

Relevant parts of the Regulations
This Section should be read in conjunction with • Parts 2 to 8 • Parts 9 to 13.

28 What is a Safe Method of Use(SMU) / Standard Operating Procedure(SOP)?

The person conducting a business or undertaking (PCBU) must ensure the following information is available:

- procedures to prevent the contamination of any equipment, clothing, or part of the laboratory.
- if a substance is an approved hazardous substance, procedures to ensure that persons in the laboratory are not exposed to more than the prescribed exposure standard (if any) for that substance.
- if a substance is not an approved hazardous substance, the laboratory's method of management of it.
- the disposal requirements for substances set out in the Hazardous Substances (Disposal) Notice 2017.
- the actions required under the laboratory's emergency response plan in the event of an accident or accidental exposure to the substances.

Standard or Safe Operating Procedures (SOPs) and Safe Methods of Use (SMOUs or SMUs) are examples of administrative controls that can be applied to minimise the risks associated with hazardous substances.

A SOP refers to a procedure employed where hazardous substances are handled and used, along with equipment, for a particular process.

A safe method of use (SMU) may be useful to provide consistent laboratory-specific guidelines on how individual hazardous substances are handled, used and stored.

Any person conducting a business or undertaking (PCBU) using a safe operating procedure (SOP) or safe method of use (SMU) or other similar procedure should clearly state its purpose, and how it will be used in the organisation.

For all SOPs and SMUs, the laboratory manager or PCBU needs to:

- review and approve any new SOP/SMU before that SOP/SMU is implemented
- ensure that all laboratory staff and students have access to the SOP/SMU documentation for the laboratory
- regularly review and revise SOPs/SMUs to ensure they are still up-to-date.

28.1 Information required in the Safe Method of Use (SMU)

The SMUs provide general summaries of factors that should be considered before a class of substance is used in a school laboratory and the controls that need to be in place for safe handling and use.

However, laboratory managers or delegates should always seek more detailed information appropriate to the substances and procedures being used.

The specific SMU needs to provide information on:

- the significant hazard of the substance (or procedure)
- any required safety controls for the substance (or procedure)

- the emergency procedures for the substance (or procedure)
- the disposal of the substance or products of the procedure.

See Appendix 17 for examples of an SOP/SMU.

The SMUs should be copied or printed and filed in a laboratory folder or equivalent and in one other location where the information needs to be available to emergency services.

Teachers need to provide a written, specific SMU for any procedure. They need to discuss the SMU with students and make it available to them during the procedure or activity.

Relevant parts of the Regulations
This Section should be read in conjunction with: • regulation 18.9 • regulation 18.10 • regulation 18.14.

29 What personal protective clothing and equipment is needed?

Firstly, steps should be taken to reduce exposure to hazardous substances as much as possible by means such as elimination, minimisation of amounts, and ventilation. Unless eliminated, there will still be some exposure to hazardous substances, which means that appropriate protective clothing and equipment must be provided and worn or used.

The following considerations apply to the proper use of protective clothing and equipment in a laboratory:

- training on when and why protective clothing and equipment is needed must be provided.
- training must also be provided on how to use, clean and store personal protective clothing and equipment.
- the type of protective clothing and equipment depends on the particular hazardous substance being used.
- check the label or safety data sheet (SDS) for each hazardous substance to determine the hazards of the substance and the precautions that need to be taken.
- the SDS will include information about the personal protective clothing and equipment that should be used.
- use personal protective clothing and equipment that meet New Zealand and/or Australian standards.
- the effectiveness of personal protective clothing and equipment is dependent on it being used correctly – fit testing will ensure that it is fitted correctly.
- make sure that personal protective clothing and equipment is frequently maintained and replaced as necessary.

29.1 Personal protective clothing and equipment items

The following items should be available in the laboratory/taiwhanga:

- disposable gloves of material that provides protection for the substances being used.
- eye protection to protect eyes from hazardous substances splashing into them, or from sharp objects (safety goggles/glasses)
- face shields or visors should be worn when decanting or handling substances that may be absorbed through, or damage skin.
- laboratory coats of fire-resistant material, which must be removed when exiting a laboratory/taiwhanga area.
- disposable dust masks – these must be stored in a sealed bag or container and only be used once.
- respiratory protective equipment (RPE), such as a cartridge half-mask respirator must be stored in any laboratory/taiwhanga that uses a class 6 substance that has an inhalation hazard.

29.1.1 Safety goggles/glasses

- All staff and students must wear safety goggles/glasses when hazardous substances are being used in the laboratory space.

- A variety of shapes and sizes should be available so that they fit comfortably.
- Prescription glasses DO NOT constitute safety glasses and not protect from splashes coming from the sides. Those wearing prescription glasses must wear safety glasses over the top of the prescription glasses.

29.1.2 Footwear

- Suitable footwear must be worn to protect the feet.
- This could include safety boots or closed footwear; sandals are not suitable footwear.

29.1.3 Gloves

- Gloves are an important method of preventing the absorption of hazardous substances through the skin on your hands and must be worn when using or handling hazardous substances.
- It is important to choose gloves that are resistant to the substance that is being used or handled.
- Some of the more chemically resistant gloves have very poor dexterity, and therefore, if precise handling is required, then PVC or PVA gloves may not be the most appropriate choice.
- Always refer to recommendations in individual SDSs for more specific guidance.

Safety company Ansell has guides on protective personal equipment for a range of settings:

- *Chemical Handling Glove Guide* (PDF)
- *Hazards in research laboratories chemical exposure*

29.1.4 Safety showers

Safety showers and/or eyewash facilities should be provided within 15 m of where oxidising, corrosive, flammable, or toxic substances are used.

These should be maintained in accordance with the manufacturer's specifications and AS 4775 and be flushed monthly.

29.1.5 Respiratory protective equipment (RPE)

- The Respiratory protective equipment (RPE) must be suitable for the work (and its hazards), be a suitable size and fit, and be compatible with other PPE as well as reasonably comfortable.
- The RPE must be kept clean, hygienic and in good working order. It must be maintained, repaired or replaced, so it continues to minimise the risk.
- PCBUs must provide information, training or instruction to workers about how to correctly use, wear, store and maintain the RPE.

You should:

- arrange for fit testing if your workers are using respirators that need a tight seal. You can usually arrange these with your RPE supplier. It should be conducted when you first provide RPE to workers
- ensure every worker has a qualitative fit test undertaken by a competent person for each piece of RPE they use
- repeat fit testing at least yearly or if there is a significant change in the wearer's facial characteristics (for example, change in weight, substantial dental work).

Relevant parts of the Regulations
This Section should be read in conjunction with regulations 15 to 20 of the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016.

30 What should be done when an event occurs?

Schools must report, record and investigate all incidents accurately and promptly, and identify any trends to the health and safety representative and WorkSafe where appropriate. Near misses with potential outcomes of serious injuries and/or illnesses should be reported to the health and safety representative.

Principals must notify WorkSafe as soon as possible after becoming aware of a notifiable event arising out of the conduct of the workplace.

30.1 Notifiable events

- A notifiable event is any of the following events that arise from work:
  - the death of a person
  - a notifiable illness or injury
  - a notifiable incident.
- The death of any person on any school site must be treated according to strict tikanga protocols. This relates to the discovery and recovery of the body/tūpāpaku, and will require the school to have a plan in place to guide this process prior to any event. This applies to any event, notifiable or not.
- Only notifiable events need to be notified; these trigger requirements to preserve the site, notify the regulator and keep records.
- The notifiable incident, illness, injury or death must arise out of work-related activities. It could be due to the condition of the worksite, the way the work activity is organised, or the way equipment or substances are used.
- Notifiable events may occur inside or outside the actual work site.

30.1.1 Notifiable illness or injury

- Notifiable illnesses or injuries are specified, serious, work-related illnesses or injuries.
- All injuries or illnesses that require, or usually require, a person to be admitted to hospital for immediate treatment are notifiable.
- The other types of injuries and illnesses that also require notification are set out in Table 1 in the WorkSafe Quick Guide - What events need to be notified? (PDF)

30.1.2 Notifiable incident

- A notifiable incident is an unplanned or uncontrolled incident in relation to a workplace that exposes a worker or others to a serious risk to that person's health and safety arising from immediate or imminent exposure to one of the factors specified in section 24(1) of HSWA. These include, but are not limited to:
  - a substance escaping, spilling, or leaking
  - an implosion, explosion or fire
  - gas or steam escaping
  - a pressurised substance escaping
  - electric shock

- the fall or release from height of any plant, substance, or thing
- the collapse, overturning, failure or malfunction of, or damage to, any plant that is required to be authorised for use in accordance with regulations
- the collapse or partial collapse of a structure.

- A notifiable incident is where someone's health or safety is seriously endangered or threatened. People might be put at serious risk even if they were some distance from the incident (for example, from a gas leak).
- A notifiable incident also covers the incidents specified above that may have resulted in only minor (non-notifiable) injuries but had the potential to cause serious injury, illness or death.

30.2 The Notify WorkSafe tool

WorkSafe relies on person conduction a business or undertaking (PCBUs) to work out whether an injury, illness or incident is notifiable.

Use the Notify WorkSafe tool to guide you through the notification process and determine whether the event is a notifiable injury, illness or incident.

30.3 Ministry of Education resources

- The injury and illness management web page contains tools and resources for schools.
- Notifiable events are described in detail within the factsheet *What Events Need to be Notified in the Education Sector?* Notifiable events include those that relate to children and not just teaching staff in the education setting, as schools are workplaces.

EMERGENCY SERVICES:

111

WORKSAFE:

0800 030 040

MINISTRY OF EDUCATION:

0800 848 326

1. When a notifiable event occurs, the priority is to assist the injured or ill person.

2. This may involve calling in ambulance services, fire and emergency, a doctor, and/or the Police.

3. After notifying WorkSafe, the Board/ECE should notify the Ministry of Education.

It may also be advisable to contact the school's or ECE service's insurer and to seek legal advice.

31 How do we prepare for emergencies?

The purpose of emergency planning is to minimise the risk to persons, property and environment in the events such as fire, earthquake or other disaster. This must include strict tikanga protocols for the death of any person on any school/kura site. This relates to the discovery and recovery of the body/tūpāpaku, and will require the school and kura to have a plan in place to guide this process.

31.1 Preparing an emergency response plan (ERP)

Regardless of the quantities of hazardous substances present, laboratories must have an emergency response plan (ERP) that complies with Subpart 2 of Part 5 of the Regulations.

The person conducting a business or undertaking (PCBU) should give careful consideration to their ERPs in relation to hazardous substances; are they workable, and what internal and external resources are required?

The ERP may be part of any other planning for an emergency.

When developing ERPs, consideration should be given to available resources and guidance such as:

- The WorkSafe website
- The WorkSafe Emergency Response flipchart
- Guidance from Fire and Emergency New Zealand
- Ministry of Education School Hazards Register – Science and Laboratory Rooms. (Word)

31.2 Emergency response plan (ERP) contents

The ERP must describe and apply to all reasonably foreseeable emergencies (including spills) involving hazardous substances that may arise at the laboratory and:

- describe all actions to be taken in an emergency including:
    - warning people within and surrounding the workplace that the emergency has occurred and provide advice to them on actions that should take to protect themselves
    - helping or treating injured people
    - how to manage the emergency to ensure adverse effects are restricted to the area initially affected, reduced in severity as soon as practicable and eliminated if reasonably possible, and re-establish controls.
- identify persons with responsibility for the actions above, and state:
    - contact details, and
    - required skills, and
    - any special training needed, and
    - actions the person is expected to take.

- specify:
    - how to obtain information about the hazardous properties of substances, their controls, and
    - the actions to be taken to contact emergency services, and
    - the purpose and location of equipment or facilities used to manage the emergency, and
    - how to decide what actions should be taken and in what sequence.
- provide:
    - an inventory of hazardous substances present at the workplace
    - a site plan showing the physical location of all hazardous substance locations within the boundary of the workplace.

In addition, the emergency response plan (ERP) must:

- state where fire extinguishers are located and specify their type, including any other firefighting equipment or facilities that have been provided, and
- specifically, address the retention of liquid or liquefied oxidising substance or organic peroxide to prevent it from contacting any incompatible substance, and
- be reviewed annually or more frequently if a person, procedure, or action specified in an ERP is changed, and
- be tested at least every 12 months to demonstrate it is workable and effective and amended where reasonably practical, and
- be tested within three months of a change to the plan involving a person, procedure or action, and
- have a record kept of tests carried out for at least two years after record was made.

Relevant parts of the Regulations
This Section should be read in conjunction with: • regulation 18.15 • Subpart 2 of Part 5 of the Regulations.

32 Technicians/Taiwhanga kaimahi

The school board as the person carry out business or undertaking (PCBU) is responsible for providing any personal protective equipment (PPE) that is necessary for the Science Technician to carry out their role.

When working with hazardous substances in the laboratory:

- Long hair must be tied up away from the face.
- A heavy-duty cotton or cotton-polyester-blend lab coat with long sleeves must be worn.
- Barrier cream can be applied to hands before putting on gloves to provide an additional layer of protection.
- Gloves should be chosen using a glove chart for their appropriateness for the task.
- Safety goggles/glasses must be worn when handling corrosive hazardous substances and when heating anything.
- A full-face shield must be worn when necessary.
- An appropriate respirator must be used if fumes are present and you are unable to use a fume cupboard (for example, in a chemical spill). The correct cartridges for the purpose must be used (for example, organic vapours and acids) and the respirator must have been fit tested for the person needing to use it.

32.1 What are safe working conditions when in a school laboratory prep room?

The school board, as the PCBU, is responsible for providing a safe and healthy environment for all of their employees.

A safe working environment should have:

- adequate active ventilation. This is particularly important if the hazardous substance storeroom is in the prep/work room and the dangerous goods cabinets or storage areas are not adequately ventilated to the exterior of the building
- dangerous goods cabinets that are vented to the exterior of the building to limit exposure to fumes
- safe, spark-free heating/cooling
- access to a fume cupboard
- access to a phone line in case of emergency
- non-slip flooring
- eye wash and safety shower facilities in case of an emergency
- separate office space to limit exposure to hazardous substance residues/gases/fumes/vapours.

33 Safety in biology/living world

33.1 What should I do before an activity?

When planning activity in the living world, Te Ao Tūroa, understanding the mātauranga Māori that guides Māori in their relationship with Te Ao Tūroa is important. This includes a world view based on the whakapapa of Ranginui and Papatūānuku; principles and values such as mauri, tapu, wairua, mana; and the practices of whanaungatanga and kaitiakitanga. As a teacher it is important that the responsibility of knowing and understanding the appropriate mātauranga Māori requires your leadership in your classroom with your students.

Prior to carrying out an activity, a teacher should follow the five steps to managing health and safety risks.

- **Identifying hazards:** finding out which situations and things could cause death, injury or illness during the activity.
- **Assessing risks:** understanding the nature of the risk that could be caused by the hazard, what the consequences could be and the likelihood of it happening. It also involves considering the severity of consequences if a person is exposed to a hazard. The level of risk will increase as the likelihood of injury or illness or its severity increases.
- **Controlling risks:** implementing the most effective control measures that are reasonably practicable in the circumstances. The most effective way of controlling risks is to eliminate a hazard. If elimination is not reasonably practicable, then the risk must be minimised by doing one or more of the steps in the hierarchy of control measures.
- **Reviewing control measures:** ensuring control measures are working as planned. Controlling health and safety risks in the classroom is an ongoing process that needs to take into account changes in the classroom.
- **Revising control measures**, if necessary.

33.2 How do I care for animals?

All schools are required to comply with the Animal Welfare Act 1999.

Clarification of which animals can be used in classrooms and the definition of manipulation can be found on the TKI Science Online website.

Guidelines for the use of animals in classrooms can be found on this TKI Science Online web page.

If ethics approval is required, follow this link to the NZ Schools' Animal Ethics Committee website.

Under the Wildlife Act 1953 it is illegal to keep native animals without a permit.

Animals should always be treated with respect. If animals are kept in schools, they should be healthy and be obtained from reliable sources, such as biological supply firms, universities, or approved breeders. Schools must not keep such animals as cockroaches, possums, hedgehogs, and rodents caught in the wild because they may be carrying disease. Animals can transmit infections, parasites, and diseases to humans.

Students must wash their hands before and after handling any animals, and existing cuts or abrasions must be covered to prevent infection. Bites from laboratory/taiwhanga animals should be treated immediately. In the case of puncture wounds, a doctor should be consulted. Some people may have allergic reactions, such as skin rashes, asthma, or sneezing, when exposed to the hair, dried urine, and excreta of particular species.

Care for animals must include:

- keeping the animal in a secure cage or container, with space for it to move around freely and display normal patterns of behaviour
- providing adequate food, water, and shelter
- preventing discomfort to the animal caused by exposure to noise, draughts, direct sunlight, and improper handling
- attending to hygiene by providing adequate clean bedding, changing it regularly, and keeping the cage or container clean
- removing unhealthy animals and seeking veterinary attention for them
- checking that when animals go home with students, responsibility is taken for the animals' security and welfare.

33.3 Bones and feathers

Items such as birds' nests and feathers, which can carry microbes and other creatures such as mites, can be placed in a plastic bag to prevent their spread. Animal bones should be sterilised or disinfected; they can be placed in a 10% hypochlorite (household bleach) solution. Feathers should also be disinfected in a common household disinfectant. In general, bones and feathers should be disposed of in an appropriate manner that recognises the respect and understanding of tikanga around disposal of this type of body part or taonga.

33.4 What should I be aware of when carrying out a dissection?

- All material for dissections must be obtained from a reputable source, for example, an abattoir, tertiary institution, or butcher's shop.
- During any dissection, the material must be treated with respect.
- Before anyone proceeds with a dissection, all their cuts and grazes must be covered.
- Clean, sharp dissection equipment should be used. Particular care should be taken when cutting the sclera of a cow's eye.
- After the dissection, the dissection equipment must be washed and either sterilised or disinfected. Scalpels and razor blades should be placed in a clearly labelled, puncture-proof container before disposal.
- The animal remains and gloves must be disposed of safely: preferably following appropriate processes that include acknowledging appropriate tikanga. This may include incineration and burial or disposal through a commercial waste-disposal company.
- All bench surfaces must be washed and disinfected.
- All people involved must wash their hands afterwards with soap and hot water.
- A web-based dissection could be used for students who do not wish to participate in the activity.

- Blunt tools lead to more injuries. Always keep the hand holding the sharp tool clean and dry, so it doesn't slip. Always cut away from the body and away from the hand holding the item. Sharp items can include scalpel blades, knives, dissection scissors, cork borer, dissection pins and needles, and hypodermic needles.

33.5 What should I be aware of when using plants?

33.5.1 Plants

These are excellent for observing as living organisms. Many are perfectly safe to use, but some flowers, berries, and seeds are poisonous, and some can trigger allergic responses.

