2

Risk assessment and control of risks

Carrying out a risk assessment is nothing unusual.
You do it all the time!

If I were to place a plank of wood, say 20 cm wide, on the floor and call for a volunteer to walk along it, probably somebody would be willing to do it. It might seem a bit odd, but somebody would most likely be willing to do it.

> **Hazard**
>
> A "hazard" is defined as "anything (including work practices or procedures) that has the potential to harm the health or safety of a person".

Now, suppose I place the plank of wood over a ravine: two cliffs in the air with a 100 m drop between them. I suspect that I would have a lot more difficulty in finding a volunteer to walk the plank! Even though the likelihood of falling off the plank would be about the same, the situation is different. What is the difference?

In the first case, the consequences of falling off the plank are "a minor stumble". In the second case, the consequences of falling are "death". You have carried out a risk assessment and decided that the severity of the risk in the second case is very high and therefore you have decided not to do it.

If we go to the same ravine and I place a concrete bridge with 1.5 m handrails over it, I will again have a good chance of finding a volunteer to walk across. The consequences are the same: death if you fall. However, the likelihood of your falling is now so low that you are willing to do it – and enjoy the view!

The term "hazard assessment" is sometimes used interchangeably with "risk assessment". Probably, risk assessment is a better term since a hazard only exists if risks are not controlled in some way.

In assessing risk, you take into account

- likelihood that something bad will happen
- consequences of the event.

You process all the relevant information and use it to make a decision.

Happily, the law has a similar idea about risk assessment.

Legal requirements for risk assessment

If you live in VIC or WA, please go to http://www.riskassess.com.au/info/legally_required to see a summary of your current legislation.

Safe Work Australia recently developed a model Work Health and Safety Act for adoption by all States and Territories, in an effort to standardise safety legislation throughout Australia. The model legislation has been passed into law in every State and Territory, except Victoria and Western Australia, where the details are still being reviewed. When these two States come aboard, the whole of Australia will have (virtually) the same workplace health and safety legislation. Even in VIC and WA, the current legislation imposes similar duties to the new WHS Act, so we will consider the Work Health and Safety Act as the starting point for health and safety requirements in schools.

According to the Work Health and Safety Act (2011 or 2012, depending on the State/Territory), a duty is imposed on a person:
(a) to eliminate risks to health and safety, so far as is reasonably practicable, and
(b) if it is not reasonably practicable to eliminate risks to health and safety, to minimise those risks so far as is reasonably practicable . . . 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 the risk . . .
[Part 2, Sections 17 and 18]

This legislation has many implications.

First of all: the good news. You are only required to eliminate risks "as far as is practicable". Superhuman efforts are not expected.

The requirement for "weighing up all relevant matters" means that issues such as
• the facilities available (e.g. fume cupboard)
• the behaviour of the class (e.g. discipline problems)
• students with special needs (e.g. limited mobility)
• students with allergies (e.g nut allergy)
and any other "relevant matters" need to be considered.
This means that every class/location needs to be treated as a separate event. A generic risk assessment is not sufficient to meet the need to consider "all relevant matters", since these matters can - and commonly do - vary from class to class.

It might seem like an impossible (or, at least, unreasonable) task to carry out a separate risk assessment for every experiment conducted in every class, but this is not the case if risk assessments are carried out electronically. Modern computer technologies and software allow easy copying and customisation of risk assessments so that it requires only a short time to carry out a risk assessment per class, as required by law.

The requirement to consider "the likelihood of the hazard or the risk occurring" and the "degree of harm that might result" is like our earlier example of walking the plank. You need to consider, both by logic and by law, the "likelihood" and the "consequences" of an event. This is enshrined in law, in the documentation of safety authorities throughout the world, and in the Australian/ISO Standard on Risk Management.

The law does not specify how the the "likelihood" and "consequences" should be considered in order to estimate the "severity" of the risk. The most common way, in situations such as this, is to define levels of likelihood and levels of consequence, then use a decision matrix, known in this case as a "risk matrix", to process the information according to the system defined by the school (see later).

Identify, assess and control risks

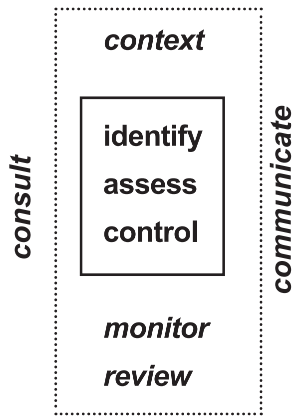

Figure 2-1
The risk management process.

Both common sense and the law require that you
- identify
- assess
- control

risks.

Before you start, you need to consider who is involved, which physical factors are involved, etc. This is the “context”.

