SAFETY AND SCIENCE

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SAFETY AND SCIENCE

- 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 board of trustees, 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.

SAFETY AND SCIENCE

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.

SAFETY AND SCIENCE – WHO IS RESPONSIBLE?

Has your school appointed a laboratory manager?

Do teachers in your department have a full understanding of health and safety?

Do students in the laboratory have an understanding of health and safety?

Do all chemicals have SDS cards with them when leaving the prep area or have access in the classroom?

	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 for 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 labelling, packaging, safety data sheets and restrictions on ingredients in certain hazardous substances products.
*** City and district councils.

Can you afford a $600K fine?

SAFETY AND SCIENCE – WHO IS RESPONSIBLE?

SAFETY AND SCIENCE – WHO IS RESPONSIBLE?

NAG 5

Each Board of Trustees is required to:

- provide a safe physical and emotional environment for students;
- comply in full with any legislation currently in force or that may be developed to ensure the safety of students and employees.

Boards of trustees should have policies and practices in place to ensure the health and safety of staff and students involved in science activities.

SAFETY AND SCIENCE – WHO IS RESPONSIBLE?

5.2.2 Worker duties (teachers)

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 others
- Comply with reasonable instructions given by the PCBU to allow the PCBU to comply with the HSWA

NOTE **(pg 52)**: - 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 immediate or imminent exposure to a hazard.

SAFETY AND SCIENCE – WHO IS RESPONSIBLE?

7.4.1 Upkeep of a laboratory/taiwhanga and equipment

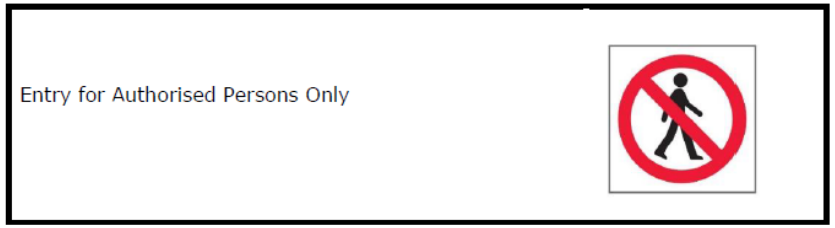
- Conduct regular inspections of safety and first-aid equipment as often as requested by the laboratory manager.
- Notify the laboratory manager, in writing, if a hazardous or possibly hazardous condition (for example, malfunctioning safety equipment or chemical hazard) is identified in the laboratory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

SAFETY AND SCIENCE – SIGNAGE

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

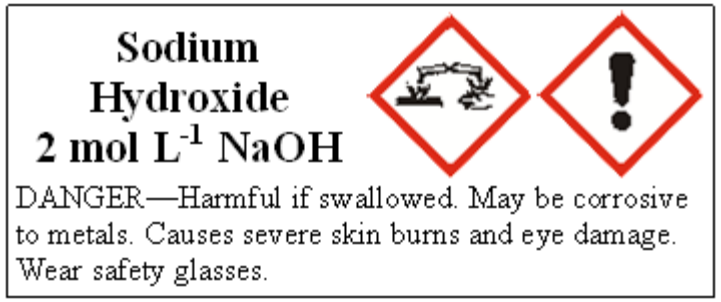
14.1 What to put on the sign

- **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.



SAFETY AND SCIENCE – SIGNAGE

25.2 Labels on secondary containers and prepared solutions



Secondary containers (this means decanted or diluted) of hazardous substances held in a laboratory need to be labelled (in English) with:

- the identity of the substance
- the concentration of the substance if diluted with a non-hazardous substance
- a pictogram (GHS) and hazard statement 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 substance 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.
- While a container is labelled as a hazardous substance, use it only for that substance. If you relabel a container, before you place a new substance in it, remove the former label and clean the container of any residue of the previous substance first. Do not use containers that were previously used for food or drink. You do not have to label portable containers if you are going to use the substance so soon after you put it into the container that it is impracticable to label it. You also need to thoroughly clean the container immediately after you use it, to remove hazards.

RISK ASSESSMENT

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
- Risk assessments are not 'one-off' and for all times involving workers

It is not an exact science - assessing risk comes with experience and using tools, for example, SDS and the WorkSafe hazardous substance calculator

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

RISK CALCULATOR

Severity 1-5 rate how severe the harm will be

Likelihood 1-5 chance so of harm occurring

Severity x Likelihood = Risk factor

High or medium-risk procedures need to be reviewed immediately to either replace with a safer experiment or add extra control levels in e.g demo only or worst-case YouTube video.