Seeds purchased from retailers may have been treated with insecticidal or fungicidal substances. Students should wash their hands thoroughly after handling them.

33.5.2 Native plants

It is not illegal to keep native plants.

Where plants growing in New Zealand bush are concerned, it is the area or ground that is protected, so native plants cannot be taken from a reserve or national park.

33.6 What should I be aware of when culturing microorganisms?

- Human or animal sources of microorganisms, other than skin, should not be used (for example, blood, saliva, pus, urine, and faecal material).
- Skin surfaces may be used only if cultures remain sealed.
- Samples should not be taken from toilets and toilet areas, including sinks and door handles.
- Known pathogens, other than genetically crippled strains of Escherichia coli, should not be used.
- Samples should not be taken from rubbish bins and drinking taps.
- Sterile swab sticks should be used to inoculate plates.
- All cultures should be labelled with student names and the date.
- Petri dishes should be covered and sealed to prevent contamination and the spreading of spores. Adhesive tape can be used to securely seal the dishes.
- Petri dishes should be incubated upside down.
- Subculturing should be carried out only on known non-pathogenic organisms that can be obtained commercially.
- Lids of petri dishes must be held open, at an angle to the base, for the minimum time that allows a transfer of material.
- All microbiological transfers should be conducted close to a Bunsen burner flame. Safety glasses should be worn.
- Incubating at 25 to 40 degrees Celsius (°C) should be avoided because this tends to select organisms adapted to the human body. Temperatures of 25°C or below should be used.
- Glassware used for fermentation experiments must either be lightly plugged with cotton wool or be covered with aluminium foil and not sealed.
- All cultures should be destroyed before disposal by heating in a pressure cooker for at least twenty minutes.

- Plastic dishes must be disposed of or could be soaked in a 10% hypochlorite (bleach) solution for three days.
- Spillages of cultures should be dealt with by a teacher or technician wearing disposable gloves. The broken container and/or spilled culture should be covered with a cloth soaked in a disinfectant of 10% hypochlorite (household bleach). After ten minutes the spillage must be cleared away using paper towels and a dustpan. The contaminated material should be placed in a disposal bag, along with the gloves, and then be disposed of. The dustpan should also be disinfected.

33.6.1 Which microorganisms are suitable to use in school?

- soil microorganisms (for example, *Azotobacter* spp.)
- vinegar-producing microorganisms (for example, *Acetobacter* spp.)
- baker's yeast
- mildew and rust from plants
- yoghurt bacteria
- cheese bacteria and fungi
- some fungal diseases on plants and rotting fruits
- potato blight
- black spot on roses
- yeasts from grapes
- fungi from jams and jellies.

Note: Some microorganisms that are part of the normal flora of humans or animals may be pathogenic for immuno-compromised persons.

33.6.2 Fungi

Some fungi, including toadstools, mushrooms, moulds, and puffballs, may be poisonous. Care should be taken when collecting or handling fungi. Plastic gloves or a plastic bag over the hands should be worn while doing so, and hands should be washed after removing the gloves. Fungi should never be placed near the mouth or nose.

33.7 How can I involve students as experimental subjects?

When undertaking any practical activity in which students are subjects, the teacher must consider the risks of both physical and emotional harm and be aware of the potential effect of drawing attention to individual differences.

Examples of activities that can be safely carried out include:

- The safe measurement of blood pressure, using computer-linked data-capture devices. There are dangers in using sphygmomanometers. A person with appropriate training, such as a nurse, may be of assistance.
- The use of disclosing tablets to show the presence of plaque on teeth. If toothbrushes are used, they must not be shared between students.
- The use of simulated blood-typing kits that are commercially available.

Activities with students as subjects of an experiment may require Human Ethics Committee approval. Check the Health Research Council Ethics Guidelines for details.

33.8 What should I be aware of during some common laboratory/taiwhanga procedures?

33.8.1 Body fluids

Body fluids or excretions are prohibited in school learning experiences. This includes saliva, semen, blood, mucus, urine, and faeces.

Some safe alternatives are:

- amylase, which can be purchased and used in place of saliva
- bull semen from an artificial insemination cattle breeder – it comes frozen in a short straw.

33.8.2 Cheek-cell scrapes

Students should wash their hands before and after carrying out this procedure. Applying sticky tape to the inside of the wrist is a suitable alternative to using cheek cells.

33.8.3 Eggs

Check for egg allergies before using in class.

Eggs should be washed before use, and students must wash their hands before and after handling them.

33.8.4 Ingredients to make food and drink in the lab

Common science learning experiences of food include making bread, ginger beer, cheese, yoghurt and other fermented food stuffs.

It is permitted to make food and drink in the laboratory **that will not be consumed.**

33.8.5 Plucks (animal lungs)

Use a vacuum cleaner or pump to inflate the lungs rather than blowing through a straw.

33.8.6 Soil and potting mix

Care should be taken when opening bags of potting mix and using home-made or commercially made potting mix. Potting mix commonly contains Legionella bacteria that can cause Legionnaires' disease, which is a type of pneumonia. It is recommended that people using potting mix wear dust masks to avoid inhaling the dust.

33.8.7 Biological stains and dyes

Stains are often powders dissolved in a solvent such as alcohol, oil, or water. All biological stains are designed to highlight a part of the cell to make it easier to view under the microscope; this means the stain will also affect your cells including specifically targeting DNA structures. Use stains sparingly. Toluidine blue should not be used, because it is a carcinogen. Aceto-orcein stain is corrosive, can burn the skin, and can irritate the respiratory system. Methylene blue can be harmful if swallowed, and the fumes can irritate the eyes and skin.

33.8.8 Stethoscopes

Earpieces should be sterilised or disinfected, and spirometers should have disposable mouthpieces, or the mouthpiece should be sterilised or disinfected.

33.9 What are the safety guidelines when sampling off site?

When carrying out Science Fair activities or sampling for in-school investigations, hazardous substances must not be used outside the laboratory. The discussion of the reliability of readings taken during safe sampling practices could form part of the report.

33.10 How do I dispose of waste safely?

Ministry for the Environment guidelines for the management of hazardous waste are detailed in two modules:

Module 1: Hazardous waste identification

Module 2: Landfill waste acceptance criteria.

33.10.1 Biological waste

Biological waste should be stored safely until it can be processed appropriately or until a reputable company can collect it and process it safely. Different regional and city/town councils may have by-laws that need to be taken into consideration when making plans for disposal of biologically hazardous waste. Safe storage could be in a bio-hazard waste bag in the freezer. Biologically hazardous waste includes agar plates that have been inoculated with microorganisms, or any biological material that has been incubated to grow or has accidentally grown bacteria or mould (for example, bread), or any biological material that has been preserved using a fixative (alcohol or formalin). Fresh biological waste (for example, from dissection), that has not been preserved with any type of fixative (alcohol or formalin) and has not grown any microorganisms is safe to dispose of by wrapping it in newspaper and putting it in the general landfill.

33.11 Broken glass

Dispose of broken glass in a dedicated broken-glass container.

34 Safety in chemistry/material world

34.1 What should I do before an activity?

Prior to carrying out an activity, a teacher should follow the five steps to managing health and safety risks.

- Identifying hazards: finding out which situations and things could cause death, injury or illness during the activity.
- Assessing risks: understanding the nature of the risk that could be caused by the hazard, what the consequences could be and the likelihood of it happening. It also involves considering the severity of consequences if a person is exposed to a hazard, combined with the likelihood of it happening. The level of risk will increase as the likelihood of injury or illness or its severity increases.
- Controlling risks: implementing the most effective control measures that are as far as is reasonably practicable in the circumstances. The most effective way of controlling risks is to eliminate a hazard. If elimination is not reasonably practicable, then the risk must be minimised by doing one or more of the steps in the hierarchy of control measures.
- Reviewing control measures: ensuring control measures are working as planned. Controlling health and safety risks in the classroom is an ongoing process that needs to take into account changes in the classroom.
- Revising control measures.

34.2 What are the safety guidelines for equipment often used for chemistry practical activities?

34.2.1 Bunsen burners

Bunsen burners should be turned off when not in use. If it is necessary to keep the Bunsen burner alight, the flame should be made luminous. A tripod should be placed over any Bunsen burner supplied with gas fuels that cannot be made luminous.

Matches, wood splints, or friction lighters should be used for lighting Bunsen burners, because these materials are cleaner and safer than paper or wax tapers.

Bunsen burners should be used with caution on window benches where curtains could be ignited; curtains should be tied back or secured.

34.2.2 Electrolysis

It is recommended that electrolysis of molten salts takes place only if demonstrated and in a fume cupboard.

34.2.3 Fire extinguishers

It is important to ensure the safety of students, workers and others prior to trained personnel using the appropriate fire extinguisher.

Fire extinguishers must have a classification and rating of at least 30B, be clearly visible and readily accessible.

34.2.4 Flexible tubing

Flexible tubing should suit its purpose. Reinforced tubing must be used where the tubing is under pressure. Plastic tubing is preferable for permanent installations, as it is less likely to perish. Tubing should be secured by the appropriate hose clips and checked regularly for damage or deterioration. For vacuum work, thick-walled or reinforced tubing should be used so that the tubing does not collapse. The tubing suppliers can provide advice when necessary.

34.2.5 Gas cylinders

Compressed gases are hazardous because each cylinder contains large amounts of energy and may also have high flammability and toxicity.

Flashback arresters must be fitted to regulators attached to flammable-gas cylinders. Cylinders of flammable gases should only be stored in areas provided with adequate ventilation to ensure any leaked gas does not accumulate to levels that exceed 10% of the lower explosive limit (LEL). Cylinders of all compressed gases must be secured to a wall or fixed structure. A recommended method of securing cylinders is by two chains, one at about one-third of its height below the valve and the other at the base, to a wall bracket. Oxygen cylinders must be separated from any class 2 flammable gas by at least 3 metres.

34.2.6 Gas burners (portable)

Portable burners with maximum capacity of 500 mL can be used, provided a risk assessment has been done. The burners should be stable and positioned such that they will not be knocked over. All students should be instructed in the safe operation of these burners, as with any other equipment.

34.2.7 Glassware

Careless handling of glassware can cause many accidents in science. Teachers and students should observe the following procedures.

- It is good practice to use small test tubes to minimise harm in the event of an accident, to conserve reagents and to generate less waste.
- Use suitable test tube holders when heating test tubes.
- Do not use metal tongs for holding, carrying, or heating glassware.
- Do not put pressure on a glass tube or thermometer.
- Warn students about the danger of attempting to remove glass tubing from, or inserting tubing into, corks or bungs. To insert glass tubing into bungs, select the smallest cork borer that fits over the glass tubing, lubricate the borer with glycerol or detergent, and insert into the bung. Then slide the glass tube into the cork borer, and remove the cork borer, leaving the glass tube in place. This procedure can be carried out in reverse to remove a tube.
- To cut glass tubing, make a scratch with a glass cutter, hold the tube in a cloth, and gently break the glass by pushing away with both thumbs.
- Only teachers or technicians should open glass ampoules.
- To remove sharp edges of glass that often protrude from freshly broken surfaces, heat the broken surface in a flame until the surface is rounded.
- Dispose of broken glass in a container reserved specifically for the purpose.

- Carry long lengths of glass tubing upright.

34.2.8 Heating and gauze mats

Asbestos is not permitted in schools.

If ceramic Bunsen burner gauze mats do contain tremolite asbestos, follow the WorkSafe collection and removal process.

Mats in good condition known to contain asbestos should be collected, placed into double plastic snap-lock bags, labelled clearly and placed in a secure place until they can be removed by the supplier.

For asbestos-containing mats that are no longer in good condition, that is, are broken or show signs of deterioration – cracking, powdering etc. – you need to take these additional steps to secure the mats: wearing a protective mask and gloves, securely bag up the mats and trays, label clearly, remove from the classroom and lock away safely. Contact an asbestos-removal contractor, who will remove the products and advise if any further remedial action needs to be taken.

For more information, see the WorkSafe website.

34.2.9 Pipetting

Pipetting by mouth is not allowed. A suction device, such as an automatic pipette filler, should be used.

34.2.10 Stirrers

Wherever possible, a magnetic stirrer or glass stirring rod should be used. The stirring speed on a magnetic stirrer should be set to low before the device is turned on. Using thermometers as stirring rods is not good practice.

34.2.11 Thermometers

Where possible, alcohol thermometers should be used rather than mercury thermometers. Thermometers should not be used as stirring rods, and laboratory thermometers should not be used as clinical thermometers. If the alcohol separates in the tube, placing the thermometer in a freezer will recombine the liquid.

34.3 What are the safety guidelines for substances often used for chemistry practical activities?

34.3.1 Acids

The following guidelines should be observed:

- Protective clothing and safety glasses should be worn when handling acids.
- Store concentrated acids and alkalis in a way that minimises the risk from spillage, for example, low on shelves and not on the floor. Acids and alkalis are incompatible.
- Ensure students understand the difference between dilute and concentrated acids.

- Do not make up cleaning mixtures that contain acids. Such mixtures can be replaced by commercially available cleaning agents.
- To prevent a build-up of gas pressure, pour only into wide-mouthed containers.
- When diluting acids, always add concentrated acid slowly to larger volumes of water, stirring until well mixed. Do not do this alone; another appropriately trained person should be nearby. Wear protective clothing.
- When reacting acids with metals, take the following precautions:
    - Use only small amounts of metals.
    - Carry out reactions in large test tubes or beakers, as some metals react vigorously, effervesce, produce high temperatures, and may boil. Do not use powdered metals such as aluminium, magnesium, and zinc.
    - Do not react sodium, lithium, and calcium with acids.

34.3.2 Adhesives

Follow the manufacturers' recommendations. Restrict access to adhesives that have the potential for solvent abuse.

34.3.3 Alkalis

The following guidelines should be observed:

- protective clothing and safety glasses should be worn when handling alkalis
- store concentrated acids and alkalis in a way that minimises the risk from spillage, for example, low on shelves and not on the floor. Acids and alkalis are incompatible
- in their solid form, sodium hydroxide, potassium hydroxide, calcium oxide, and calcium hydroxide can react violently with concentrated acids and water
- the fumes evolved from alkalis can affect the respiratory system of a person handling them
- wet material in contact with calcium oxide may generate excessive heat, which could cause an explosion
- all alkalis (especially sodium hydroxide) are corrosive and very dangerous to the skin
- care should be taken when mixing aluminium or zinc with solutions of strong alkalis, because hydrogen gas is evolved
- solid pellets of alkalis should be handled only with tweezers or a scoop to avoid burns
- solid and concentrated sodium hydroxide and potassium hydroxide are dangerous when mixed with many metals, chlorides, and hydrochloric acid
- care should be taken when making a solution of sodium hydroxide or potassium hydroxide. Always use a fume cupboard and a magnetic stirrer and, if possible, stand the mixing beaker in a larger bowl of cold water to dissipate the heat produced.

34.3.4 Cosmetics

Before using any ingredients for cosmetic preparations, teachers/kaiako must make themselves aware of any potential hazards or risks associated with flammable solvents, acids, and alkalis used in them. Care must be taken when using excess alkali in

preparation. The pH must be tested at the end of a procedure and adjusted, if necessary, to ensure the resulting preparations are neutral. Preparations must be disposed of after the lesson and not stored or kept for future use. Students/ākonga who may have sensitive skin should not use these preparations. Students/ākonga must not make toothpaste.

34.3.5 Crystal making

For information on crystal making, refer to the information in Section 37 on primary science.

34.3.6 Diffusion experiments

Before carrying out any diffusion experiments involving gases, teachers/kaiako must inform themselves and others that may be involved of any hazards associated with the gases.

34.3.7 Dyes and biological stains

Teachers/kaiako need to be aware that many stains are potentially harmful although the risk is limited by the small quantities used. Consult the safety data sheet (SDS) for specific advice. Dyes and stains may cause allergic reactions and should be kept off the skin. Toluidine blue should not be used, because it is a carcinogen. Aceto-orcein stain is corrosive, can burn the skin, and can irritate the respiratory system. Methylene blue can be harmful if swallowed, and the fumes can irritate the eyes and skin. Some stains are flammable, and it is a wise precaution to keep them away from naked flames.

34.3.8 Ethers

Ethers, and compounds that contain the ether grouping, are especially prone to oxidation, by air, to peroxides. Do not keep them for long periods in half-empty bottles or in clear glass bottles. When a little-used bottle is nearly empty, discard the residue. Do not distil ether from such bottles because it may explode. Even though an ether has been treated to destroy peroxide, stop distillation when about 15% remains in the flask.

34.3.9 Evaporating to dryness

Teachers/kaiako and students/ākonga need to be aware of the following when evaporating to dryness:

- Always carry out evaporation in an evaporating dish or crucible.
- Remove the heat source before the water has totally evaporated.
- Spitting may occur when solutions are being evaporated to dryness, so do not remove safety glasses, even when the heat has been turned off.
- A steam bath may be used when evaporating to dryness.

34.3.10 Explosives

Making explosives is forbidden in schools.

The following substances are commonly used in the manufacture of explosives, so students' access to them should be restricted:

- aluminium powder
- ammonium nitrate

- charcoal
- nitric acid
- potassium dichromate
- potassium nitrate
- stearic acid
- sulfur
- urea.

34.3.11 Metals

When using metals for experimental procedures, teachers and students should be aware of the following:

- Alkali metals can react explosively with water, so, due to their reactivity with water vapour, they are stored under hydrocarbon oil.
- Lithium is less reactive but must still be treated with caution.
- Calcium is the most suitable metal to use for water–metal reactions. To demonstrate group trends, the teacher could place rice-grain-sized pieces of sodium and lithium in shallow water in a large deep trough. Other Group 1 elements must not be used.
- Before starting an experiment, bulk supplies of hazardous substances should be removed, and lids placed on all containers.
- Finely divided metals such as aluminium, magnesium, and zinc are easily ignited and burn vigorously.
- Metal powders should not be in contact with, or mixed with, oxidising agents such as nitrates and peroxides, because they form explosive mixtures.
- Metal powders, such as magnesium and zinc, react violently with sulfur. Carry out the reaction between powdered zinc and powdered sulfur by using only small quantities in a crucible. The reaction between powdered sulfur and iron filings is safe in a dry test tube in a fume cupboard.
- When heating metals, only small pieces of metal should be used. Use metal tongs to hold them in the flame.

34.3.12 Organic substances

Minimum quantities of organic substances should be present in laboratories or preparation rooms. Bulk supplies should be kept in the dangerous goods store.

The following common solvents and organic reagents have flash points below 93°C and should be kept in a well-ventilated area:

- butanone (methyl ethyl ketone)
- cyclohexane
- cyclohexene
- ethanal (acetaldehyde)
- ethanol (ethyl alcohol)
- ethoxyethane (diethyl ether)
- ethyl ethanoate (ethyl acetate)
- methanol (methyl alcohol)
- pentane
- methyl benzene (toluene)

- pentyl ethanoate (amyl acetate)
- propanone (acetone)
- petroleum ether
- propan-1-ol (n-propyl alcohol)

34.3.13 Paint

Follow the manufacturers' instructions when using paint. Be aware of the potential for solvent abuse with some products.