After you have finished the process, by controlling the risks, you need to “monitor and review” what happened. Maybe carrying out an experiment in the fume cupboard did not work since the suck of the fume cupboard was not enough; you need to review things and get the fume cupboard fixed.

All along the process, you need to keep people informed: the students and your colleages. This is the need to “consult and communicate”. The whole process is "risk management" (Figure 2-1)
Let us now look at the three stages in the process in turn.

Risk identification

First, you should look at history: “Those who do not understand history are condemned to repeat the mistakes of the past.”

Consider the “accidents” and “near accidents” that have occurred at your school and similar schools. Brainstorm with colleagues over a coffee. Think laterally about the things that might happen. Go through checklists of possible bad things that might happen.

Identification of risks is better with more experience, more people and more persistence.

Risk assessment

As we saw before, to assess the severity of a risk, you need to consider
- consequences of an event
- chance that it will occur (likelihood)

There are different ways to combine the estimates of “consequences” and “likelihood” to decide whether to do something or not. The Australian/New Zealand/ISO Standard on Risk Management (AS/NZS ISO 31000:2009) is a good starting point for formal considerations of risk, as you are required to do in a school. It also has a guide (HB 436:2013), which is even more helpful.

Risk matrix, 2 x 2

The simplest way to consider the consequences and the likelihood of a risk that has been identified is to use a 2 x 2 risk matrix (Figure 2-2). This matrix is an example of a "decision matrix" and is sometimes called a "risk level matrix".

There are four possible combinations of likelihood and consequences. Examples of the combinations are:

unlikely/minor = walking along a 20 cm plank on the floor.
This is ok.

likely/severe = jumping off a balcony as a fast way of getting to the ground. This is not very smart. Don’t do it!

likely/minor = bumping into a pointy door handle every time you try to get into a corner where your desk is situated.
This won’t kill you, but you get bruise upon bruise upon bruise.
You should consider fixing it.

unlikely/severe = football match
There is a small chance of something very bad happening: broken bones, spinal injuries, etc. You need to give serious consideration to such situations.

The unlikely/severe combination is the most troublesome:
“She’ll be right mate”
“I’ve been doing this for 20 years and it never happened to me”

A 2 x 2 risk matrix is probably too simple for use in a school.
A 3 x 3 risk matrix is the minimum (see later), viz. 3 levels of consequences and 3 levels of likelihood.

Consequences

Likelihood	Minor	Severe
Likely	?	X
Unlikely	✓	??

- ✓ = low risk
- ? = medium risk
  CONSIDER OTHER OPTIONS
  to reduce the risk
- ?? = high risk
  Either DON'T DO IT or
  PROCEED WITH GREAT CARE
  introducing measures to reduce the risk
- X = extreme risk
  DON'T DO IT!

Figure 2-2
A 2 x 2 risk matrix, the simplest possible risk matrix.

Risk control

This is the third in the trilogy of identify/assess/control.
Once you have assessed the risk, you might decide the risk is too high and control measures need to be introduced to reduce the risk. You should follow a logical hierarchy (Figure 2-3):

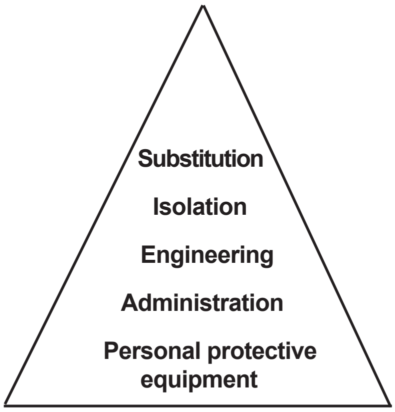

Figure 2-3
Hierarchy of control measures.

Substitution
Simply get rid of something that poses a significant risk,
e.g. instead of potassium chromate, use food dye to give a yellow colour to solutions for demonstrations

Isolation
Keep away from it,
e.g. use a stick to poke something, rather than touching it directly

Engineering
Use a device to protect you,
e.g. carry out an experiment in a fume cupboard

Administration
Arrange things so that people do not go near something risky,
e.g. ride-on lawn mowers prohibited during break or lunch periods

Personal protective equipment
Finally, protect yourself and others,
e.g. safety glasses

The whole risk assessment process

When considering an "experiment", or more generally, an "activity" [Figure 2-4, top], how do you end up with a "risk assessment" [Figure 2-4, bottom]?

What are the intellectual processes involved in doing it?

First of all, you need a written procedure.
You can (and often do) an assessment of risk for something entirely in your head, but in a school these days, you need a formal written procedure.