Safe Method of Use and Standard Operating Procedure

SMU's and SOP's

- 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 - how you actually do the procedure step by step
- A safe method of use (SMU) are 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
- Risk assessment programme ($350 annually) is another alternative/supplement and requires the teacher to input the chemicals and equipment online so they see the hazard as they generate the form. This gives the chemical and equipment hazards in detail and disposal but lacks information on controls and emergency response. Positive is that it is generated for every experiment, so teachers are more likely to spot hazards whilst they plan the lesson. The form is also a signed document and countersigned by the lab technician

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.

Risk Assessment Programme

magnesium, ribbon — **Mg**

Class: 4.1 PG: III Users: 7-12 Training: 1-5 UN: 1869 CAS: 7439-95-4

GHS data:

DANGER  In contact with water releases flammable gases which may ignite spontaneously

Potential hazards
Burns with white-hot flame; UV radiation emitted from flame may cause eye damage; do not allow students to view flame from close distance. Reaction with ethanol may be violent after a long induction period. Reactions of magnesium with dichromate salts, nitrate salts, sulfur, phosphorus or halogenated solvents can be dangerously violent. Reaction of magnesium with silica (sand) to form silicon may be dangerously exothermic if the silica is not completely dry. Do not use magnesium as an alternative to aluminium in the thermite reaction; the reaction is dangerously explosive. Magnesium ribbon can, however, be used as a fuse for the thermite reaction.

Standard handling procedures
Keep containers tightly sealed to prevent corrosion.

Disposal
Retain for collection by a waste service or <100 g/day may be dissolved in dilute hydrochloric acid and poured down the drain. Do not place in the garbage, due to the possibility of ignition.

sulfuric acid 1.7-17.8 M (15-95% wt/wt) — **$H_2SO_{4(aq)}$**

Class: 8 PG: II Users: 11-12 Training: 1-5 UN: 1830 CAS: 7664-93-9

GHS data:

DANGER  Causes severe skin burns and eye damage

Potential hazards
HIGHLY CORROSIVE TO SKIN AND EYES. Much heat evolved when mixing the concentrated acid with water; evolves toxic fumes on heating.

Standard handling procedures
ALWAYS ADD ACID TO WATER, SLOWLY, WITH VIGOROUS STIRRING.

Disposal
<5 mL/day may be added slowly, with stirring, to 100 times the volume of water, then poured down the drain. Larger quantities should be placed in an Acid waste container.

Chemicals to be produced

hydrogen, gas generated during experiment — **H_2**

Class: 2.1 PG: none Users: 7-12 Training: 1,2,5 CAS: 1333-74-0

GHS data:

DANGER  Extremely flammable gas

SAFETY AND SCIENCE – SDS

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

SAFETY AND SCIENCE – SAFETY REQUIREMENTS

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 operations 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).

SAFETY AND SCIENCE – SAFETY REQUIREMENTS

26 What are the basic safety requirements?

- 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.

SAFETY AND SCIENCE – FOOD AND DRINK IN A LAB

- The intention of the document is that no food or drink is consumed in a laboratory.
- If you have a learning activity that involves food or drink, then find an appropriate space to complete this.
- Drink bottles should not be in a laboratory

SAFETY AND SCIENCE – SUBSTANCES

Appendix 4 – Substances prohibited for use in schools/kura

Appendix 5 – Substances with greater hazardous nature than educational utility

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

NAUGHTY LIST

- Benzene
- Carbon tetrachloride
- Chlorates and perchlorates
- Chloroform (use dichloromethane in its place)
- Explosives, including fireworks
- Formaldehyde (Unless in a sealed container, for the purposes of biological preservation.
- Formaldehyde is classified as 6.7A, ERMA approval code HSR001162)
- Hydrofluoric acid
- Perchloric acid
- Potassium
- Radioactive materials (apart from those specifically mentioned in the section on radioactive materials in Safety in Science, MOE 2000)
- White phosphorus

LIMIT USE - NOT SO NAUGHTY LIST!

- Appendix 5 has a list of substances that we are allowed to use in a laboratory, but we need to think about how to limit use.
- Here are some examples of chemicals that you need to reflect on use …
  - Bromine Vials
  - Hydrogen
  - Potassium dichromate
  - Silver nitrate
  - Strontium nitrate

HOW SAFE AND COMPLIANT IS YOUR WORK PLACE?

How many unlabelled bottles do you have in the Science Department?

How many teachers do you have that don't take their H&S responsibilities seriously?

What are steps that you can take to improve Health and Safety?

Have you had an audit of Health and Safety in the Science Department?

Ask them now!

Think of them later – then send an email to nzase@xtra.co.nz

Questions will be shared via STANZ and NZASE newsletters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AND
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