34.3.14 Pesticides

Store pesticides in a locked cupboard. Use them only under strict supervision and in accordance with the manufacturers' instructions. Do not dispose of pesticides into the sewerage system. If large quantities need to be disposed of, contact the local authority.

34.3.15 Plastics

Carry out any heating of plastics, fibres or fabrics of known composition in either a fume cupboard or a well-ventilated area. Use small pieces 1 cm^2 or less. Do not use samples of unknown composition.

34.3.16 Proteases

Proteases may cause allergic reactions; use only small quantities.

34.3.17 Radioactive substances

For information on radioactive substances, see Appendix 4.

34.3.18 Restriction enzymes

Restriction enzymes may cause allergic reactions; use only small quantities.

34.3.19 Solvents

The term ‘solvent’ is often used for organic liquids. They tend to be used in large quantities and are often flammable, highly volatile, and hazardous. The vapour presents the greatest hazard, as it may harm the eyes, the respiratory tract or skin depending on the solvent. Before using any solvent, find out whether any hazards or risks are associated with the substance and refer to the SDS. Where directed, use a fume cupboard. Methylated spirits, surgical spirits, and 'white spirits’ are highly flammable.

34.4 What are the safety guidelines when sampling off-site?

When carrying out Science Fair activities or sampling for in-school investigations, hazardous substances must not be used outside the laboratory. The discussion of the reliability of readings taken during safe sampling practices could form part of the report.

34.5 What are the safety guidelines when carrying out redox reactions?

Reactions that involve oxidation and reduction may produce heat and could lead to a fire.

Reductions involving magnesium, aluminium, and zinc powders must be demonstrated only; when burning metals in oxygen, use only a small sample, for example:

2 cm^2 of aluminium foil

2-cm lengths of magnesium ribbon

1 cm^3 of granulated zinc.

Take care when burning metals in air.

In many oxidation–reduction reactions, there may be large energy transfers in the form of heat. It is possible for constituents of the reaction to explode. For metal or metal-oxide reactions, the rate of reaction depends on the metals' relative positions in the activity series. Do not react sodium, lithium, and calcium with other metal oxides. Magnesium, aluminium, zinc, iron, tin, lead and copper can be reacted with metal oxides, but do not use powdered metals in such reactions.

35 Safety in earth and space science/planet earth and beyond

35.1 What should I do before an activity?

Prior to carrying out an activity, a teacher should follow the five steps to managing health and safety risks.

- Identifying hazards: finding out which situations and things could cause death, injury or illness during the activity.
- Assessing risks: understanding the nature of the risk that could be caused by the hazard, what the consequences could be and the likelihood of it happening. It also involves considering the severity of consequences if a person is exposed to a hazard. The level of risk will increase as the likelihood of injury or illness or its severity increases.
- Controlling risks: implementing the most effective control measures that are reasonably practicable in the circumstances. The most effective way of controlling risks is to eliminate a hazard. If elimination is not reasonably practicable, then the risk must be minimised by doing one or more of the steps in the hierarchy of control measures.
- Reviewing control measures: ensuring control measures are working as planned. Controlling health and safety risks in the classroom is an ongoing process that needs to take into account changes in the classroom.
- Revising control measures if necessary.

35.2 What are the safety guidelines when examining samples?

35.2.1 Rocks and minerals

- When using acids to test minerals, wear protective safety goggles/glasses.
- Flush the sample with water after testing.
- When breaking up rocks and minerals, place the specimens in a heavy canvas bag, use an appropriate geologic hammer, and wear goggles/glasses and aprons.
- Use a dust mask when crushing or milling/grinding samples.

35.2.2 Handling soil samples

- Wear safety glasses
- Wear gloves if unsure of any possible soil contamination
- Dispose of soil samples appropriately.

35.3 What are the safety guidelines when using equipment?

35.3.1 Ocean acidification experiment

- Wear safety glasses for all practical work.
- Use appropriate safety procedures with the safe handling of acids and bases.
- Wash hands after experiments.

35.3.2 Force measuring devices

- Students must be careful when projecting objects (steel balls or marbles). The area should be clear of all obstacles.

35.3.3 Sling psychrometer

- Care should be exercised in using this device. Be sure thermometers are securely fastened.

35.3.4 Stream tables

- Be sure that adequate receptacles are available to catch the run-off.
- Check all hoses and tables are free of leaks.
- Use only electrical equipment designed for stream tables to reduce the risk of electrical shock.

35.3.5 Wind generating devices (hairdryer, electric fan, etc.)

- As these devices are often used with water, they present a risk of electric shock. No one should disconnect, connect, or operate these devices with wet hands or while standing on a wet floor.

35.3.6 Telescopes and binoculars

- Eyepieces of shared telescopes and binoculars should be cleaned periodically to reduce the risk of transmission of eye infections.
- Never observe the sun directly through a telescope or binoculars.

35.3.7 Ultraviolet lamps

- Special glasses (such as those coated with an ultraviolet absorbing film) should be used when examining mineral samples with an ultraviolet lamp.

35.4 What are the safety guidelines when viewing the sky?

- Never allow students to look at the sun directly, with or without any optical devices (sunglasses, magnifying lens, telescopes, etc.).
- For solar eclipse viewing, use the pinhole method where the sun's image is projected by a pinhole in a sheet of paper/foil onto a screen. Any other method can cause permanent eye damage.

35.5 What are the safety guidelines to follow when launching rockets?

- Do not have metal components in the rockets; rockets can experience CATOs (catastrophes at take-off). This is especially true around the motor area.
- Rockets need a guidewire to launch reliably.
- Remember that rockets turn into the wind in flight.
- Don’t fire rockets in winds that will carry them into neighbouring properties or fire hazard zones.
- Everyone should wear eye protection.
- You must have someone appropriate designated as the launch safety officer. This person has the responsibility for ensuring the sky is clear of aircraft.
- Do not use rocket launchers containing explosives (class 1 substances).

35.5.1 Launch procedure

1. Prior to moving to the launch site, hold a safety briefing with the following items:
    - Who is the safety officer?
    - Is everyone wearing safety glasses?

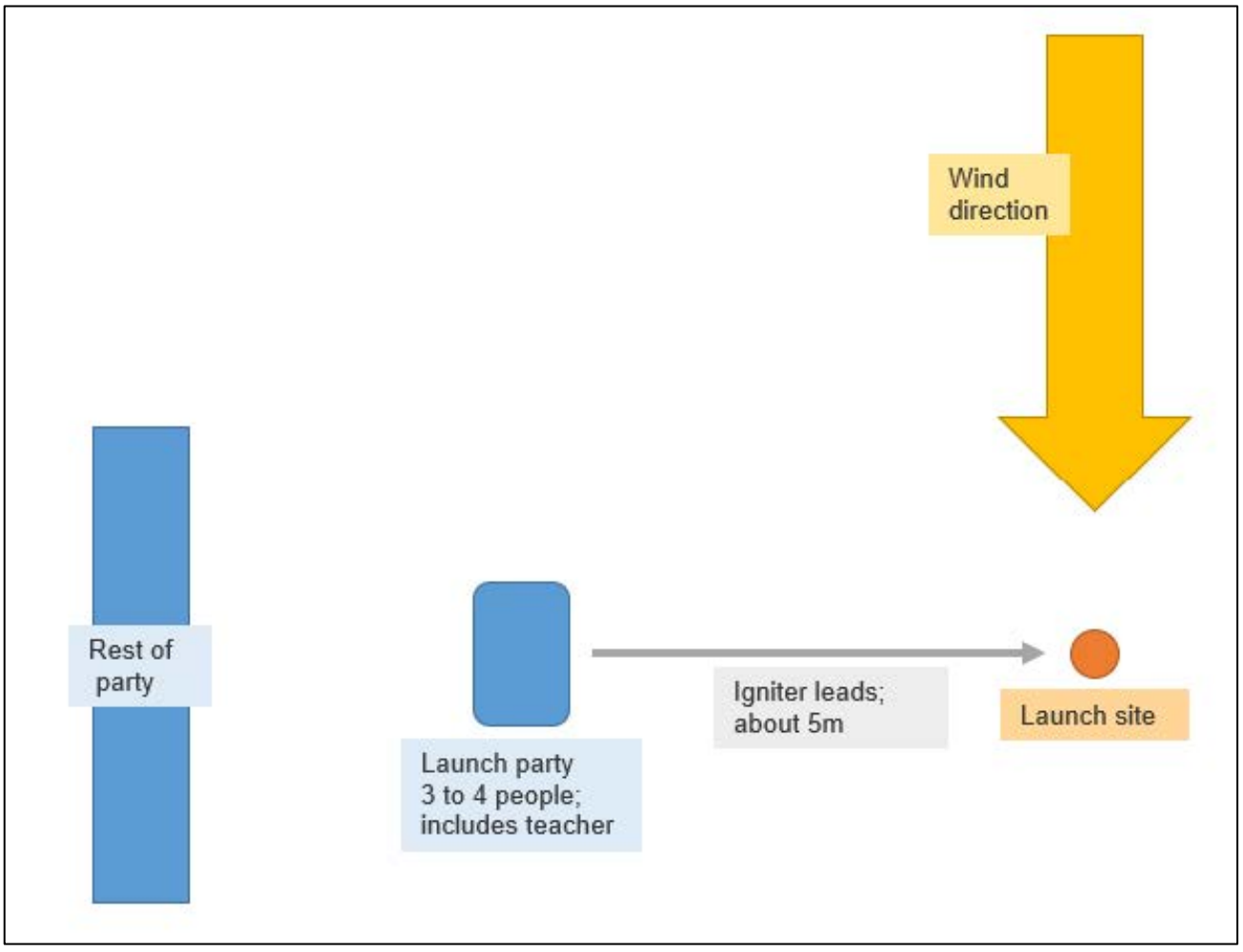
- How to connect igniters.
- Who will disconnect igniter leads after launch (because of the fire risk)?
- What is the correct warning for launch (that is, 'stand by, firing in 5,4,3,2,1')?
- What is the misfire procedure? Wait 60 seconds, disconnect leads, replace igniter, re-try.
- Don't chase rockets, walk only.
- All observers should be watching the rocket when standby is called out, so they can take avoiding action (just turn away).
- All observers must be standing (and so able to move away from rapidly descending rocket).

2. Move to launch site.

A plan of a launch site is shown below.

- Explain why rockets turn into the wind and why students stand behind the launch party.
- Be sure other exposed groups are alerted to your activity.

Launch site plan



3. Brief for the launch process
    - Check battery is safe before connecting igniter.
    - Disconnect battery after firing, as leads may catch fire if there is contact between alligator clips at igniter end.
    - Ensure proper firing warnings are used.
    - In the event of a horizontal launch into the crowd, instruct party to turn their backs.
    - Be aware that at that distance the rocket will be moving at 30 to 50 m/s.
    - Check there are no aircraft operating near launch site.
4. After the launch
    - Replace the protector on launch rail/wire.
    - Remove all igniter and other waste.
    - In summer, pour water on any hot or risk areas.
5. Debrief in the classroom
    - Leave waste in the fire bucket for a couple of hours before putting an external bin.
    - Don’t throw any waste in the bin until you are sure it will not catch fire.

36 Safety in physics/physical world

36.1 What should I do before an activity in Physics?

Prior to carrying out an activity, a teacher/kaiako should follow the five steps to managing health and safety risks:

- **Identifying hazards**: finding out what situations and things could cause death, injury or illness during the activity.
- **Assessing risks:** understanding the nature of the risk that could be caused by the hazard, what the consequences could be and the likelihood of it happening. It also involves considering the severity of consequences if a person is exposed to a hazard. The level of risk will increase as the likelihood of injury or illness or its severity increases.
- **Controlling risks:** implementing the most effective control measures that are reasonably practicable in the circumstances. The most effective way of controlling risks is to eliminate a hazard. If elimination is not reasonably practicable, then the risk must be minimised by doing one or more of the steps in the hierarchy of control measures.
- **Reviewing control measures:** ensuring control measures are working as planned. Controlling health and safety risks in the classroom is an ongoing process that needs to take into account changes in the classroom.
- **Revise controls**, if necessary.

36.2 What are the safety guidelines for practical activities involving electricity?

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, including isolating transformers and residual current devices (RCDs) 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 power tool agent and 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 accidents.

Teachers need to know how to deal appropriately with electric shock – how much current is too much? The key factor is the size of the current passing through the body. A current of 1 milliampere (mA) may cause a nasty jolt, but a current of 20 mA could be fatal.

A power pack with a maximum voltage of 15 volts (V) should not be able to deliver a fatal shock to a dry person.

It is recommended that students should not use any supply over 30 V.

However, a high-voltage supply with an output current limited to 5 mA may be used by teachers or by students following a risk assessment. Although the current from electrical devices may be small, some students are more sensitive than others, and it is possible that a heart pacemaker might be damaged.

36.2.1 Electrical equipment (mains powered)

Where possible, all circuits used by students should be protected by an RCD. The teacher needs to know where the circuit master switch is so that all sockets can be disconnected if necessary.

36.2.1.1 Capacitors

A high-grade capacitor can have a residual effect as high as 10% of its original potential difference (voltage). A discharge of 10 joules (J) can be a danger to life, and 0.25 J can give a shock. Therefore, complete discharge of the following, for example, could present a serious hazard:

- 0.2 microfarads (μF) charged to 10 000 V, or
- 2000 μF charged to 100 V.

High-grade capacitors should be stored and handled carefully; for example, by keeping them short-circuited when not in use, if they are ever connected to a high voltage.

36.2.1.2 Electrical leads

Plugs and sockets should be in serviceable condition, and leads should not be weakened by pulling on them. Where multiple connections are necessary, a power board should be used rather than piggybacking ‘tap-on’ plugs.

Power supplies should be fitted with a pilot light to indicate when they are connected to the mains. Socket switches should be turned off before any equipment is plugged in or unplugged. Electrical equipment should not be handled with wet hands or when standing on a wet surface.

The use of extension cords should be avoided wherever possible, but if they are needed, the two cables should be looped together before connection so that they cannot be pulled apart. Such leads should not trail across an area where people may walk. Any equipment used outside the classroom or laboratory should be connected through an RCD.

36.2.1.3 Electrostatic generators

Electrostatic generators contain capacitors. Van de Graaff generators can produce high voltages, but low currents and therefore should normally be safe. However, they may pose a risk to someone with a heart pacemaker. A Wimshurst machine can give a nasty shock – the knobs should be discharged before being touched.

36.2.1.4 High-voltage power supplies

Only units designed for school use and limited to 5 mA should be used.

36.2.1.5 Induction coils

The current should be limited to 5 mA

36.2.2 Electrical equipment (not mains powered)

36.2.2.1 Cells and batteries

Dry cells are useful for a range of experimental activities. Car or motorcycle wet cell batteries may be used following a risk assessment for demonstration only. However, great care should be taken because they can give a spark, the acid can spill, they are too heavy for many students to lift safely, and when recharging, they give off a flammable gas. The short-circuit current is sufficient to cause burns from hot wires.

Anyone cutting open a dry cell to investigate the structure should wear gloves. Alkaline manganese cells, button cells (for example, from a calculator or watch), and rechargeable cells should not be cut open.

Rechargeable cells can be used in equipment, but should not be used for investigating circuits. Rechargeable cells have a low internal resistance and can therefore give a high current if the resistance in the external circuit is small. They should be recharged only with a trickle charger at the correct rate, not with a power pack.

For more information, read the regulations on the WorkSafe website.

36.3 What are the safety guidelines for practical activities using lasers?

Schools should be using lasers that are intended only for use in schools/kura and obtained from a reputable supplier.

Schools should only use continuous-wave (CW) lasers that emit light in the visible spectrum, because the concentrated pulse of light from a pulsed laser can cause eye damage.

Although it is acceptable to use Class 1, Class 2, and Class 3A lasers, schools buying new equipment are advised to buy only Class 1 or 2 lasers.

Class 1 lasers, such as supermarket barcode readers, are low-powered.

Class 2 and Class 3A lasers may be used, provided the following precautions are taken:

- Lasers must be used under the strict supervision of the teacher, who is required to warn students not to look directly into the beam. Prolonged viewing is longer than 0.25 seconds, which is the time for the blink reflex.
- Students/ākonga should be positioned so that they cannot receive direct or indirect light from the laser, and they should maintain these positions. The beam should be either above or below eye level.
- People should avoid laser reflections coming towards their eyes from reflecting surfaces.
- The room in which the laser is used should be as brightly lit as possible so that the pupil of the eye is small.
- The laser should be positioned to ensure that nobody entering the room can walk into its beam. It should be securely mounted when in use so that a knock does not redirect the beam.
- In preparation, the laser should be run in a blacked-out room for a short time when no students are present so that the teacher can detect the presence of any stray reflections.
- If the laser is used on a benchtop, the students should be standing up so that they are looking down on the beam.
- When not in use, the laser should be turned off, or the beam should be terminated by a shutter mounted on the laser head. At other times, the laser should be locked away, or a key switch should be used to lock the high-voltage power supply. The laser should be stored securely so that it is accessible only to authorised staff.
- Appropriate laser hazard symbols should be placed both inside and outside the demonstration area and in locations giving access to the area.

For information on laser pointers, see the Ministry of Health website.

36.4 What are the safety guidelines for practical activities involving other light and sound apparatus?

36.4.1 Binoculars

Students/ākonga should never be permitted to look at the daytime sky using binoculars or a telescope in case they accidentally get the sun in their line of vision.

36.4.2 Strobe lamps

At certain frequencies, strobe lamps can trigger health problems in susceptible people. Those who are known to have epilepsy should not be present when there is this risk. Frequencies between 5 hertz (Hz) and 15 Hz should be avoided.

36.4.3 Sound

At certain frequencies, sound can trigger health problems. Frequencies below 40 Hz should be avoided.

A strobe lamp and sound below 40 Hz, should never be used at the same time.

Loud sound can induce hearing loss and can mask warning messages or signals. For the protection of hearing, an instantaneous sound should never exceed 115 decibels (acoustic) (dBA) unless all present have appropriate hearing protection, and the general

ambient sound over the school day should not exceed 70 dBA. For general health purposes, the ambient sound over the day should not exceed 55 dBA.

36.4.4 Ultraviolet light

Eyes can be seriously damaged by exposure to ultraviolet (UV) light. Lamps should be arranged so that it is not possible to look directly at them or at a reflection of their light. Lamps should have a hazard warning label pointing out the danger of looking directly at them.

36.5 What are the safety guidelines for practical activities involving ionising radiation?

Some old X-ray tubes still found in schools give dangerously high levels of radiation. Some cathode-ray tubes that operate on very high voltages (for example, tubes of the Maltese cross type) may produce X-rays. Devices such as gas discharge tubes, Maltese cross devices, and other similar apparatus operated at voltages above 5000 V are extremely hazardous.