Next, an activity will involve, some or all of the following:

Equipment	e.g. Bunsen burner [burns, fires]
Materials	e.g. paper [paper cuts, flammable]
Chemicals	e.g. sodium hydroxide [corrosive!]
Living organisms	e.g. slug [rat lungworm disease, if eaten]
People	e.g. students [discipline issues]

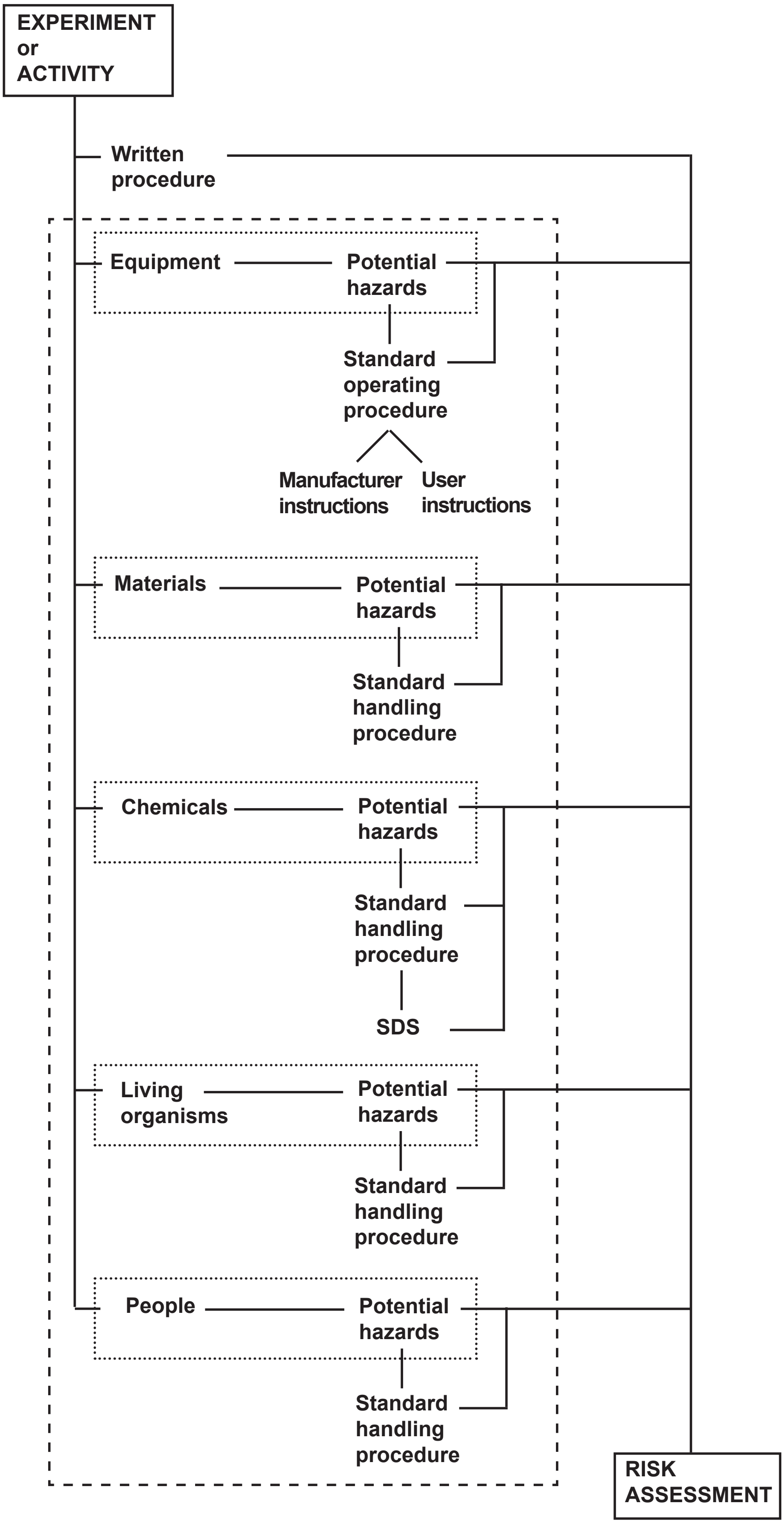

Figure 2-4
Logic of a risk assessment.

Small dotted rectangles indicate mini risk assessments of individual components of the activity.

Large dashed rectangle indicates the major risk assessment of the interactions between the components of the activity.

Most time and care is needed to identify and evaluate the interactions between components. Most injuries occur when interactions are overlooked.

You can consider the "potential hazards" of each item **as it is generally used**.
e.g. Bunsen burner: lighting, using under tripod/gauze.