Schools should take great care with any radioactive source; see the guidelines in Appendix 4 on substances prohibited for use in schools.

36.6 What are the safety guidelines for practical activities involving projectiles?

Safety glasses should be used when there is any possibility of projectile motion (rubber bands, pellets, spring-fired darts, paper darts, paper rockets, water rockets, centripetal force measurement, pressurised containers).

Centripetal acceleration experiments using a whirling mass balanced by a central gravity force must use strong, undamaged cord. The cord must be inspected before and after any use. The snapping of the cord while in use has the potential to do serious damage.

When using any sort of projectile, such as a water rocket, it is essential to ensure that nobody is in the line of fire or leaning over the projectile when it is being prepared. Safety glasses should be worn when projectiles, such as ball-bearings, are fired from a spring.

36.7 Old equipment

Although dismantling old equipment may be useful for investigating how things work, caution is required. Old refrigerators should not be pulled apart in such a way that there is any risk of the refrigerant escaping. Television tubes can store lethal charges. Equipment that contains electrical parts and vacuum tubes (for example, old television sets) needs to be handled with great care and should not be connected to a power source again after dismantling. Plugs should be cut off.

37 Safety in science in primary schools/kura tuatahi

Science in primary schools/kura tuatahi is generally very safe. There should be and usually are, few risks associated with science. However, as a precaution, teachers should read the relevant sections of this manual and check the safety of equipment before beginning any science lesson. Students need to be taught to use equipment safely, do activities safely, and avoid risks or manage them appropriately.

Acting responsibly includes acting with due regard for the safety of oneself and others. Safe classrooms are planned classrooms, with equipment, layout, and activities thought out before the lesson. Potential hazards can be identified and risks managed by elimination or appropriately minimised where it is not reasonably practicable to eliminate.

Students should be taught about safety issues and appropriate behaviours. It is important to discuss the safety aspects of an activity, such as the need to wash hands after working in practical science, and that students should never taste, smell, or touch substances unless they have been told to do so. Some general guidelines follow for teaching science safely. More detailed information is available and can be referred to in other parts of the document.

37.1 What should I do before an activity?

Prior to carrying out an activity a teacher/kaiako should follow the five steps to managing health and safety risks

- **Identifying hazards:** finding out what situations and things could cause death, injury or illness during the activity.
- **Assessing risks:** understanding the nature of the risk that could be caused by the hazard, what the consequences could be and the likelihood of it happening. It also involves considering the severity of consequences if a person is exposed to a hazard. The level of risk will increase as the likelihood of injury or illness or its severity increases.
- **Controlling risks:** implementing the most effective control measures that are reasonably practicable in the circumstances. The most effective way of controlling risks is to eliminate a hazard. If elimination is not reasonably practicable, then the risk must be minimised by doing one or more of the steps in the hierarchy of control measures.
- **Reviewing control measures:** ensuring control measures are working as planned. Controlling health and safety risks in the classroom is an ongoing process that needs to take into account changes in the classroom.
- **Revise controls**, if necessary.

37.2 What are the safety guidelines for equipment/activities in primary schools/kura tuatahi?

37.2.1 Animals

The use of animals is regulated by Animal Ethics regulations. Any use of animals in investigations may require ethics approval, and this should be applied for from the Animals Ethics Committee.

The 3Rs (Replacement, Reduction, Refinement) of animals ethics should be considered when deciding on the use of animals in the classroom. It is important that schools are aware of the laws surrounding what are considered animals and those which cannot be used, as indicated in the Animal Welfare Act 1999.

After working with animals, children should wash their hands.

37.2.1.1 Animal dissection

Information on animal dissection is in the Biology/Living World section.

37.2.2 Batteries

Information on batteries is in the section in Physics/Physical World.

37.2.3 Crystals

Ensure the reactants and products of the process are **suitable.** Information on hazardous substances is discussed in Section 17.

Take suitable precautions with hot water and heating equipment.

Wear safety glasses and ensure students do not rub their eyes; wash hands when finished. Store solutions in a safe place.

37.2.4 Dry ice

Gloves and safety glasses should be worn when handling dry ice. Dry ice will 'burn' skin if they come into contact.

37.2.5 Electrical equipment

Information on electrical equipment is in the section in Physics/ Physical World.

37.2.5.1 Electrical circuits

Care is needed when using electrical circuits and components.

Most circuits will run off low voltage batteries or power sources, so should not cause electrical shocks.

When using mains power packs, these too need be checked regularly for any faults or problems.

When using circuits, it is important to ensure no short circuits are produced as this can lead to heating of wires and possibly fires.

Batteries and wires should not be put away or stored connected together, due to the possibility of short circuits.
Button batteries can cause series health issues if ingested.

Before starting a unit with electrical circuits:

- Check all electrical wires to ensure they are not broken or unsafe.
- Check all circuit components are useable and not broken or damaged.

Batteries should be removed from appliances that are being stored, to avoid corrosion.

37.2.6 Food

Food and drink must not be used in laboratory spaces (that is where hazardous substances are used or stored; this includes reticulated gas for Bunsen burners).

Care must be taken when using and storing food substances at school.

Substances for consumption should be stored by themselves in a container labelled 'For Human Consumption.'

Any food substances that are to be used for general experiments must not be stored in the same container.

Measuring spoons and containers used for making food for consumption must be stored separately from general use utensils.

Plates and cutlery used for eating or serving food must be stored separately and, if reusable, must be washed and stored appropriately.

Care should be taken that children do not share utensils and that used utensils do not contaminate food sources.

General hygiene should be considered when eating any food made in the class.

Students should be taught how to correctly smell any substance.

Food allergies of students/ākonga must always be considered.

37.2.7 Glassware

Detailed information on glassware is in the section in Chemistry/Material World.

When students go outside to collect things, they should use appropriate plastic containers.

Normal glass cannot withstand dramatic changes in temperature as ovenware or Pyrex can. Substances should be heated in ceramic, metal, or ovenware glass containers. For example, small quantities could be heated in metal bottle tops.

37.2.8 Hazardous substances

Detailed information on hazardous substances is in Section 17. Hazardous substances should be kept in a locked area to which no students have access. They should be stored in clearly labelled, appropriate containers. Containers that would usually hold food, soft-drink bottles, or bottles with a shape that is familiar to students as a drinkable-liquid bottle, must not be used.

A list of substances with minimal risk that can be used in primary and intermediate schools is given in Section 37.2.14.

Teachers/kaiako need to be aware of the following:

- any acid, for example, vinegar, when mixed with household bleach, produces highly toxic chlorine gas.
- copper sulfate is poisonous, and students' access to it should be limited. Because it can also seriously damage eyes, students must have eye protection before they use it.
- burning plastics may give off poisonous, irritating vapours.
- methylated spirits, surgical spirits, and white spirits can be used as solvents.
- eye protection should always be used when using hazardous substances.
- hands must always be washed after using hazardous substances.
- if hazardous substances must be smelled, the vapour should be waved towards the nose with a hand. A direct sniff of the substance should not be taken.
- only small quantities of hazardous substances should be used.
- spoons or spatulas should be used to handle hazardous substances.

37.2.9 Heating substances

Heat should be used only under teacher/kaiako supervision. Safety glasses should be worn. The best sources of heat for primary schools are:

- candles that cannot tip over, which should be placed in an appropriate flat container
- electric hot plates
- ovens
- hairdryer, but not hot-air paint strippers
- hot water (stored energy)
- the sun.

37.2.10 Lasers

Detailed information is available in the section in Physics/Physical World.

- Ensure all lasers are of the appropriate strength for use in classrooms.
- Never allow lasers to be pointed in the eyes of any person or animal.

37.2.11 Microorganisms

Detailed information on microorganisms is available in the section in Biology/Living World.

37.2.12 Plants

Detailed information on using plants is available in the section in Biology/Living World.

37.2.13 Thermometers

Detailed information on thermometers is available in the section in Chemistry/Living World.

37.2.14 Substances with minimal risk

The following substances may be used in a primary and intermediate school classroom with minimal risk:

- alum (aluminium potassium sulfate)
- baking powder
- baking soda (sodium bicarbonate)
- carbonated drinks
- chalk (calcium carbonate)
- charcoal
- citric acid
- common Salt (sodium chloride)
- cream of tartar (tartaric acid)
- detergent (dishwash liquid)
- Epsom salts (magnesium sulfate)
- food colouring
- glycerine
- litmus paper
- oils – vegetable
- petroleum jelly
- plaster of Paris (calcium sulfate)
- soap
- sour milk (contains lactic acid)
- steel wool
- sugar (sucrose)
- tartaric acid
- tea (contains tannic acid)
- vinegar (contains acetic acid)
- vitamin C (ascorbic acid)
- washing soda (sodium carbonate).

Appendix 1 – Laboratory/taiwhanga guidance for Person conducting a business or undertaking (PCBUs)

PCBUs must:

- ensure that any approved hazardous substance is handled, packaged, and stored in the laboratory in the same way in accordance with Regulation 18.9
- ensure that any room (including preparation rooms and storage areas) in which a hazardous substance is used or stored is compliant with the Regulations.
- ensure that any unapproved substance is handled, packaged, and stored in the laboratory in accordance with Regulation 18.10
- ensure that any hazardous substances are disposed of as set out in the Hazardous Substances (Disposal) Notice 2017 and in accordance with the Regulations
- make themselves familiar with the Regulations and develop appropriate mechanisms and processes to meet the requirements for their laboratories and activities.
- ensure, so far as is reasonably practicable, that the laboratory, the means of entering and exiting the laboratory, and anything arising from the laboratory is without risks to the health and safety of any person including students, workers, visitors, and the general public.
- engage with workers/kaimahi on health and safety matters that may, or are likely to directly, affect them so far as is reasonably practicable.
- have worker participation practices that give workers reasonable opportunities to participate effectively in improving health and safety on an ongoing basis.
- ensure that appropriate risk mitigation and controls are in place to manage the risks associated with hazardous substances, including ensuring competencies and security controls are in place to limit access to the laboratory to authorised individuals only after hours or when there is limited supervision.
- define the vehicle, room, building or structure which meets the definition of a laboratory and therefore is subject to the Regulations.
- define their laboratory footprint and site boundaries to ensure signage is in appropriate locations, including all entrances to the laboratory.
- establish controls/procedures to protect cleaning and maintenance personnel from harm associated with the hazardous substances.
- develop a competency framework for authorised persons to access a laboratory without the direct supervision of a laboratory manager or their delegate. This competency framework needs to be commensurate with the activities which they will be undertaking and the skills required (for example, relief teachers, cleaners, contractors).

Relevant parts of the Regulations
This Section should be read in conjunction with: • Parts 2 to 8 • Parts 9 to 13 • Part 18

Appendix 2 – Standards, Acts, Regulations and Rules

Standards

AS 1940-2017 The storage and handling of flammable and combustible liquids

AS 2714-2008 The storage and handling of organic peroxides

AS 3780-2008 The storage and handling of corrosive substances

AS/NZS2982:2010 Laboratory Design and Construction

AS/NZS2243.1:2005 Safety in Laboratories. Part 1: Planning and operational aspects

AS/NZS2243.2:2006 Safety in Laboratories. Part 2: Chemical aspects

AS/NZS2243.8:2014 Safety in Laboratories. Part 8: Fume cupboards

AS/NZS2243.10:2004 Safety in Laboratories. Part 10: Storage of chemicals.

AS/NZS 4452:1997 The storage and handling of toxic substances

AS/NZS 60079.10.1:2009 Classification of areas – Explosive gas atmospheres, especially ZA.7.3 Fume cupboards and laboratories; ZA 9.2.2.9 Laboratories.

Acts, Regulations and Rules

Health and Safety at Work Act 2015

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

Health and Safety at Work (Worker Engagement, Participation, and Representation) Regulations 2016

Health and Safety at Work (Hazardous Substances) Regulations 2017

Hazardous Substances and New Organisms Act 1996

Hazardous Substances (Hazard Classification) Notice 2020

Hazardous Substances (Disposal) Notice 2017

Hazardous Substances (Hazardous Properties Controls) Notice 2017

Fire and Emergency New Zealand (Fire Safety, Evacuation Procedures, and Evacuation Schemes) Regulations 2018

Electricity (Safety) Regulations 2010

Land Transport Rule: Dangerous Goods 2005: Rule 45001/1

Note:
A number of these documents have been amended and these amendments should be checked for relevance.

Appendix 3 –Examples of the classification for aqueous solutions of corrosives

Sodium hydroxide	Sulfuric acid	Hydrochloric acid	Nitric acid
>5%	>10%	>25%	65-70%
Acute toxicity: oral (cat 4) (6.1D) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1B)(8.2B) Serious eye damage (cat 1)(8.3A)	Acute toxicity: inhalation (Cat 4)(6.1D) Carcinogenicity (cat 1)(6.7A) Target organ toxicity (cat 1)(6.9A) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1B)(8.2B) Serious eye damage (cat 1)(8.3A)	Acute toxicity: inhalation (Cat 2)(6.1B) Acute toxicity: oral (Cat 4)(6.1D) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1B)(8.2B) Serious eye damage (cat 1)(8.3A) Aquatic toxicity (Cat 3) (9.1D)	Oxidising liquid (cat 3)(5.1.1C) Acute toxicity: inhalation (Cat 4)(6.1D) Target organ toxicity (cat 2)(6.9B) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1B)(8.2B) Serious eye damage (cat 1)(8.3A) Aquatic toxicity (Cat 3) (9.1D)
>2–5%	5–10%	>10–25%	>10–<65%
Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1C)(8.2C) Serious eye damage (cat 1)(8.3A)	Target organ toxicity (cat 2)(6.9B) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1C)(8.2B)	Acute toxicity: oral (Cat 4)(6.1D) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1B)(8.2B)	Acute toxicity: inhalation (Cat 4)(6.1D) Target organ toxicity (cat 2)(6.9B) Corrosive to metals (cat 1) (8.1A)

	Serious eye damage (cat 1)(8.3A)	Serious eye damage (cat 1)(8.3A)	Skin corrosion (cat 1B)(8.2B) Serious eye damage (cat 1)(8.3A)
0.5–2%	0.5–5%	>2–10%	0.5–10%
Skin irritation (cat 2)(6.3A) Eye irritation (cat 2)(6.4A)	Skin irritation (cat 2)(6.3A) Eye irritation (cat 2)(6.4A) Corrosive to metals (cat 1) (8.1A)	Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1C)(8.2C) Serious eye damage (cat 1)(8.3A)	Target organ toxicity (cat 2)(6.9B) Corrosive to metals (cat 1) (8.1A) Skin corrosion (cat 1C)(8.2C) Serious eye damage (cat 1)(8.3A)
		0.5–2%	
		Skin irritation (cat 2)(6.3A) Eye irritation (cat 2)(6.4A)	

Appendix 4 – Substances prohibited for use in schools/kura

Chemical Name	CAS Number	HSNO Hazard Classification*
2,4-dinitrophenylhydrazine	119-26-6	4.1.1B 6.1C 9.3C
1, 2 dibromoethane	106-93-4	6.1C 6.3A 6.4A 6.7A 9.1B 9.3A
1,2 dichloroethane	107-06-2	3.1B 6.1C 6.3A 6.4A 6.5B 6.6B 6.7B 6.9B 9.1D 9.3B
1,4 dichlorobenzene	106-46-7	6.1E 6.3A 6.4A 6.7B 6.9B 9.1A
Acid green 16 (biological stain)	12768-78-4	61D 6.6B 9.1A 9.3C
Acid green 50 (biological stain)	3087-16-9	6.1D 6.3A 6.4A 9.3C
Aniline	62-53-3	3.1D 6.1C 6.3A 6.5B 6.6A 6.7B 6.9A 8.3A 9.1A 9.3B
Antimony (and its compounds)		
Aromatic amines		
Arsenic and its compounds (except when in commercially available water test kits)		
Asbestos (except in mineral form in a sealed container)		
Auramine (biological stain)	2465-27-2	6.1D 6.4A 6.7B 9.1B 9.3C
Benzene	71-43-2	3.1B 6.1B 6.3A 6.4A 6.6A 6.7A 6.8A 6.9A 9.1D 9.3C

Chemical Name	CAS Number	HSNO Hazard Classification*
Benzidene	92-87-5	Not approved
Benzoyl peroxide	94-36-0	5.2B 6.4A 6.5B 9.1D
Bismuth and its compounds		
Bromoethane	74-96-4	3.1B 6.1D 6.7B
Cadmium and its compounds		
Carbon disulphide	75-15-0	3.1B 6.1C 6.3A 6.4A 6.6B 6.8A 6.9A 9.1D 9.3C
Carbon tetrachloride	56-23-5	6.1B 6.3A 6.4A 6.7B 6.9A 9.1C 9.3B
Chlorates and perchlorates		
Chloroform (use dichloromethane in its place)	67-66-3	6.1D 6.3A 6.4A 6.7B 6.8B 6.9A 9.1D 9.3B
Chromic acid	7738-94-5	5.1.1B 6.1D 6.5A 6.5B 6.6A 6.7A 6.8B 8.1A 8.2B 8.3A 9.1A 9.2B 9.3B
Coal tar and crude petroleum (except in sealed containers)		
Congo red (3-5)	573-58-0	6.7A 6.8B
Cyanides		
Dianisidine	119-90-4	Not approved
Di-chloroethylene	107-06-2	3.1B 6.1C 6.3A 6.4A 6.5B 6.6B 6.7B 6.9B 9.1D 9.3B

Chemical Name	CAS Number	HSNO Hazard Classification*
Ethidium bromide	1239-45-8	6.1A 6.3A 6.4A 6.6B 9.3B
Explosives, including fireworks		
Formaldehyde (unless in a sealed container, for the purposes of biological preservation)	50-00-0	3.1C 6.1B 6.5B 6.6B 6.7A 6.9B 8.2C 8.3A 9.1D 9.2A 9.3B
Hydrofluoric acid	7664-39-3	6.1C 6.9A 8.1A 8.2C 8.3A 9.3B
Magenta I (biological stain)		
Mercury	7439-97-6	6.1B 6.5B 6.8A 6.9A 8.1A 9.1A 9.2B 9.3A
Mercury (I) chloride	10112-91-1	6.1D 6.3A 6.4A 9.1A 9.3C
Mercury (II) chloride	7487-94-7	6.1B 6.9A 8.2C 8.3A 9.1A 9.3A
Mercury (II) nitrate	10045-94-0	6.1B 6.9A 9.1D 9.3A
Naphthalene	91-20-3	4.1.1B 6.1D 6.3B 6.4A 6.7B 6.9A 9.1A 9.3B
Nitrobenzene and related compounds	98-95-3	6.1C 6.7B 6.8B 6.9A 9.1B 9.3B
Paris green (biological stain)	82-94-0	6.1D
Perchloric acid	7601-90-3	5.1.1A 6.1D 6.8C 6.9A 8.1A 8.2A 8.3A 9.1D 9.3B
Phenols and phenolic compounds (Except those listed in Appendix 6)		

Chemical Name	CAS Number	HSNO Hazard Classification*
Phenylthiocarbamide (PTC) and phenylthiourea (PTU) papers and solutions		
Phosphorus (white)	12185-10-3	4.2A 6.1A 8.2A 9.1A 9.3A
Phosphorus (red)	7723-14-0	4.1.1B 6.1D 6.9A 9.1C
Picric acid	88-89-1	1.1D 6.1C 6.3B 6.5B 6.9B 8.3A 9.1D 9.3B
Polyacrylamide	9003-05-8	
Potassium	7440-09-7	4.3A 8.2B 8.3A 9.1C
Prussic acid	74-90-8	6.1A 6.3A 6.4A 6.5A 6.5B 6.8B 6.9A 9.1A 9.2A 9.3A 9.4A
Pyridine	110-86-1	3.1B 6.1D 6.3A 6.7B 6.9B 8.3A 9.1C 9.3C
Radioactive materials (apart from those specifically mentioned below**)		
Sudan IV (biological stain)	85-83-6	

* A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority website.

** Radioactive substances: schools may use sealed radioactive materials prepared for the purposes of instruction or demonstration. However, there are limitations.

When the radioactive source is not in use, keep it in a locked cupboard with the standard radioactive-warning symbol on the outside. When radioactive sources are no longer required, send them to the National Centre for Radiation Science. Contact them for advice about transportation requirements.

The following sealed radioactive materials are the only ones permitted.

- The nuclides sodium-22, cobalt-6O, strontium-90, caesium-137, and thallium-204 in activities not exceeding 1 megabecquerel in each source.
- The nuclides polonium-210, radium-226, thorium-232, uranium-238, plutonium-239, and americium-241 in activities not exceeding 0.3 megabecquerel (1 Bq = 1 disintegration/s).

Radioactive materials other than those listed above require a licence from the National Centre for Radiation Science. They will consider applications from schools and in some cases may approve a restricted licence.

Contact address for information and advice:

Postal address: National Centre for Radiation Science, Christchurch Science Centre, PO Box 29181, Fendalton, Christchurch 8540
Telephone: (03) 351 6019
Email: ncrs@esr.cri.nz

Appendix 5 –Substances with greater hazardous nature than educational utility

We recognise these substances have some educational use; however, we suggest that they should be substituted if possible.

Chemical Name	CAS Number	HSNO Hazard Classification*
Acrylonitrile	107-13-1	3.1B 6.1B 6.3A 6.4A 6.5B 6.7A 6.8B 6.9A 9.1B 9.2A 9.3A
Ammonium chromate	7788-98-9	6.5B 6.7A 9.1A
Ammonium dichromate	7789-09-5	5.1.1B 6.1B 6.5A 6.5B 6.6A 6.7A 6.8AB 6.9A 8.2C 8.3A 9.1A 9.2B 9.3B
Aniline hydrochloride	142-04-1	6.1D 6.7B 6.9A 9.1A 9.3C
Anthracene	120-12-7	6.1D 6.3A 6.4A 6.5A 6.5B 9.1B
Ascarite II	N/A	8.2C 8.3A
Bromine (vials)	7726-95-6	6.1A 8.2A 8.3A 9.1A
Calcium cyanide	592-01-8	5.1.1C 6.1D 6.3B 9.3B
Chloral hydrate	302-17-0	6.3A 6.4A
Chlorine	7782-50-5	5.1.2A 6.1A 6.9A 8.1A 8.2A 8.3A 9.1A 9.2A
Chloropromazine	50-53-3	Not approved
Chromium hexavalent compounds	N/A	N/A
Chromium trioxide (chromic)	1333-82-0	5.1.1B 6.1B 6.5A 6.5B 6.6A 6.7A 6.8A 6.9A 8.1A 8.2A 8.3A 9.1A 9.2B 9.3B

Chemical Name	CAS Number	HSNO Hazard Classification*
Dimethylaniline	121-69-7	6.1C 6.7B 9.1B 9.3B
1,4-Dioxane	123-91-1	3.1B 6.1D 6.3B 6.4A 6.7A 6.9B 9.3C
Ethylene oxide	75-21-8	2.1.1A 6.1C 6.3A 6.4A 6.5A 6.5B 6.6A 6.7A 6.8A 6.9A 9.1D 9.2D
Hexachlorophene	70-30-4	
Hydrobromic acid	10035-10-6	6.1B 6.9A 8.1A 8.2B 8.3A 9.3C
Hydrogen	1333-74-0	2.1.1A
Hydriodic acid	10034-85-2	6.1B 6.9A 8.1A 8.2B 8.3A 9.3C
Lead arsenate	7784-40-9	6.1B 6.6B 6.7A 6.9A 9.1A 9.1B 9.3A
Lead carbonate	598-63-0	6.1D 6.8A 6.9B 9.1A 9.3C
Lead (VI) chromate	7758-97-6	6.6A 6.7B 6.8A 6.9B 9.1A
Osmium tetroxide	20816-12-0	6.1A 8.2C8.3A
Methyl iodide (iodomethane)	74-88-4	6.1B 6.3A 6.4A 6.7B 9.1A 9.3B

Chemical Name	CAS Number	HSNO Hazard Classification*
Methyl methacrylate	80-62-6	3.1B 6.1D 6.3B 6.4A 6.5B 6.9B 9.1D
Methyl orange	547-58-0	6.1C 9.3B
Methyl red	493-52-7	6.7B
Nickel, metal	7440-02-0	6.5B 6.7B 9.1A 9.2C
Nickel oxide	1314-06-3	6.5B 6.7A 9.1D
Nicotine	45-11-5	6.1B 9.1B 9.3A
Phosphorus pentoxide	1314-56-3	8.2B 8.3A
Phthalic anhydride	85-44-9	6.1D 6.3A 6.5A 6.5B 6.8B 8.3A 9.3C
Potassium chromate	7789-00-6	6.3A 6.4A 6.5B 6.6A 6.7A 9.1A
Potassium dichromate	7778-50-9	5.1.1B 6.1A 6.5A 6.5B 6.6A 6.7A 6.8A 6.9A 9.1A 9.2B 9.3A
Potassium oxalate	583-52-8	6.1D 9.3C
Potassium sulfide	1312-73-8	4.2B 8.2C 8.3A 9.1A
Selenium	7782-49-2	6.1B 6.6B 6.9B 9.1C 9.3C
Silver cyanide	506-64-9	6.1C 6.4A 9.3B
Silver oxide	20667-12-3	5.1B 6.1D 9.1A 9.3C

Chemical Name	CAS Number	HSNO Hazard Classification*
Sodium arsenate	7778-43-0	6.1C 6.7A 9.1D 9.3B
Sodium arsenite	7784-46-5	6.1C 6.7A 9.1D 9.3B
Sodium azide	26628-22-8	6.1B 9.1A 9.3A
Sodium chromate	7775-11-3	6.1B 6.3A 6.5B 6.6A 6.7A 8.3A 9.1A 9.3A
Sodium cyanide	143-33-9	6.1A 6.3B 6.4A 6.5B 6.8B 6.9A 8.1A 9.1A 9.2A 9.3A 9.4A
Sodium thiocyanate	540-72-7	6.1D 6.5B 9.1B 9.3B
Stannic chloride (anhydrous)	7646-78-8	8.2C 8.3A 9.1C
Strontium	7440-24-6	4.2A
Strontium nitrate	10042-76-9	5.1.1C 6.1D 6.3A 6.4A 6.9B 9.1A 9.3C
Sulfuric acid, fuming	8014-95-7	6.1A 6.7A 6.9A 8.1A 8.2A 8.3A 9.1D
Tannic acid	1401-55-4	6.1E 6.4A 9.1C
Tetrabromoethane	79-27-6	6.1B 6.4A

Chemical Name	CAS Number	HSNO Hazard Classification*
Thioacetamide	62-55-5	6.1D 6.3A 6.4A 6.7B 9.1C 9.3C
Thiourea	62-56-6	6.1C 6.3A 6.4A 6.5B 6.8B 6.9B 9.1B 9.3B
Titanium trichloride	7705-07-9	6.1E 8.2C 8.3A
Titanium tetrachloride	7550-45-0	8.2C, 8.3A
o-Toluidine	95-53-4	6.1B 6.4A 6.7B 9.1A
Uranyl acetate	541-09-3	
Urethane	51-79-6	6.6B 6.7B
Wood's metal	8049-22-7	

* A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority website.

Appendix 6 – Substances with a hazardous nature, but with potential educational utility

These substances should be removed from the schools/kura if alternatives can be used. For those that must be retained, amounts should be kept to a minimum.

Risk assessment must be carried out; with consideration of the teacher/kaiako experience, students/ākonga in the class, space and layout of the class, availability of personal protective equipment (PPE). Demonstrations should be considered if necessary, to manage risks.

Safe method of use (SMU) must be read before handling these substances, and be available for quick access if needed during the time the substance is being used. The SMU must contain key information from the safety data sheet (SDS).

Chemical Name	CAS Number	HSNO Classification*
1-Iodobutane	542-69-8	3.1C
1 Chlorobutane	109-69-3	3.1B 6.1E 6.3B 6.4A
1,6 Di-amino hexane	124-09-4	6.1D 6.9B 8.2C 8.3A 9.1D 9.2B 9.3B
1-Chloro-2- methylpropane	513-36-0	3.1B
1,2-Ethanediol (ethylene glycol)	107-21-1	6.1D 6.4A 6.9A 9.3C
2-Methyl butan-2-ol (tert-amyl alcohol)	75-85-4	3.1B 6.1D 9.3C
2-Methylpropan-1-ol (iso-butyl alcohol)	78-83-1	3.1C 6.1E 6.3B 6.4A
2-Methylpropan-2-ol (tert-butyl alcohol)	75-65-0	3.1B 6.1E 6.3B 6.4A
Acetamide (ethanamide)	60-35-5	6.7B
Acetic acid (ethanoic acid)(>80% aqueous solution)	64-19-7	3.1C 6.1D 6.9B 8.1A 8.2B 8.3A 9.1D 9.3C
Acetic orcein	not found	6.1D 6.9B 8.1A 8.2B 8.3A 9.1D 9.3C
Acetone	67-64-1	3.1B 6.1E 6.3B 6.4A

Chemical Name	CAS Number	HSNO Classification*
Acetyl chloride (ethanoyl chloride)	75-36-5	3.1B 6.1D 8.1A 8.2B 8.3A 9.1D 9.3C
Acramine yellow	none	6.1C 6.3A 6.4A 6.9B 9.3B
Aluminium chloride	7446-70-0	6.1D 8.1A 8.2B 8.3A 9.1B 9.3B
Aluminium nitrate	13473 -90-0	5.1.1C 6.1D 6.3B 6.4A 6.8B 9.1B 9.3C
Aluminium potassium sulphate	10043-67-1	6.1D 6.3A 6.4A 8.1A 9.1D 9.3C
Aluminium powder	7429-90-5	4.1.1A
Aluminium sulfate	10043-01-3	6.1D 6.3A 6.4A 8.1A 9.1B 9.3C
Aluminium turnings	7429-90-5	4.3C
Ammonia (.89)	1336-21-6	6.1D 8.1A 8.2B 8.3A 9.1A 9.3B
Ammonium acetate	631-61-8	6.3B 6.4A
Ammonium bromide	12124-97-9	6.1E 9.1D
Ammonium carbonate	506-87-6	6.1E 6.3B 6.4A
Ammonium chloride	12125-02-9	6.1D 6.3B 6.4A 8.1A 9.1C 9.3C
Ammonium dihydrogen phosphate	7722-76-1	6.3B 6.4A
Ammonium iodide	12027-06-4	6.1E 6.3A 6.4A
Ammonium iron (II) sulfate	10045-89-3	6.3A 6.4A
Ammonium iron III citrate (ferric)	1185-57-5	6.3B 6.4A
Ammonium molybdate	12027-67-7	6.9B
Ammonium nitrate	6484-52-2	5.1.1C 6.1E 6.4A 9.1D
Ammonium oxalate	1113-38-8	6.1D 9.3B

Chemical Name	CAS Number	HSNO Classification*
Ammonium persulfate	7727-54-0	5.1.1C 6.1D 6.3A 6.4A 6.5A 6.5B 6.9B 9.1D 9.3C
Ammonium sulfate	7783-20-2	6.1D 9.1D 9.3C
Ammonium thiocyanate	1762-95-4	6.1D 9.1C 9.3B
Ammonium thiosulphate	7783-18-8	6.1D
Ammonium vanadate	7803-55-6	6.1B 6.4A 9.3A
Amyl acetate (isoamyl acetate)	123-92-2	3.1C 6.3B 6.4A 9.1D
Amyl alcohol	75-85-4	3.1B 6.1D 9.3C
Ascorbic acid	50-81-7	6.3B 6.4A
Barium acetate	543-80-6	6.1D 9.3C
Barium carbonate	513-77-9	6.1D 9.3C
Barium chloride	10361-37-2	6.1C 9.3B
Barium hydroxide (anhydrous)	17194-00-2	6.1D 8.2A 8.3A 9.3B
Barium nitrate	10022-31-8	5.1.1B 6.1D 6.3B 6.4A 6.9B 9.3B
Benzaldehyde	100-52-7	3.1C 6.1D 6.3B 6.5B 9.1D 9.2D 9.3C
Benzoic acid	65-85-0	6.1D 6.4A 6.9B 9.3C
Boric acid	10043-35-3	6.1E 6.3B 6.4A 6.8B 9.1D
Bromine (water)	7726-95-6	6.1A 8.2A 8.3A 9.1A
Bromobutane (n-Butyl bromide)	109-65-9	3.1B 6.1E 9.1C
Bromocresol Green (3.8-5.4)	76-60-8	No information found

Chemical Name	CAS Number	HSNO Classification*
Bromophenol blue	115-39-9	No information found
Bromothymol blue (6.0-7.6)	76-59-5	No information found
Butan-1-ol (n-Butanol)	71-36-3	3.1C 6.1D 6.3A 8.3A 9.3C
Butane-2-ol(sec-Butyl alcohol)	78-92-2	3.1C 6.1E 6.4A
Butanoic acid (n-Butyric acid)	107-92-6	8.2C 8.3A
Butoxybutane	142-96-1	3.1C 6.1E 6.3A 6.4A 9.1C
Calcium (metal) granular	7440-70-2	4.3B 6.1E 6.3A 6.4A
Calcium acetate (ethanoate)	62-54-4	6.1E
Calcium carbide (CaC_2)	75-20-7	4.3A 6.3A 8.3A
Calcium chloride (anhydrous)	10043-52-4	6.1D 6.3A 6.4A 9.3C
Calcium chloride (dihydrate)	10035-04-8	6.1D 6.3A 6.4A 9.3C
Calcium hydroxide	1305-62-0	8.2C 8.3A 9.1D
Calcium hypochlorite (bleaching powder)	7778-54-3	5.1.1C 6.1D 8.1A 8.2C 8.3A 9.1A 9.2A 9.3C
Calcium nitrate (anhydrous)	10124-37-5	5.1.1C 6.1D 6.3B 9.3B
Calcium nitrate tetrahydrate	13477-34-4	6.1D 8.3A 9.3C
Calcium oxide	1305-78-8	8.2C 8.3A 9.1D
Camphor	79-92-5	4.1.1B 8.3A 9.1A
Carbon (activated)	7440-44-0	4.2C

Chemical Name	CAS Number	HSNO Classification*
Carbon (charcoal)	7440-44-0	4.2C
Carbon powder (coarse)	7440-44-0	4.2C
Carbon powder (fine)	7440-44-0	4.2C
Carbon powder (graphite)	7440-44-0	4.2C
Carbon dioxide (dry ice)	124-38-9	Not classified
Carmine	1390-65-4	6.5A 6.5B
Chromium (III) chloride	10025-73-7	6.1A 9.1A 9.3B
Chromium (III) potassium sulfate (chromic)	7788-99-0	6.3A 6.4A
Chromium sulfate	10101-53-8	Not hazardous
Citric acid	77-92-9	6.1E 6.3B 8.3A
Clove oil	8000-34-8	6.1D 6.3A
Coal	7440-44-0	4.2C
Cobalt (II) chloride	7646-79-9	6.1C 6.3B 6.4A 6.5A 6.5B 6.7B 6.8B 6.9A 9.1B 9.3B
Cobalt (III) oxide	1308-06-1	6.5B 6.7B
Cobalt sulfate	10124-43-3	6.1D 6.3A 6.4A 6.5A 6.5B 6.7B 6.8B 6.9A 9.1A 9.3B
Copper (I) chloride	7758-89-6	6.1D 9.1A 9.3C
Copper (I) oxide (cuprous)	1317-39-1	6.1D 6.4A 6.9B 9.1A 9.3B
Copper (II) carbonate (cupric)	12069-69-1	6.1D 6.4A 6.5B 6.9B 9.1A 9.3B
Copper (II) chloride (cupric)	7447-39-4	6.1B 6.3B 6.4A 6.5B 6.9B 9.1A 9.2D 9.3A

Chemical Name	CAS Number	HSNO Classification*
Copper (II) nitrate	3251-23-8	5.1.1B 6.1D 6.5A 6.8B 6.9A 8.2C 8.3A 9.1A 9.3B
Copper (II) oxide	1317-38-0	6.1D 6.4A 6.9B 9.1A 9.3C
Copper (II) sulfate	7758-99-8	6.1D 6.3A 6.4A 6.9B 9.1A 9.3C
Copper foil	7440-50-8	6.4A 6.5B 6.6A 6.9B 9.1A
Copper powder	7440-50-8	6.1B 6.4A 6.5B 6.6A 6.9B 9.1A 9.2D 9.3A
Copper turnings	7440-50-8	6.4A 6.5B 6.6A 6.9B 9.1A
Cresol red (0.1-2.8)	1733-12-6	8.1A
Cyclohexane	110-82-7	3.1B 6.1D 6.3B 9.1B 9.3C
Cyclohexanone	108-94-1	3.1C 6.1C 6.4A 9.2B 9.3C
Cyclohexene	110-83-8	3.1B 6.1D 6.3B 9.1B 9.3C
Cyclohexylamine	108-91-8	3.1C 6.1B 6.5B 6.6B 6.8B 6.9A 8.2B 8.3A 9.1D 9.3A
D-Fructose	57-48-7	Not hazardous
D-Galactose	59-23-4	Not hazardous
Dextrose	50-99-7	Not hazardous
Di Ammonium hydrogen ortho phosphate	7783-28-0	6.1E 6.3A 6.4A 9.1D
Di-amino ethane	107-15-3	3.1C 6.1C 6.5A 6.5B 8.2B 8.3A 9.1D 9.3B
Diatase (Pancreatin)	8049-47-6	6.3A 6.4A 6.5A 6.5B
Di-chlorofluorescein	76-54-0	No hazards determined
Di-chloromethane	75-09-2	6.1D 6.3A 6.4A 6.7B 6.9B 9.3C
Di-methyl-glyoxime	95-45-4	6.1D