In general, there is a "standard handling procedure" for each item.
e.g. place charcoal blocks in water to ensure they are extinguished before storing in a wooden cupboard over the weekend!

For chemicals there are also Safety Data Sheets (SDSs), which are required by law and must be provided by the supplier.

For equipment, we speak of standard operating procedures.
These are usually of two kinds:
"manufacturer instructions" (often barely intelligible), and
"user instructions" (simplification/translation produced by users).

You can't carry out a risk assessment on an item without considering its use,
e.g. you can't do a risk assessment on a chemical in isolation from its handling and use. A chemical in a sealed bottle poses different risks to the same chemical in an open container in a laboratory full of students!
If you are considering the toxicity of a chemical, you are assuming that someone has taken the chemical into his/her body by ingestion, absorption through skin, or by inhalation.
If the chemicals inside a mercury cell battery (for a camera) are eaten, severe poisoning is likely, but if the chemicals remain in the undamaged casing, there is very little danger; indeed the mercury cell is designed to be eaten by a child without ill-effects!

You need to carry out an assessment of risks on the whole of an activity, as it is actually carried out.

The risk assessment process involves carrying out "mini" risk assessments on the individual components of an activity [Figure 2-4, small dotted boxes] as they are usually carried out, then a holistic assessment, taking into account the interactions between components [Figure 2-4, large dashed box].

It is essential to consider the interactions between components, since it is commonly the interactions that cause injury:
EXAMPLE 1: sleeve of woollen jumper catches on rough edge of gauze on a tripod holding up a beaker of boiling water, which spills on student.
EXAMPLE 2: bottle of methylated spirits is used to refill a spirit burner when the flame is apparently extinguished but still burning with almost invisible flame, followed by an explosion of air/vapour mixture in the bottle, dropping of the bottle, smashing of the bottle, and burning methylated spirits spilt on nearby students.

Multilevel scale of consequences

The earlier risk matrix with just two levels of consequences (minor, severe) and two levels of likelihood (likely, unlikely) is a little too simplistic for use in schools.

The Australian/ISO standard allows an organization to choose any risk matrix that makes sense within the context of the organization.

A 3 x 3 risk matrix has generally proven acceptable in schools, but your school is free to choose a different one if it wishes. Some organisations require larger matrices (commonly 5 x 5 or even 7 x 7). In a 3 x 3 risk matrix, such as the one recommended in RiskAssess software, the three levels of consequence are:

Level 1 : first aid treatment at the school (Minor)

Level 2: treatment by a doctor (Moderate)

Level 3: immediate hospitalization or death (Severe)

These levels have the benefit of a simple test basis and correspond to the manner in which most people would see levels of severity for personal injuries.

The terms "minor", "moderate" and "severe" can be applied to the three levels, and some examples of injuries at each level are as follows:

Minor
- splinter in the skin
  e.g. wood splinter in finger
- small shallow cut
  e.g. cut fingers while picking up broken glass
- heat burn to minor area of body (<1 cm^2)
  e.g. touching a hot object with fingers

Prognosis: full recovery with no long-term ill effects
(First-aid treatment within the school)

Moderate
- heat burn to moderate area of body (1-5 cm^2)
  e.g. splash of burning liquid on skin
- eye injury without damage to the cornea
  e.g. wood dust in the eye
- cut requiring stitches, but with damage only to skin (no damage to arteries or tendons)

Prognosis: full recovery or, at worst, an insignificant scar
(Treatment by doctor)

Severe
- death
  e.g. fall from height
- eye injury with damage to the cornea
  e.g. hot concentrated sodium hydroxide solution in the eye
- heat burn to large area of the body (>100 cm^2)
  e.g. methylated spirits fire

Prognosis: permanent injury, serious scarring or death
(Immediate hospitalization)

Multilevel scale of likelihood

Similarly, we can define three levels of likelihood for a 3 x 3 risk matrix:

Level 1: known to commonly occur; not unexpected in the class
(Likely)

Level 2: uncommon, rare, but sufficiently frequent to have been witnessed by self or a known person
(Unlikely)

Level 3: very rare; have heard of it happening; may possibly have been witnessed by self or a known person
(Very unlikely)

The terms "likely", "unlikely" and "very unlikely" can be applied to the three levels, and some examples of events at each level are as follows:

Likely
- cutting fingers while cleaning up broken glass
  e.g. a broken test tube on the floor
- bruises and abrasions in playground
  e.g. falling over at play on hard surface
- injury during fight between students in a difficult class
  e.g. black eye

Unlikely
- injury during fight between students in a satisfactory class
  e.g. black eye
- eating biological materials for a "dare"
  e.g. roasting lobe of rat's liver over Bunsen flame and eating it
- burns from flaming gas jet
  e.g. turning bench gas tap full on and lighting with a match

Very unlikely

- deliberate self-harm
  e.g. burning self, eating a toxic chemical
- injury during fight between students in a good class
  e.g. black eye
- motor vehicle accident
  e.g. car or bus accident

The likelihood of many injuries depends on the behaviour of the class, in general, and certain individuals, in particular. In the examples above, the likelihood of injury during fighting ranges from likely to very unlikely, depending on whether the class is "difficult", "satisfactory" or "good".