Chemical Name	CAS Number	HSNO Classification*
di-potassium hydrogen phosphate	7758-11-4	6.1D 9.3C
Dodecan-1-ol	112-40-3	3.1D
EDTA disodium salt ethylenediamine acetic acid	139-33-3	6.1E 6.3B 6.4A
Eosin (2-3.5)	17372-87-1	6.4A
Eriochrome black T	1787-61-7	6.4A 9.1B
Ethanamide	60-35-5	6.7B
Ethane-diol	107-21-1	6.1D 6.4A 6.9A 9.3C
Ethanoic acid (acetic acid)	64-19-7	3.1C 6.1D 6.9B 8.1A 8.2B 8.3A 9.1D 9.3C
Ethanol 100%	64-17-5	3.1B 6.4A
Ethanol 95%	64-17-5	3.1B 6.4A
Ethyl acetate (see ethyl ethanoate)		
Ethyl ethanoate (acetate)	141-78-6	3.1B 6.1E 6.4A 6.9B
Ethylamine	75-04-7	2.1.1A 6.1C 6.9A 8.2B 8.3A 9.1D 9.3B
Fluorescein	2321-07-5	6.1E 6.5B
Formic acid (methanioc acid)	64-18-6	3.1C 6.1C 8.1A 8.2B 8.3A 9.1D 9.3C
Fuchsin (Rosaniline hydrochloride)	632-99-5	6.7B
Gentian violet (crystal violet, methyl violet)	548-62-9	6.1C 6.3B 8.3A 9.1A 9.3B
Giemsa's stain	51811-82-6	6.1D 9.3C

Chemical Name	CAS Number	HSNO Classification*
Glass wool	none	Not hazardous
Glucose	50-99-7	Not hazardous
Glycerol	56-81-5	Not hazardous
Heptan-1-ol	111-70-6	3.1D 6.4A 9.1D
Hexane	110-54-3	3.1B 6.1E 6.3B 6.4A 6.9A 9.1B
Hexanoic acid	142-62-1	8.2C 8.3A
Hydrochloric acid	7647-01-0	6.1B 8.1A 8.2B 8.3A 9.1D 9.3C
Hydrogen (compressed)	1333-74-0	2.1.1A
Hydrogen peroxide 100 vol	7722-84-1	5.1.1A 6.1D 6.9B 8.2A 8.3A 9.1D 9.3B
Indigo carmine (C.I. Acid blue 74)	860-22-0	6.1D 6.4A 6.5A 6.5B 6.6B 9.1D 9.3C
Iodine	7553-56-2	6.1D 6.5B 6.9B 8.2C 8.3A 9.1A 9.3C
Iodine (vials)	7553-56-2	6.1D 6.5B 6.9B 8.2C 8.3A 9.1A 9.3C
Iron (II) ammonium sulfate (ferrous)	10045-89-3	6.3A 6.4A
Iron (II) sulfate	7782-63-0	6.1D 6.3A 6.4A 9.1D 9.3C
Iron (II) sufide (ferrous)	1317-37-9	No hazards determined
Iron (III) ammonium sulphate (anhydrous)	10138-04-2	6.1E
Iron (III) chloride (ferric)	7705-08-0	6.1D 6.3A 8.3A 9.1C 9.3B
Iron (III) nitrate (ferric)	10421-48-4	5.1.1C 6.1D 6.3B 6.4A 9.3C
Iron (III) oxide (ferric)	1309-37-1	6.4A
Iron (III) sulfate	10028-22-5	6.1D

Chemical Name	CAS Number	HSNO Classification*
Iron filings	7439-89-6	Not hazardous
Iron sand	none	Not hazardous
Iron turnings	7439-89-6	Not hazardous
Iron wool	7439-89-6	Not hazardous
Kerosene	8008-20-6	3.1C 6.1E 6.3B 9.1B
Lavender oil	8000-28-0	6.1E 6.4A
Lead	7439-92-1	6.1C 6.6B 6.7B 6.8A 6.8C 9.1A 9.3B
Lead (II) bromide	10031-22-8	6.1D 6.8A 6.9B 9.1A 9.3C
Lead (II) oxide (litharge, yellow lead)	1317-36-8	6.1D 6.8A 6.9B 9.1A 9.3C
Lead (II/IV) oxide (red lead)	1314-41-6	5.1.1C 6.1C 6.7B 6.8A 6.9A 9.1A 9.3A
Lead (IV) oxide	1309-60-0	5.1.1C 6.1C 6.7B 6.8A 6.9A 9.3A
Lead (II) carbonate	598-63-0	6.1D 6.8A 6.9B 9.1A 9.3C
Lead (II) chloride	7758-95-4	6.1D 6.8A 6.9B 9.1A
Lead acetate (ethanoate)	301-04-2	6.1C 6.4A 6.6B 6.7B 6.8A 6.8C 6.9A 9.1A 9.3B
Lead nitrate	10099-74-8	5.1.1B 6.1C 6.3B 6.4A 6.6B 6.7B 6.8A 6.8C 6.9A 9.1A 9.3B
Lithium	7439-93-2	4.3A 6.8A 8.2B 8.3A 9.1C 9.2C
Lithium carbonate	554-13-2	6.1D 6.4A 6.8A 6.9A 9.3B
Lithium chloride (anhydrous)	7447-41-8	6.1D 6.3A 6.4A 9.1D 9.3C
Lithium nitrate	7790-69-4	5.1.1C 6.3A 6.4A 6.8A
Litmus	none	No hazards determined

Chemical Name	CAS Number	HSNO Classification*
Magnesium carbonate	546-93-0	No hazards determined
Magnesium chloride	7791-18-6	No hazards determined
Magnesium hydroxide	1309-42-8	6.4A
Magnesium nitrate	10377-60-3	5.1.1C 6.3B 6.4A
Magnesium oxide	1309-48-4	No hazards determined
Magnesium powder	7439-95-4	4.2B 4.3A 6.1E 9.3C
Magnesium ribbon	7439-95-4	4.1.1B 6.1E 9.3C
Magnesium sulfate (anhydrous)	10034-99-8	No hazards determined
Magnesium turnings	7439-95-4	4.1.1B 6.1E 9.3C
Maleic acid	110-16-7	6.1D 6.3A 8.3A 9.1D 9.3C
Maltose	69-79-4	Not hazardous
Manganese (II) sulfate	7785-87-7	6.1D 6.9A 9.1B 9.3C
Manganese chloride	7773-01-5	6.1D 9.3C
Manganese dioxide	1313-13-9	6.1B 6.4A 6.8B 6.8C 6.9A 9.3C
Methanoic acid (formic acid)	64-18-6	3.1C 6.1C 8.1A 8.2B 8.3A 9.1D 9.3C
Methanol	67-56-1	3.1B 6.1C 6.4A 6.8B 6.9A 9.3C
Methyl cellulose	9004-67-5	No hazards determined
Methyl orange (2.8–4.6)	547-58-0	6.1C 9.3B
Methyl red (4.2–6.3)	493-52-7	6.7B
Methyl salicylate	119-36-8	6.1D 6.3A 6.4A 9.1D 9.2D 9.3C
Methyl Violet	8004-87-3	6.1D 6.7B 8.3A 9.1A 9.3C

Chemical Name	CAS Number	HSNO Classification*
Methylamine	74-89-5	2.1.1A 6.1C 6.9B 8.2B 8.3A 9.2D 9.3B
Methylated spirit	none	3.1B 6.1E 6.4A 6.9A 9.1D
Methylene blue	61-73-4	6.4A 9.1C
Nickel chloride	7718-54-9	6.1C 6.5B 9.1A 9.3B
Nickel nitrate	13138-45-69	5.1.1C 6.3B 6.4A 6.5A 6.5B 6.7A 9.1B
Nitric acid	7697-37-2	5.1.1C 6.1D 6.9B 8.1A 8.2A 8.3A 9.1D
Octan-1-ol (octanol)	111-87-5	3.1D 6.1D 6.3A 6.4A 9.1D 9.3C
Oleic acid	112-80-1	6.3A 6.4A
Orcein natural	1400-62-0	No hazards determined
Oxalic acid crystals (ethandioic acid)	144-62-7	6.1D 6.8C 6.9B 8.1A 8.2C 8.3A 9.3B
Oxygen (compressed)	7782-44-7	5.1.2A
Paraffin liquid	8002-74-2	Not hazardous
Paraffin wax	8002-74-2	Not hazardous
1-Pentanol (n-amyl alcohol)	71-41-0	3.1C 6.1C 6.3A 6.4A 9.1D 9.2B 9.3B
3-Pentanol	584-02-1	3.1C 6.1D 9.3C
Pepsin	9001-75-6	6.3A 6.4A 6.5A
Petroleum jelly	8009-03-8	No hazards determined
Phenol red	143-74-8	No hazards determined
Phenolphthalein crystals	77-09-8	6.7B
Phenolphthalein solution	77-09-8	6.7B
Phosphoric acid	7664-38-2	6.1D 8.1A 8.2C 8.3A 9.1D 9.3C

Chemical Name	CAS Number	HSNO Classification*
Phosphorous trichloride	7719-12-2	6.1A 6.9A 8.2A 8.3A
Potassium aluminium sulfate	10043-67-1	6.1D 6.3A 6.4A 8.1A 9.1D 9.3C
Potassium biphthalate	877-24-7	No hazards determined
Potassium bisulfate	7646-93-7	6.1E 8.2C 8.3A
Potassium bromate	7758-01-2	5.1.1B 6.1C 6.3A 6.4A 6.6B 6.7B 6.8B 6.9B 9.3B
Potassium bromide	7758-02-3	6.1D 6.3A 6.4A 6.5B 6.9B 9.1C 9.2C 9.3C
Potassium carbonate	584-08-7	6.1D 6.3A 6.4A 9.3B
Potassium chloride	7447-40-7	6.1E 6.3B 6.4A 9.3B
Potassium dihydrogen phosphate	7778-77-0	6.1D 6.4A 9.3C
Potassium ferricyanide (iron III)	13746-66-2	6.1D
Potassium ferrocyanide (iron II)	13943-58-3	6.1D
Potassium hydrogen carbonate (Potassium bicarbonate)	298-14-6	No hazards determined
Potassium hydrogen phthalate	877-24-7	No hazards determined
Potassium hydroxide	1310-58-3	6.1C 8.1A 8.2B 8.3A 9.1D 9.3B
Potassium iodate	7758-05-6	5.1.1B 6.1D
Potassium iodide	7681-11-0	6.5B 9.1B
Potassium nitrate	7757-79-1	5.1.1C 6.1D 6.3B 6.4A 9.3C
Potassium nitrite	7758-09-0	5.1.1B 6.1C 6.3B 6.4A 6.6B 6.9B 9.1A 9.3B
Potassium oxalate	583-52-8	6.1D 9.3C

Chemical Name	CAS Number	HSNO Classification*
Potassium permanganate	7722-64-7	5.1.1B 6.1D 6.8B 6.9A 8.2C 8.3A 9.1A 9.2A 9.3C
Potassium phosphate monobasic	7778-77-0	6.1D 6.4A 9.3C
Potassium sulfate	7778-80-5	6.3B
Potassium thiocyanate	333-20-0	6.1D 9.3C
Propan-1-ol (n-propyl alcohol)	71-23-8	3.1B 6.1D 6.4A 9.3C
Propan-2-ol	67-63-0	3.1B 6.1E 6.3B 6.4A
Propane-1,2-diol	57-55-6	Not hazardous
Propionic acid	79-09-4	3.1C 6.1C 8.2B 8.3A 9.1D 9.3B
Propylene	115-07-1	2.1.1A
Pyrogallol	87-66-1	6.1D 6.6B 9.1C 9.3C
Ringers salts	none	No hazards determined
Safranin stain	477-73-6	6.3A 6.4A
Salicylic acid (ortho-hydroxy benzoic acid; 2-hydroxy benzoic acid)	69-72-7	6.1D 6.3A 6.4A 9.1D 9.3B
Sand (purified)	none	Not hazardous
Sebacoyl chloride	111-19-3	6.1D 8.2C 8.3A 9.3C
Silica gel	63231-67-4	Not hazardous
Silicon	7440-21-3	4.1.1B 6.1E
Silicon dioxide sand	none	Not hazardous
Silver acetate (ethanoate)	563-63-3	6.4A

Chemical Name	CAS Number	HSNO Classification*
Silver chloride	7783-90-6	No hazards determined
Silver nitrate	7761-88-8	5.1.1B 6.1D 6.9A 8.2B 8.3A 9.1A 9.2A 9.3A
Soda lime: mixture of sodium hydroxide and calcium hydroxide	8006-28-8	8.2C 8.3A
Sodium (under paraffin)	7440-23-5	4.3A 8.2B 8.3A 9.1D
Sodium acetate (anhydrous) (ethanoate)	127-09-3	6.1E 6.4A
Sodium acetate (hydrated)	6131-90-4	No hazards determined
Sodium bisulfate	7681-38-1	8.2C 8.3A
Sodium borate (anhydrous)	1330-43-4	6.1D 6.4A 6.8B 9.1D 9.3C
Sodium bromide	7647-15-6	6.1E
Sodium carbonate (anhydrous)	497-19-8	6.1D 6.3A 6.4A
Sodium carbonate (hydrated)	6132-02-1	6.4A
Sodium chloride	7647-14-5	6.1E 6.4A
Sodium citrate	68-04-2	Not hazardous
Sodium dihydrogen phosphate	7558-80-7	6.1E 6.3B 6.4A
Sodium fluoride	7681-49-4	6.1C 6.3A 6.4A 6.6B 6.8B 6.9A 9.1D 9.3B
Sodium hydrogen carbonate (sodium bicarbonate)	144-55-8	Not hazardous

Chemical Name	CAS Number	HSNO Classification*
Sodium hydrogen sulfate	7681-38-1	8.2C 8.3A
Sodium hydroxide	1310-73-2	6.1D 8.1A 8.2B 8.3A 9.1D 9.3C
Sodium hypophosphite	7681-53-0	No hazards determined
Sodium hypochlorite	7681-52-9	5.1.1B 6.1E 8.2C 8.3A 9.1A
Sodium iodide	7681-82-5	6.1E 6.5B 6.9A 9.1A
Sodium lauryl sulfate	151-21-3	6.1C 6.3B 6.4A 9.1D 9.2D 9.3C
Sodium metabisulfite	7681-57-4	6.1D 6.3A 6.5A 6.5B 8.3A 9.1D 9.2B 9.3C
Sodium metavanadate	13718-26-8	6.1C 6.3A 6.4A 9.3A
Sodium molybdate	7631-95-0	6.1E
Sodium nitrate	7631-99-4	5.1.1C 6.1D 9.3C
Sodium nitrite	7632-00-0	5.1.1C 6.1C 6.4A 6.6B 6.9B 9.1A 9.3B
Sodium orthophosphate	7601-54-9	6.1C 8.1A 8.2C 8.3A 9.1D
Sodium orthovanadate	13721-39-6	6.1C 9.3B
Sodium oxalate	62-76-0	6.1D 9.3C
Sodium perborate	10486-00-7	5.1.1C 6.1E 6.3B 6.4A 6.6A 6.8B 6.9B
Sodium peroxide	1313-60-6	5.1.1A 8.1A 8.2A 8.3A 9.1D
Sodium persulfate	7775-27-1	5.1.1C 6.1D 6.3A 6.4A 6.5A 6.5B 9.1D 9.2C 9.3C
Sodium phosphate monobasic	7558-80-7	6.1E 6.3B 6.4A
Sodium potassium tartrate (rochelle salts)	304-59-6	Not hazardous
Sodium salicylate	54-21-7	6.1D 6.3B 6.4A 9.3C

Chemical Name	CAS Number	HSNO Classification*
Sodium silicate (anhydrous)	6834-92-0	6.1D 8.1A 8.2C 8.3A 9.3C
Sodium sulfate (anhydrous)	7757-82-6	Not hazardous
Sodium sulfite	7757-83-7	9.1C
Sodium sulfide	1313-82-2	4.2B 6.1C 8.2B 8.3A 9.1A 9.3B
Sodium tetraborate	1303-96-4	6.1E 6.4A 6.8B 9.1D
Sodium thiosulfate	7772-98-7	6.3A 6.4A 6.5B
Sorbose	3615-56-3	Not hazardous
Starch (soluble)	9005-25-8	Not hazardous
Stearic acid	57-11-4	Not hazardous
Strontium chloride	10476-85-4	6.1E 6.4A
Strontium nitrate	10042-76-9	5.1.1C 6.1D 6.3A 6.4A 6.9B 9.1A 9.3C
Sudan III	85-86-9	Not hazardous
Sulfur (powder)	7704-34-9	4.1.1B 6.4A
Sulfur (roll)	7704-34-9	4.1.1B 6.4A
Sulfuric acid	8014-95-7	6.1A 6.7A 6.9A 8.1A 8.2A 8.3A 9.1D
Superphosphate		Not hazardous
Talc	14807-96-6	Not hazardous
Tannic acid	1401-55-4	6.1E 6.4A 9.1C
Tartaric acid	147-71-7	6.4A
Thymol blue(1.2–2.8, 8.0–9.6)	76-61-9	6.3A 6.4A

Chemical Name	CAS Number	HSNO Classification*
Tin (II) chloride (stannous)	7772-99-8	6.1D 6.3A 6.4A 6.5B 9.3C
Tin (IV) oxide (stannic)	10026-06-9	8.2C 8.3A
Tin foil	7440-31-5	Not hazardous
Tin granules	7440-31-5	6.1D 6.4A 9.1D
Titanium III sulphate sol.	13825-74-6	8.2C 8.3A
o-Toluidine	95-53-4	6.1B 6.4A 6.7B 9.1A
Turpentine	8006-64-2	3.1C 6.1D 6.3A 6.4A 6.5B 9.1C
Universal indicator	mixture	contains alcohol
Urea	57-13-6	6.3B 6.4A 9.3C
Wintergreen oil (methyl salicylate)	119-36-8	6.1D 6.3A 6.4A 9.1D 9.2D 9.3C
Witch hazel	68916-39-2	No hazards determined
Zinc acetate (ethanoate)	557-34-6	6.1D 6.3A 6.4A
Zinc carbonate	3486-35-9	No hazards determined
Zinc chloride	7646-85-7	6.1C 8.1A 8.2C 8.3A 9.1A 9.3B
Zinc foil	7440-66-6	No hazards determined
Zinc granules	7440-66-6	No hazards determined
Zinc nitrate	7779-88-6	5.1.1B 6.1C 9.1A 9.3B
Zinc oxide	1314-13-2	9.1A 9.3C
Zinc pellets	7440-66-6	No hazards determined
Zinc powder pyrophoric	7440-66-6	4.2A 6.1E 9.1A
Zinc sulfate	7733-02-0	6.1D 6.9B 8.3A 9.1A 9.3C

* A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority (EPA) website.

Sources:

Environmental Protection Agency - Database search

Avantor Sciences

Appendix 7 – Strategies to reduce the amount and/or toxicity of waste hazardous substances generated in the laboratory/taiwhanga

All laboratories that use hazardous substances inevitably produce chemical waste that must be properly disposed of. It is crucial to minimise both the toxicity and the amount of substance waste that is generated.

Consider establishing a waste management and reduction policy at your school/kura.

Several things can be done to minimise hazards, waste generation, and control costs:

- Purchase hazardous substances in the smallest quantity needed.
- Use safer hazardous substance substitutes/alternatives such as substances which have been determined to be less harmful or toxic (Table A7 contains examples).
- Use microscale experiments – hazardous substance experiments using smaller quantities of substances.
- Recycle hazardous substances by performing cyclic experiments where one product of a reaction becomes the starting material of the following experiment.
- Consider detoxification or waste neutralisation steps.
- Use interactive teaching software and demonstration videos in lieu of experiments that generate large amounts of substance waste.
- Perform classroom demonstrations.
- Use pre-weighed or pre-measured packets of hazardous substances that reduce bulk substance disposal problems (no excess substances remain).

For information about the United States Environmental Protection Agency (US EPA) Green Chemistry programme, which promotes the use of innovative technologies to reduce or eliminate the use or generation of hazardous substances, visit the US EPA website or the American Chemical Society

Table A7. Possible substitutions

Toxic chemicals/equipment	**Possible substitution(s)**
Mercury thermometers	Digital and alcohol thermometers
Mercury barometer	Aneroid or digital pressure sensors
Methyl orange or methyl red	Bromophenol blue, bromothymol blue
Lead chromate	Copper carbonate
p-Dichlorobenzene	Lauric acid
Dichromate/sulfuric acid mixture	Ordinary detergents, enzymatic cleaners
Alcoholic potassium hydroxide	Ordinary detergents, enzymatic cleaners

Appendix 8 – Understanding Safety Data Sheet (SDS) headings

Safety data sheets must include the following 16 headings:

Section 1	Identification
Section 2	Hazard identification (this is where the classification should be)
Section 3	Composition/information on ingredients
Section 4	First-aid measures
Section 5	Firefighting measures
Section 6	Accidental release measures
Section 7	Handling and storage (may include information about incompatible substances and materials)
Section 8	Exposure controls/Personal protective equipment (PPE)
Section 9	Physical and chemical properties
Section 10	Stability and reactivity (may include information about incompatible substances and materials)
Section 11	Toxicological information (this is where information on health effects can be found)
Section 12	Ecological information (this is where information on environmental effects can be found)
Section 13	Disposal considerations
Section 14	Transport information (this is where the UN class and packing group can be found)
Section 15	Regulatory information (this is where information on controls and the Hazardous Substances and New Organisms (HSNO) approval may be found)
Section 16	Other information

Appendix 9 – Maximum quantities that may be stored in schools/kura[3]

HSNO Classification*	Property	Maximum quantity for closed containers	Suggested maximum quantity for schools
1	Explosives	Forbidden in schools	
2.1.1A and 2.1.1B	Flammable gases	100 kg or 100 m^3 where permanent gas	100 kg
2.1.2A	Flammable aerosols	Forbidden in schools	
3.1A	Flammable liquids	20 L	10 L (4 × 2.5 L Winchesters)
3.1B	Flammable liquids	250 L (containers up to 5 L)	50 L (20 × 2.5 L Winchesters)
3.1C	Flammable liquids	1,500 L in closed containers	50 L (20 × 2.5 L Winchesters)
3.2A, B and C	Liquid desensitised explosives	Forbidden in schools	
4.1.1A	Readily combustible	1 kg	1 kg
4.1.1B	Readily combustible	100 kg	5 kg
4.1.2A to G	Self-reactive	Forbidden in schools	
4.1.3A to C	Solid desensitised explosive	Forbidden in schools	

[3] For classes 1 to 5, these quantities are less than or equal to the quantities of class 2, 3, 4 substances that activate hazardous substance location requirements, as specified in the Regulations (Schedule 9). However, this does not preclude schools from obtaining advice from a Compliance Certifier or other Hazardous Substances advisor.

HSNO Classification*	Property	Maximum quantity for closed containers	Suggested maximum quantity for schools
4.2A	Spontaneously combustible	1 kg	1 kg
4.2B and C	Spontaneously combustible	25 kg	1 kg
4.3A	Dangerous when wet	1 kg	1 kg
4.3B	Dangerous when wet	25 kg	5 kg
4.3C	Dangerous when wet	50 kg	5 kg
5.1.1A	Liquid/solid oxidisers	50 kg or 50 L	5 L
5.1.1B	Liquid/solid oxidisers	500 kg or 500 L	10 kg or 10 L
5.1.1C	Liquid/solid oxidisers	1000 kg or 1000 L	10 kg or 10 L
5.1.2A	Gas oxidisers	200 m^3 or 100 kg	1 G size[4] cylinder
5.2A and B	Organic peroxides	Forbidden in schools	

[4] Cylinder capacities are measured in litres water capacity of the cylinder. Approximate equivalent capacities are: E size, 15.4 L; F 30.8 L; G 46.6 L. If oxygen is required, it is safer to use smaller cylinders.

HSNO Classification*	Property	Maximum quantity for closed containers	Suggested maximum quantity for schools
5.2C to F	Organic peroxides	None known to be used in schools	
6.1A to C	Acute toxic		Keep minimum quantities
6.3	Skin irritants		Keep minimum quantities
6.4	Eye irritant		Keep minimum quantities
6.5	Sensitiser		Keep minimum quantities
6.6A	Mutagenic		Keep minimum quantities
6.7A	Carcinogenic		Keep minimum quantities
6.8A	Reproductive/ developmental toxic		Keep minimum quantities
6.9A	Target organ systemic toxic		Keep minimum quantities
8.2A	Skin corrosive		Keep minimum quantities
8.3A	Eye corrosive		Keep minimum quantities
9.1A, 9.2A, 9.3A, 9.4A	Ecotoxic		Keep minimum quantities

* A correlation table for HSNO and GHS classifications is available at the Environmental Protection Authority website.

Appendix 10 – Incompatible substances and materials

HSNO classification*	Incompatible substances and materials**
2.1.1	All class 1 substances
	Class 2.1.2 substances
	All class 3 substances
	All class 4 substances
	All class 5 substances
2.1.2	All class 1 substances
	All class 3 substances
	All class 4 substances
	All class 5 substances
3.1	All class 1 substances
	All class 2 substances
	Class 3.2 substances
	All class 4 substances
	All class 5 substances
3.2	All class 1 substances
	All class 2 substances
	Class 3.1 substances
	Class 4.1, 4.2 and 4.3 substances

HSNO classification*	Incompatible substances and materials**
	All class 5 substances
4.1.1 (readily combustible solids)	All class 1 substances
	All class 2 substances
	Class 4.1.2, 4.1.3, 4.2, and 4.3 substances
	All class 5 substances
4.1.1 (those solids which cause fire through friction only)	Any substance likely to cause a spark when struck against a class 4.1.1 substance
	All class 1 substances
	All class 2 substances
	Class 3.1 and 3.2 substances
	Class 4.1.3 and 4.2 substances
	All class 5 substances
	Catalytic impurities having a detrimental influence on the thermal stability and hazard presented by class 4.1.2 substances
4.1.3	All class 1 substances
	Class 2 substances
	All class 3.1 substances
	All class 4.2 substances
	All class 5 substances
4.2	All class 1 substances
	Class 2 substances

HSNO classification*	Incompatible substances and materials**
	All class 3 substances
	All class 4.1.1, 4.1.2, 4.1.3, and 4.3 substances
	All class 5 substances
	Air
	Oxygen
4.3	All class 1 substances
	Class 2 substances
	All class 3 substances
	All class 4.1.1, 4.1.2, 4.1.3, and 4.2 substances
	All class 5 substances
	All class 8 substances
	Water
5.1.1 or 5.1.2	Class 5.2 Class 1, 2, 3, 4, 6.1A, 6.1B, 6.1C, or 8 Any organic matter, or substance that contains carbon Zinc or magnesium in any form, and any other metal in powdered form Any substance or material that will combust with air, or will combust with or catalyse the decomposition of a class 5.1.1 or 5.1.2 substance
6.1A, 6.1B, 6.1C	All class 1 substances
	All class 5 substances

HSNO classification*	Incompatible substances and materials**
6.1A, 6.1B, 6.1C (toxic cyanides)	All class 1 substances
	All class 5 substances
	All class 8.2 substances corrosive acids
8.2A and 8.2B corrosive acids	All class 1 substances
	Class 4.3A, 4.3B, 4.3C substances
	All class 5 substances
	Class 6.1A, 6.1B, 6.1C substances toxic cyanides
	Class 8.2A and 8.2B substances corrosive alkalis
8.2A and 8.2B corrosive alkalis	All class 1 substances
	Class 4.3A, 4.3B, 4.3C substances
	All class 5 substances
	Class 8.2A and 8.2B substances corrosive acids

* A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority website.

** See Appendix 4 for substances that are forbidden for use in schools.

Appendix 11 – Determining whether a laboratory/taiwhanga or storage area is a hazardous substance location

Quantities of substances that activate hazardous substance location requirements for laboratories or dedicated storage areas are listed in Tables A9 to A12

A compliance certificate is not required for a laboratory/taiwhanga that is a hazardous substance location. However, a dedicated storage area that is a hazardous substance location will require certification.

Table A9: Thresholds for laboratories or storage areas holding class 2, 3 and 4 substances being hazardous substance locations

HSNO Hazard classification*	Hazardous substance location needed when holding amounts over thresholds below
2.1.1A and 2.1.1B	100 kg (or 100 m^3 for a permanent gas)
2.1.2A	3,000 L (aggregate water capacity)
3.1A	20 L
3.1B	Laboratory (open containers) 50 L Dedicated storage area (closed containers) 100 L (in containers more than 5 L in size) or 250 L (in containers 5 L or less in size)
3.1C	Laboratory (open containers) 250 L Dedicated storage area (closed containers) 500 L (in containers more than 5 L in size) or 1,500 L (in containers 5 L or less in size)
3.2A.B and C	1 L
4.1.1A	1 kg

HSNO Hazard classification*	Hazardous substance location needed when holding amounts over thresholds below
4.1.1B	100 kg
4.1.2A and B	1 kg
4.1.2C and D	25 kg
4.1.2E, F and G	50 kg
4.1.3A, B and C	1 kg
4.2A	1 kg
4.2B and C	25 kg
4.3A	1 kg
4.3B	25 kg
4.3C	50 kg

* A correlation table for HSNO and GHS classifications is available at the Environmental Protection Authority website.

Table A10 Thresholds for laboratories or storage areas holding class 5.1.1 substances being hazardous substance locations

HSNO Hazard classification*	Hazardous substance location needed when holding amounts over thresholds below
5.1.1A	Laboratory (use) 5 kg or 5 L Dedicated storage area (kept closed) 50 kg or 50 L
5.1.1B	Laboratory (use) 50 kg or 50 L Dedicated storage area (kept closed) 500 kg or 500 L
5.1.1C	Laboratory (use) 100 kg or 100 L Dedicated storage area (kept closed) 1,000 kg or 1,000 L
5.1.2A	Laboratory (use) 50 m^3 or 50 kg Dedicated storage area (kept closed) 100 kg (non-permanent gas) 200 m^3 (permanent gas)
Oxygen	200 m^3 in discrete cylinder or tank
Chlorine	150 kg
Nitric acid, 65-70% aqueous solution	Not applicable for class 5.1.1

* A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority website.

Table A11 Thresholds for laboratories or storage areas holding class 5.2 substances being hazardous substance locations

HSNO Hazard classification*	Hazardous substance location needed when holding amounts over thresholds below
5.2A	Any quantity
5.2B	1 kg
5.2C, 5.2D	10 kg
5.2E, 5.2F	25 kg

* A correlation table for HSNO and GHS classifications is available at the Environmental Protection Authority website.

Table A12 Thresholds for laboratories or storage areas holding class 6 and 8 substances being hazardous substance locations

HSNO Hazard classification*	Hazardous substance location needed when holding amounts over thresholds below
6.1A	50 kg or 50 L
6.1B	250 kg or 250 L
6.1C	1,000 kg or 1,000 L
8.2A	50 kg or 50 L
8.2B	250 kg or 250 L

* A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority website.

Appendix 12 – Example inventory

Last date updated: DD / MM / YEAR

NAME OF PRODUCT AND/OR UN NUMBER	APPROVAL NUMBER AND GROUP STANDARD NAME (if applicable)	HAZARD CLASSIFICATION, UN CLASS AND PACKING GROUP	CURRENT SDS AVAILABLE?	SPECIFIC STORAGE AND SEGREGATION REQUIREMENTS*	CONTAINER SIZE	OPEN OR CLOSED CONTAINER?	GAS, LIQUID OR SOLID	LOCATION (eg Flammable Goods Cabinet, Storage Room 02)	MAXIMUM LIKELY AMOUNT
Required or useful	Useful for Calculator	Useful for Calculator	Required information	Required information	Useful for Calculator	Useful for Calculator	Useful for Calculator	Required information	Required information
Acetone	HSR001070	3.1B, 6.1E, 6.3B, 6.4A 3 II	Yes	Store away from sources of heat and ignition Keep away from bases, oxidising agents, reducing agents, reacts violently with phosphorous oxide	4 x 10 L 1 x 5 L	Closed	Liquid	Flammable goods cabinet	45 L
Polyurethane	HSR002662 – Surface coatings and colourants (Flammable) Group Standard 2006	3.1C, 6.1E, 6.3A, 6.4A, 6.5A, 6.5B, 6.8B, 6.9A, 9.1D 3 III	Yes	Incompatible with oxidising agents and flammable gases Store in approved flammable liquid storage area	10 L	Closed	Liquid	Flammable goods cabinet	10 L
Polyurethane thinner	HSR002650 – Solvents (Flammable) Group Standard 2006	3.1B, 6.1E, 6.3A, 6.4A, 6.8B, 6.9B,9.1D, 9.3C 3 III	Yes	Store out of direct sunlight Incompatible with oxidising agents and flammable gases	10 L	Closed	Liquid	Flammable goods cabinet	6 L
LPG	HSR001009	2.1.1A 2.1 (no packing group)	Yes	Incompatible with oxidising agents, flammable liquids and acids Keep away from heat and ignition sources Hazardous area Location compliance certificate required	45 kg	Closed	Gas	Locked LPG cage	180 kg

TABLE 1: Example inventory

* These are only examples of the information you can include in this column. See section 7 and 10 of your substance's SDS for specific storage requirements and incompatible substances.

Example inventory provided online (page 5) by WorkSafe New Zealand

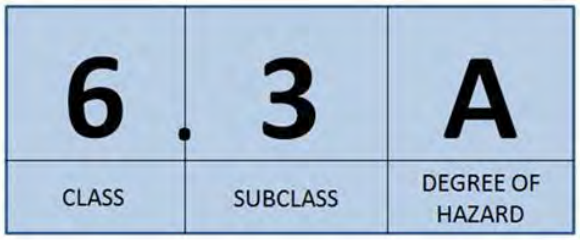
Appendix 13A – Hazardous Substances and New Organisms

(HSNO) Classification Symbols

The eight HSNO classes are shown below. (Class 7 covers radioactive materials, which are regulated under the Radiation Safety Act 2016.)

Class number	Hazard type
Class 1	Explosives
Class 2	Flammable gases
Class 3	Flammable liquids
Class 4	Flammable solids
Class 5	Oxidising substances
Class 6	Substances toxic to people
Class 8	Corrosive substances
Class 9	Substances toxic to the environment

Understanding HSNO labels



In this example,

- 6 is the class, which indicates the substance is toxic to people
- 3 is the subclass, which indicates the type of toxicity, for example, irritating to the skin
- the letter A indicates the degree of hazard, with A being the highest hazard.

Therefore, a hazardous substance classified as 6.3A is highly irritating to the skin.

A correlation table for Hazardous Substances and New Organisms (HSNO) and Globally Harmonised System (GHS) classifications is available at the Environmental Protection Authority website.

Appendix 13B – Symbols on labels

Physical hazards

Type of hazard	GHS symbol	Transport of Dangerous Goods symbols
Flammables These pictograms refer to flammable substances		    

Type of hazard	GHS symbol	Transport of Dangerous Goods symbols
Oxidisers These symbols are for products with oxidising properties. The products could be gas, solid or liquid and can cause or intensify fire and explosion. Keep products with these symbols well away from flammable products.		
Organic peroxides Organic peroxides may contribute to fire, explosion or chemical decomposition.		 
Corrosives Products with these symbols are corrosive and can cause severe skin burns and eye damage. They may also be corrosive to metals.		
Gases under pressure Products with these symbols are products where gas is kept under pressure. These products may explode when heated. If they are refrigerated gases, they may cause cryogenic burns or injuries. Even normally safe gases can be dangerous when pressurised.		 

Health hazards

Type of hazard	GHS symbol	Transport of Dangerous Goods symbols
Acute toxicity Products with these symbols are acutely toxic. If you see these symbols on the label you need to be aware that you are handling very dangerous products that could cause death if they come into contact with skin or you inhale or ingest them.		Acutely toxic gas  Toxic 
Less severe acute health hazards Products with this symbol may cause one or more of the following: • skin–sensitisation • skin and eye irritation • respiratory irritation • drowsiness or dizziness. •		No dangerous goods symbols

Type of hazard	GHS symbol	Transport of Dangerous Goods symbols
Chronic (long-term) health hazards Products with this symbol can cause chronic health issues if people are exposed to the product. These products can: cause cancer cause mutations affect fertility cause damage to an unborn child cause allergies, asthma or breathing difficulties when inhaled. They can also be respiratory sensitisers.		No dangerous goods symbols

Environmental hazards

Type of hazard	GHS symbol	Transport of Dangerous Goods symbols
Environmental hazard Products with this symbol are toxic to the environment (ecotoxic).		

Signal words

You may also see signal words on the label such as DANGER and WARNING. DANGER is used for the higher risk substances, while WARNING is used for lower risk substances. Hazardous substances imported from Australia might use the signal words CAUTION, POISON or DANGEROUS POISON. CAUTION is used for the least dangerous while DANGEROUS POISON is used for the most dangerous substances.

Hazard statements

Hazard statements are a statement that describes the nature of the hazards for the substance, and if appropriate the degree of the hazard. These statements alert you to

the harm that the hazardous substance can cause, for example, MAY CAUSE MILD SKIN IRRITATION

Precautionary statements

Precautionary statements are statements on the label that describe the measures that should be taken to minimise or prevent adverse effects resulting from exposures to a hazardous product, or from improper storage or handling of a hazardous substance, for example, USE ONLY OUTDOORS OR IN A WELL-VENTILATED AREA.