Risk matrix, 3 x 3

The resulting 3 x 3 risk matrix, with the levels of consequence and likelihood described in the previous two sections, is shown in Figure 2-5.

We define it an acceptable risk if, at its worst, the activity could result in minor consequences (first-aid treatment in school). Otherwise, students would not be allowed to run around in the playground.

We also define it acceptable if the activity has a very unlikely chance of causing moderate consequences, for the same reason: a student may occasionally fall over and sprain/break a wrist, requiring a doctor.

If something is unlikely to cause moderate consequences, we need to consider it carefully; but if it is likely to have moderate consequences, we need to avoid it.

The situations where severe injuries (immediate hospitalization or death) may result should be prohibited at the levels of likely and unlikely.

If an activity is very unlikely to cause severe injuries, e.g. football or travel in a vehicle, it may be allowable in the context of risk levels that are accepted in society: sporting injuries are accepted by society at a “very unlikely” level; motor vehicle injuries are accepted by society at a “very unlikely” level.

Where activities are carried out with the very unlikely/severe combination, every effort should be taken to reduce the risk, e.g. bus with seat belts, excellent driver, bus in good repair, etc.

Other risk matrices

See www.riskassess.com.au/assets/RiskMatrix.pdf for a description of the risk matrices in the different States, along with their input levels of likelihood and consequences.

State school systems in QLD, VIC, SA and TAS each require the use of a 5 x 5 risk matrix, with different definitions of consequence and likelihood and a different pattern of severity of risk in the body of each risk matrix. These risk matrices are more complicated to use than the 3 x 3 risk matrix shown in Figure 2-5. Staff should use the risk matrix adopted by their school.

Many risk matrices are derived from the business world, where the focus is on financial loss to the organisation. If your school has a choice of risk matrix, it is recommended that one be chosen which has a focus on the individual rather than the institution. Whereas one serious injury each year may be acceptable (even good!) for an institution running 1000 schools, the same outcome each year for a single school would be completely unacceptable.

Iterations of risk assessment

Unfortunately, the severity of risk cannot be reduced to "low risk" in other school areas, e.g. sporting events such as football, or travel by motor vehicle.

The "inherent risk" is the severity of risk of an experiment or activity when no control measures are introduced beyond the "routine procedures" in the laboratory. If the inherent risk is low, further control measures are not required; however, if the inherent risk is medium or higher, control measures should be introduced to reduce the level of risk to "low risk". It should always be possible to reduce the severity of risk in science laboratories to "low risk" by introducing sufficient control measures, since the environment is amenable to a high level of control.

The process of risk assessment is an iterative one. It requires that you first assess the level of inherent risk using the school's risk matrix and then introduce adequate control measures to reduce the severity of risk to an appropriate level. You should re-assess the risks of the experiment with the control measures in place using the school's risk matrix, in order to check that the severity of risk has been reduced to "low risk". If not, further control measures are required and the check with the risk matrix should be repeated.

Australian/New Zealand ISO Standard on Risk Management

The latest Australian/New Zealand ISO standard on risk management (AS/NZS ISO 3100:2009) and its guidelines (HB 436:2013) provide assistance in the analysis and management of risks. The main elements of risk management are:

- Communicate and consult
  The people involved in different aspects of an experiment or activity should talk to each other.

Consequences

Likelihood	Minor	Moderate	Severe
Likely	✓	X	X
Unlikely	✓	?	X
Very unlikely	✓	✓	??

✓ = low risk

? = medium risk
CONSIDER OTHER OPTIONS
to reduce the risk

?? = high risk
Either DON'T DO IT or
PROCEED WITH GREAT CARE
introducing measures to reduce risk

X = extreme risk
DON'T DO IT!

Figure 2-5
Risk matrix for calculating the severity of risk, used by RiskAssess.

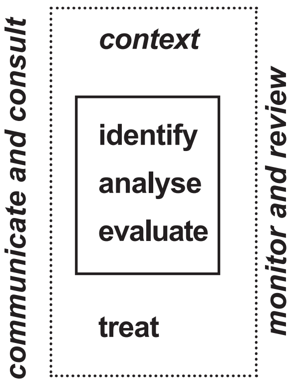

Figure 2-6
The risk management process according to the Australian/ISO Standard on Risk Management (2009). Risk assessment comprises the three core activities of risk identification, analysis and evaluation (in central box).

- Establish the context
  The context includes the location, the facilities available and the expected behaviour of the students involved.

- Identify risks
  This is the "brainstorming" time. What could possibly go wrong? What has gone wrong in similar situations in the past?

- Analyse risks
  Rate the risks on the basis of their likelihood of occurence and the consequences if they do happen.

- Evaluate risks
  What is the severity of each risk, based on its likelihood and consequences? A risk analysis matrix should generally be used at this point. What level of risk is acceptable?

- Treat risks
  Work out how to reduce the risk of bad things happening, starting with the worst. Unless the severity of risks can be reduced to an acceptable level, don't do it!

- Monitor and review
  Monitor the risks, and assess the effectiveness of your treatment measures for the risks. These need to be reviewed regularly in case better ways of reducing risks can be developed or in case circumstances change.

Since no numerical data are available for likelihoods or consequences of risks in school activities, only qualitative risk assessments can be performed.

The standard is explicit that rating systems of likelihood or consequence must make sense within the context of the organisation where it is to be applied. The standard also requires that any matrix for assessing the severity of risks must be useable, so that each combination of likelihood and consequences can be explored and accurately reflects the organisational perception of risk.

The logical structure of the Standard is shown in Figure 2-6.
It clearly defines "risk assessment" as the three core activities of risk identification, risk analysis and risk evaluation. The Standard refers to "identify/analyse/evaluate/treat", rather than "identify/assess/control", which is currently in much more common use and is the terminology of the Codes of Practice referenced in the Work Health and Safety Act and its Regulation. Most schools and school authorities still use "identify/assess/control", as described earlier in the chapter; this book will continue with the older convention.

RiskAssess

The legal requirement for "weighing up all relevant matters" in the Work Health and Safety Act means that a separate risk assessment has to be carried out for each science class, since the "relevant matters" may sometimes be different. This would appear a daunting task!

In fact, it is relatively simple to carry out a separate risk assessment for each class, if an electronic method of risk assessment is used; and there are many other benefits in terms of providing backgound information, storage of records and communication between staff.

At present, RiskAssess is only available for the Science area. Work has begun on versions for "tech" and "art" subjects and the plan is to ultimately produce customised versions for all school areas.

The web-based software called "RiskAssess" has been custom-designed for Science departments in schools to provide the fastest and most convenient way of performing risk assessments, sharing them between staff members, and storing them for future reference or for legal purposes.

Advantages of a formalised system for risk assessment

The most basic reason for carrying out risk assessments is to reduce the frequency of injuries to students and staff. There are follow-on benefits in terms of reduced costs for paperwork, litigation and payouts for injuries. It is also a good idea to comply with the law, since a school is, after all, a teaching institution! When students emerge from the school system and take up positions in the workplace, they will encounter very serious systems of risk management.

A formalised system of risk assessment ensures proper consideration of risks and control measures. This is particularly valuable for new or inexerienced staff, and it limits "cowboys" and "spur of the moment" experiments, which have a higher chance of causing problems.

Teachers and laboratory technicians need to work together to arrange experiments for science students and a formalised system can improve communication and organisation, especially if linked to an equipment ordering and laboratory scheduling system (as in RiskAssess).

A formalised procedure for risk assessment allows standardisation of risk assessment processes within a school and, if all the schools in a school system use the same processes, it becomes easier for staff to move between schools. A formalised system also assists orientation of new staff.

The law requires that risk assessments be stored as a long-term record. The Statute of Limitations is 7 years. However, courts routinely waive the Statute in cases, e.g. chemically-induced cancers, where the Plaintiff could not have been aware of the injury until much later. This means that, in effect, risk assessments should be stored for the lifetime of the persons involved!

Problems with paper-based systems

It is possible, but extremely difficult to comply with current legal requirements using a paper-based system. Paper forms are generally unweildy. Either they have many prompts, and the completed form ends up being mostly empty space; or they have few prompts and a high level of knowledge and skill is required, but not always available. Paper forms are non-searchable for key words and difficult to update. Finally, there are the storage problem: imagine the number of filing cabinets needed to store a paper risk assessment for each class for each experiment at a school for 80 years, the likely remaining lifetime of some of the students!

It is extremely time consuming and difficult to use a paper-based system to comply with current legal requirements for risk assessment.