Appendix 14 – Determining hazards of substances

Information on the classifications of a hazardous substance can be found in the:

- Safety Data Sheet (SDS) for the substance
- Hazardous Substances Calculator which can be found on the Toolbox website
- Environmental Protection Authority (EPA) databases
- European Chemicals Agency (ECHA) classification and labelling inventory
- OECD eChemPortal

Appendix 15 – Example risk factor calculation table

Risk Factor Calculation Tables

Hazard: a situation or thing with the potential to cause death, injury or illness.

Risk: the likelihood that death, injury or illness might occur when exposed to a hazard.

Severity: Quantify the severity of harm which will result from the hazard; how bad will it be?

1	2	3	4	5
Minor	**Moderate**	**Serious**	**Major**	**Catastrophic**
Near hit Injury requiring first-aid	Medical treatment not requiring hospitalisation Restricted work for less than 28 days	Injury or illness requiring hospitalisation for less than 48 hours Restricted work greater than 28 days Lost time injury with lost time less than two weeks	Permanent disability Illness or injury requiring hospitalisation greater than 48 hours Amputation Lost time injury with lost days greater than two weeks	Single or multiple deaths

Likelihood: Quantify the likelihood of harm from the hazard.

1	**Remote**	People are unaware of occurrences. Occurrence considered unlikely under significantly changed conditions. Possibility considered unlikely under significantly changed conditions.
2	**Unlikely**	Not known to have occurred under similar conditions. Occurrence considered unlikely under current or slightly changed conditions.
3	**Possible**	Persons are aware of at least one occurrence under similar conditions. Lack of evidence to provide assurance of impossibility.

		Occurrence considered possible under current or slightly changed conditions.
4	**Likely**	Persons are aware of infrequent occurrences under similar conditions. Expected to occur at some time under current risk-control process. Estimate 50/50 chance of occurrences under current conditions.
5	**Almost certain**	Persons aware of frequent occurrences under similar conditions. Expected to occur at least once unless preventative action is taken.

Risk Factor: Calculate the risk factor by multiplying the quantitative value for severity and likelihood.

Severity		**Likelihood**		**Risk Factor**
	×		**=**	

Risk Level	**Management Action**	**Criteria**
High	Immediate action	**Risk factor: 11–25** Unacceptable risk under existing circumstances. Requires immediate action to eliminate or minimise risk so far as is reasonably practicable. This can include stopping work immediately until the risk level is brought down to an acceptable level.
Medium	Review and manage risks and monitor	**Risk factor: 4–10** Risk must be reviewed and managed with controls; existing controls are not managing the risk to an acceptable level.
Low	Acceptable with controls	**Risk factor: 1–3**
		Work can proceed with accepted controls in place and monitored.

Appendix 16 – Example risk factor calculation worksheet

Risk Assessment

Date: _____
1. Assess the Risk
Severity

Identify the hazard [this may be an activity]: Describe the hazard:

Quantify the severity of harm which will result from the hazard; how bad will it be?

1	2	3	4	5
Minor	Moderate	Serious	Major	Catastrophic

Likelihood

Quantify the likelihood of harm from the hazard.

1	2	3	4	5
Remote	Unlikely	Possible	Likely	Almost certain

Risk Factor

Calculate the risk factor by multiplying the quantitative value for severity and likelihood.

Severity		Likelihood		Risk Factor
	×		=	

2. Control the risk

Possible Action:	Date:

Action to be taken:	Date:

Action completed: ☐ Date:_____

3. Review control measures

Date to be reviewed: _____

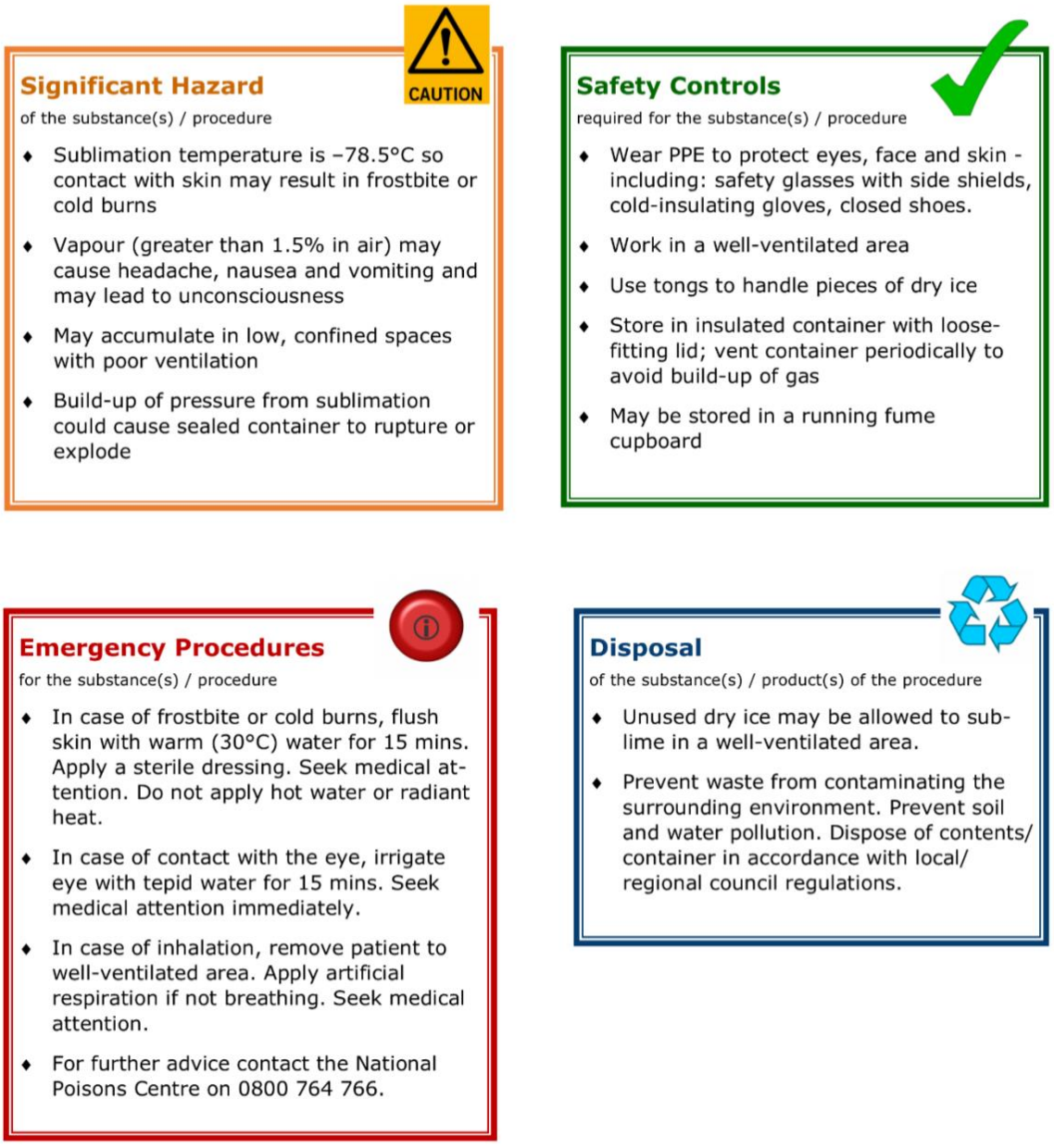
Signed: _____

Name: _____

Position:_____

Appendix 17 – Example of safe operating procedure (SOP)/safe method of use (SMU or SMOU)

Dry ice (solid carbon dioxide, CO_2)



Significant Hazard

CAUTION

of the substance(s) / procedure

- Sublimation temperature is –78.5°C so contact with skin may result in frostbite or cold burns
- Vapour (greater than 1.5% in air) may cause headache, nausea and vomiting and may lead to unconsciousness
- May accumulate in low, confined spaces with poor ventilation
- Build-up of pressure from sublimation could cause sealed container to rupture or explode

Safety Controls

required for the substance(s) / procedure

- Wear PPE to protect eyes, face and skin - including: safety glasses with side shields, cold-insulating gloves, closed shoes.
- Work in a well-ventilated area
- Use tongs to handle pieces of dry ice
- Store in insulated container with loose-fitting lid; vent container periodically to avoid build-up of gas
- May be stored in a running fume cupboard

Emergency Procedures

for the substance(s) / procedure

- In case of frostbite or cold burns, flush skin with warm (30°C) water for 15 mins. Apply a sterile dressing. Seek medical attention. Do not apply hot water or radiant heat.
- In case of contact with the eye, irrigate eye with tepid water for 15 mins. Seek medical attention immediately.
- In case of inhalation, remove patient to well-ventilated area. Apply artificial respiration if not breathing. Seek medical attention.
- For further advice contact the National Poisons Centre on 0800 764 766.

Disposal

of the substance(s) / product(s) of the procedure

- Unused dry ice may be allowed to sublime in a well-ventilated area.
- Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/ container in accordance with local/ regional council regulations.

Updated: 08/10/2019

Glossary of key terms

accident. Any occurrence that results in a person's injury, disease, or death, or in property damage.

apparatus. The technical equipment or machinery needed for a particular activity or purpose. *Apparatus* and *equipment* have been used interchangeably.

approved hazardous substance. A substance for which an approval to import or manufacture for release, or to import into containment or to manufacture in containment, has been issued by the EPA under the Hazardous Substances and New Organisms Act 1996 (HSNO Act).

authorised person. In relation to a laboratory, means a person (person A) who, in the normal course of his or her work, is required to enter the laboratory, and includes any other person under person A's direct supervision while person A is present in the laboratory [Regulation 18.5(3)].

auto-ignition temperature. in relation to any class 2.1.1, 2.1.2 or 3.1 substance, means the minimum temperature at which a mixture of flammable vapour and air, or gas and air, is marginally self-igniting when tested in accordance with ASTM e659-14; or AS/NZS 60079.20.1:2012. [Regulation 10.1].

carcinogen. Cancer-causing agent.

circuit breaker. A device that cuts off the flow of current in a circuit if the current exceeds a certain level.

classification system. The Hazardous Substances and New Organisms (HSNO) classification system set out in the Hazardous Substances (Hazard Classification) Notice 2020.

compatible. In relation to a class 6 or 8 substance means those substances which would not react dangerously if stored together.

combustible. Capable of or used for burning.

competent person (under Part 19). A certified handler or a person who has received information, instruction and training in accordance with regulation 4.5. [Regulation 19.1].

corrosive. Capable of attacking (corroding) metals or of visibly destroying or permanently damaging human tissue

dBA. Decibel (acoustic): a measure of sound loudness.

entrance. In relation to a laboratory, means a door, gate, or passage that is a point of entry into the laboratory [Regulation 18.5(3)].

Ecotoxic. Toxic to the environment.

EOTC. Education outside the classroom.

EPA. The Environmental Protection Authority of New Zealand.

EPA notice. A notice issued in the Gazette by the EPA under the HSNO Act.

equipment. Equipment and *apparatus* have been used interchangeably.

ERP. Emergency Response Plan required under Subpart 2 of Part 5 of the Regulations.

flammable Capable of being ignited easily and burning rapidly in air.

flashpoint. The minimum temperature at which, under specified test conditions, a flammable substance emits enough vapour to ignite immediately when an ignition source is applied.

fume. Cloud of airborne particles arising from condensation of vapours or from chemical reaction.

GHS. The Globally Harmonized System of Classification and Labelling of Chemicals.

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

hazardous area. An area in which an explosive gas atmosphere is, or may be expected to be, present, in quantities such as to require special precautions for the construction, installation and use of equipment. Hazardous areas are classified into zones based on the frequency of the occurrence and duration of an explosive gas atmosphere.

hazardous substance. Is defined in the HSNO Act as meaning, unless expressly provided otherwise by regulations or an EPA notice,

(a) a substance with one or more of the following intrinsic properties:

- explosiveness
- flammability
- capacity to oxidise
- corrosiveness
- toxicity
- ecotoxicity, with or without bioaccumulation

(b) which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any 1 or more of the properties specified in paragraph (a)

The Hazardous Substances (Hazard Classification) Notice 2020 defines what constitutes a hazardous substance for each hazardous property. There is a level below which a substance is not considered hazardous under this legislation.

It is also defined in the Regulations as having the same meaning as that stated in the HSNO Act, however it does not include:

- food, but includes a food additive; and
- medicine, but includes new medicine that is treated as hazardous under the HSNO Act; and
- psychoactive substance that is treated as not hazardous under the HSNO Act; and

the meaning is modified for the purposes of these regulations by omitting ecotoxicity.

hazardous substance location. In relation to a class 2, 3, 4, 5, 6, or 8 substance,—

(i) means an area where a quantity of the substance exceeds the relevant quantity specified in table 4 in Schedule 9, table 1 or 2 in Schedule 10, table 1 in Schedule 11, or regulation 13.38 is located for more than—

(A) 24 hours, in the case of a substance that is not subject to the tracking provisions of Part 19:

(B) 2 hours, in the case of a substance subject to the tracking provisions of Part 19:….

hazardous waste. Waste that is:

(a) generated by a manufacturing or other industrial process; and

(b) reasonably likely to be or contain a substance that meets 1 or more of the classification criteria for substances with explosive, flammable, oxidising, toxic, or corrosive properties under the Hazardous Substances (Classification) Notice 2017.

HSNO Act. The Hazardous Substances and New Organisms Act 1996.

HSWA. The Health and Safety at Work Act 2015

immiscible. Not able to be mixed or combined.

incompatible substances. Incompatible substances (or materials are substances that must be kept away from each other to prevent them from mixing and causing an adverse reaction such as a fire or explosion or generating flammable, corrosive or toxic vapours or gases.

knowledge. A knowledge of the hazards associated with each HSNO class of substance

and general precautions to mitigate these hazards.

known carcinogen. A substance proven to cause cancer in humans.

laboratory. A laboratory that meets the requirements of Part 18 of the Regulations. Which applies to a laboratory that uses hazardous substances in research and development, analytical testing, or teaching: and none of those substances or any substance created from their use, is sold by that laboratory as a substance or in a product containing or derived from 1 or more of those substances except under certain circumstances. (regulation 18.2)

laboratory facility manager. A person designated as in charge of a company/organisation which has a laboratory and who has specified duties and functions in respect of these guidelines.

laboratory manager. A person responsible for one or more laboratories (rooms) or parts thereof and having specified duties and functions under the Regulations [Regulation 18.1].

LEL. The lower explosive limit, being the concentration of flammable gas, vapour, or mist in standard air, below which an explosive gas atmosphere will not be formed at 20°C and at 101.3 kPa absolute pressure [Regulation 10.1].

MSDS. Material Safety Data Sheet – now referred to as Safety Data Sheet

mutagenic substance. A substance capable of causing genetic mutations in

humans. *oxidation–reduction reactions.* The exchange of electrons or oxygen.

oxidising agent (oxidiser, oxidant). A substance that oxidises another substance, being itself reduced in the process, and gaining electrons. It can be a solid, liquid or gas and can cause or intensify fire and explosion.

PEL. Permissible exposure limit.

polyethylene terephthalate (PET) bottle. A plastic bottle, such as a 1.5-litre soft-drink bottle.

protected place. includes:

- a dwelling, residential building, place of worship, public building, school or college, hospital, child care facility, or theatre, or any building or open area in which persons are accustomed to assemble in large numbers, whether within or outside the property boundary of a place where a hazardous substance location is situated
- any factory, workshop, office, store, warehouse, shop, or building where persons are regularly employed, whether within or outside the property boundary of a place where a hazardous substance location is situated
- a ship lying at permanent berthing facilities
- a public railway.

but does not include a small office or other small building associated with a place where storage, handling, use, manufacture, or disposal of a class 2, 3, 4, 5, 6, or 8 substance is a major function.

public place. A public place means a place (other than private property or a protected place) that is open to, and frequented by, the public; and includes a public road.

readily accessible. In relation to a duty to provide a document, means that the document is capable of being accessed without difficulty in hard copy, electronic, or other form.

RCD (residual current device). A device that limits the current, for example, if insulation fails or if a person accidentally touches live conductors.

reducing agent (reductant). A substance that brings about reduction by becoming oxidised and losing electrons.

Regulations. The Health and Safety at Work (Hazardous Substances) Regulations 2017.

safe work instrument. Safe work instruments are approved by the Minister for Workplace Relations and Safety and may be used to provide an alternative means of complying with regulations. For further information see About Safe Work Instruments on the WorkSafe website.

safe method of use (SMOU/SMU). An SMU provides consistent laboratory-specific guidelines on how specific hazardous substances are handled and stored. See Section 28.

Section 33, HSNO Act. Provides for the exemption from HSNO Act requirements for the small-scale use of hazardous substances in research and development and teaching. Section 33, HSNO Act.

sensitisation. The development, over time, of an allergic reaction to a chemical.

Site plan. Means a reference to a plan of the relevant place that is accurate and drawn to scale to the extent necessary to enable the plan to meet its purpose in the provision that refers to it (in particular, by enabling a person inspecting the plan to identify actual distances and other relevant dimensions) and need not necessarily be prepared by a person with qualifications in the preparation of plans.

small container. A container in which a hazardous substance is being held before or during use in a laboratory in quantities typically used for that purpose; and includes any laboratory equipment in which any hazardous substance remains after that use [Regulation 18.1].

so far as is reasonably practicable. That which is, or was, at a particular time, reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters, including:

(a) the likelihood of the hazard or the risk concerned occurring; and

(b) the degree of harm that might result from the hazard or risk; and

(c) what the person concerned knows, or ought reasonably to know, about

i) the hazard or risk; and

ii) ways of eliminating or minimising the risk; and

(d) the availability and suitability of ways to eliminate or minimise the risk; and

(e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

standard/safe operating procedure (SOP). An SOP is a procedure employed where hazardous substances are handled/used along with equipment, etc., for a particular process.

suspected carcinogen. A substance proved to cause cancer in animals and suspected to have the same effect on humans.

technical knowledge. Sufficient knowledge to carry out duties/responsibilities specified in these guidelines and the Regulations.

teratogenic substance. A substance capable of causing birth defects in the offspring if the mother is exposed to it during pregnancy.

toxic. Can harm people if it enters the body through skin, inhalation or ingestion. The effects can range from mild to life threatening, and can be immediate (acute) or long term (chronic).

tracked substance. A substance specified in Regulation 19.1 of the Regulations.

UEL. The upper explosive limit, being the concentration of flammable gas, vapour, or mist in standard air, above which an explosive gas atmosphere will not be formed [Regulation 10.1].

use. In relation to a class 5.1.1 or 5.1.2 substance includes removing a hazardous substance from, or putting it into, a package or container.

volatile. Evaporates readily at room temperature and pressure.