Benefits of an electronic system

An electronic system, computer-based and connected to the web, is relatively rapid and can adapt to context by changing prompts, screens, etc. This means that if a relatively low-risk experiment is to be carried out, e.g. growing wheat seeds on wet cotton wool in a plastic dish on the window sill, the risk assessment can involve a much simpler process than for one with a high level of inherent risk, e.g. adding sodium to water.

Electronic systems do not use paper, except when it is desired to have a physical copy. There is no legal requirement for printing of risk assessments - you can opt for a completely electronic system of risk assessment and record keeping, if you wish, but you should ensure that your back-up systems are adequate.

It is easy to review and update electronic documents, searching documents by keywords, date, author, etc is fast and simple, and storage is no problem. The cost of electronic storage on hard-drives and in the "cloud" has been falling rapidly and is now insignificant for the operations of a school.

More than 900 schools in Australia, New Zealand and Canada are now using the electronic system called RiskAssess and more than 400,000 risk assessments have been carried out using it. It works!

Overview of RiskAssess

RiskAssess is web-based, meaning that there is no software to install on school computers, there is instant update of the software, and users can log in at school, at home or at any point on the planet with an internet connection.

The software follows the Australian/ISO Standard on Risk Management, so that school procedures can always be legally defended. State school systems in Queensland (DET), Victoria (DEECD) and South Australia (DECD) also follow this Standard with their risk management procedures.

RiskAssess has been customised to the school situation. It was developed in collaboration with teachers and laboratory technicians. Current users provide a steady stream of suggestions for improvements and new features, which are the basis of the continuing development of the software. RiskAssess provides electronic templates for entering experimental information with the minimum of key strokes. Databases within RiskAssess provide school-appropriate information about the potential hazards and standard handling procedures for chemicals, equipment and biological items, to assist users in assessing risks.

One of the many time-saving feature of RiskAssess is the easy creation of "modifiable copies" of existing risk assessments as the starting point for new risk assessments. Most data do not need to be re-entered and this allows the user to focus on the key aspects of assessing risks, in particular, the ways in which risks might be different for a particular class due to facilites available, class behaviour, special needs, allergies etc.

RiskAssess provides facilities for equipment ordering by teachers and for lab scheduling. Although these are not part of the risk assessment process, they are related to communication and the smooth functioning of science experiments. They result in considerable time savings and efficiencies for both teachers and laboratory staff.

Logical structure of RiskAssess

RiskAssess separates the tasks carried out by laboratory technicians (before and after class) from those carried out by teachers (during class). According to law, each person is only responsible for his/her own activities. However, it is desirable for each to check the activities of the other and, if possible, identify further risks or better ways of doing things. For this reason, RiskAssess facilitates cross-checking by teacher and laboratory technician and, in the case of experiments with high inherent risk, checking by a third person (reviewer) is mandatory.

Routine procedures are procedures, determined by the school, to be used in every class.

RiskAssess requires an inital assessment of "inherent risk" for an experiment, that is, the level of risk if no control measures were introduced beyond those "routine procedures" used in the laboratory (e.g. safety glasses, enclosed footwear, hair tied back) If the inherent risk is "low", an abbreviated risk assessment is possible and the process is completed rapidly. If the inherent risk is "medium" or higher, it is necessary to record control measures which are sufficient to reduce the risk level of the experiment to "low risk" (with the control measures in place). If the inherent risk is "high" or "extreme", a third reviewer is required to check that the control measures are sufficient.

Note that an experiment with control measures in place is not the same as the experiment without control measures. Control measures are part of an experiement.

In a science laboratory, it should always be possible to introduce sufficient control measures to reduce the risk level of an experiment to "low risk". As an example, consider the addition of sodium to water. The uncontrolled addition of a fist-sized lump of sodium to a bucket of water while standing over the bucket (even wearing safety glasses) would pose an "extreme" level of inherent risk. However, if the size of the sodium lump is no larger than a pea, the sodium is added to a beaker filled to the brim with water (so that no air/hydrogen mixture can accumulate), in a fume cupboard, with students standing back and with everyone wearing safety glasses, the risk level of the experiment as performed is "low risk".

Not all school areas can be as well controlled as a science laboratory. For instance, if the students after watching the sodium/water demonstration, go to play in a wet playground, play football or go on a bus trip, the chance of serious injury during these later activities is far greater.

Details of RiskAssess

RiskAssess can be accessed from computers, tablets or smart phones, provided only that there is an internet connection. A virtually unlimited number of people can use RiskAssess at the same time.

After one person at a school has entered the details of an experiment, other people can make "modifiable copies" as the starting point for their own risk assessments, saving the time of data entry.

The background information provided for chemicals in RiskAssess complements the information in safety data sheets. RiskAssess provides information about potential hazards that are appropriate to the school situation, rather than the industrial workplace.

RiskAssess backs up data on multiple systems in different countries. While it is not possible, for legal reasons, to guarantee that RiskAssess will preserve risk assessments forever, the system has been designed for long-term security of record keeping. Schools should, however, back up their risk assessments.

Further information, the User Guide, and a wide range of learning materials are available on the RiskAssess website at

www.riskassess.com.au

Student RiskAssess

Student RiskAssess allows students to easily carry out risk assessments as required for the new Australian Curriculum for Science, for the International Baccalaureate, and for extended investigations (student-initiated experiments).

More than 100 schools have subscribed to Student RiskAssess since its release in January 2013. It is going well and the students seem to enjoy it!

The importance of safety training is now being recognised in learning programs at schools. Training in the assessment of risks will provide a life-long skill, which will benefit both the students themselves and their future co-workers and employers.

The Australian Curriculum for Science has been released for Years F to 12 including that for each of the Senior Secondary Science subjects. The curriculum requires students to take an increasingly active role in considering safety and risk in investigations as they progress from Year 5 to Year 12. Identification of risks is mentioned from Year 5, assessment of risk from Year 9 and conducting risk assessments is an inquiry skill for Years 11 and 12. The safety requirements of the new Australian Curriculum for Science are summarised in Table 2-1.

Student RiskAssess has been optimised for student use:

- students must agree to conduct each experiment safely in accordance with school rules and teacher instructions
- student name(s) are recorded for individual or group work
- student(s) assess risks on the basis of likelihood and consequences using a risk matrix
- student(s) assess inherent risk and record control measures
- on-line help screens, electronic documents and User Guide for Student RiskAssess are provided
- separate lab scheduling page for student experiments is provided to help lab technicians.

Student RiskAssess continues to have all the facilities of RiskAssess:

- database information on chemicals, equipment and living things
- templates that follow the Australian ISO Standard on Risk Management
- assessment of inherent risk and recording of control measures by teachers and lab techs
- electronic signing by teacher and laboratory technician, email and risk assessment storage, and
- lab scheduling.

Student RiskAssess can be used in the classroom on laptops, iPads (and other tablets) and on smart phones (iPhones, Android, etc). Students can access Student RiskAssess from home or from any location with an internet connection, providing incentive for students to learn and embrace new technologies.

It is hoped that the combination of RiskAssess and Student RiskAssess will not only reduce injuries in schools, but also influence workplace health and safety more generally, as students emerge from the school system with an understanding of risk assessment and safe work practices.

Table 2-1
Safety requirements in the Australian Curriculum for Science[1] for each of the Senior Secondary Science subjects[2].

Year 5	"Use equipment and materials safely, identifying potential risks" (Content description) "explaining rules for safe processes and use of equipment" (Elaboration 1)
Year 6	"Use equipment and materials safely, identifying potential risks" (Content description) "discussing possible hazards involved in conducting investigations, and how these risks can be reduced" (Elaboration 1)
Year 7	". . . ensuring safety and ethical guidelines are followed" (Content description) "learning and applying specific skills and rules relating to the safe use of scientific equipment" (Elaboration 2)
Year 8	". . . ensuring safety and ethical guidelines are followed" (Content description) ". . . safe investigation when planning investigations" (Elaboration 3)
Year 9	"assess risk" (Content description) "identifying the potential hazards of chemicals and biological materials used in experimental investigations" (Elaboration 2)
Year 10	"assess risk" (Content description) "identifying the potential hazards of chemicals and biological materials used in experimental investigations" (Elaboration 3) "identifying safety risks and impacts on animal welfare and ensuring these are effectively managed within the investigation" (Elaboration 6)
Year 11 Year 12	"Conduct risk assessments" is one of the Science inquiry skills, and is mentioned in the content descriptions[3] in Biology Units 1-4, Chemistry Units 1-4, Earth and Environmental Sciences Units 1-4 and Physics Units 1-4. "It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students and that school practices meet the requirements of the *Workplace Health and Safety Act 2011*, in addition to relevant state or territory health and safety guidelines"[4].

1. http://www.australiancurriculum.edu.au/Science/Curriculum/F-10
2. http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Biology/Senior-secondary-Science-subjects
3. http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Biology/Curriculum/SeniorSecondary
http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Chemistry/Curriculum/SeniorSecondary
http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Earth-and-Environmental-Science/Curriculum/SeniorSecondary
http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Physics/Curriculum/SeniorSecondary
4. http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Biology/Safety
http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Chemistry/Safety
http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Earth-and-Environmental-Science/Safety
http://www.australiancurriculum.edu.au/SeniorSecondary/Science/Physics/Safety

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