IOSH Managing Safely

MODULE 3: RISK CONTROL

SAMPLE MATERIAL

(Material correct Autumn 2013)

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Risk Control Options

Key Information

- Risk can be controlled by reducing the likelihood of a hazardous event, or reducing the consequences of the event, or both.
- Residual risk is the risk that remains after risk control options have been put in place.

In this section of the course we are going to look at the three main options that can be used to control risk. We will also consider that even when these options have been correctly used, there will always be an element of risk remaining.

Reducing Likelihood And Consequence

You will remember from the last module that one of the key steps in the risk assessment process involves evaluating the risk. This means answering the question - is this level of risk acceptable? Yes or no?

If the level of risk is completely acceptable then no further action needs to be taken. If, however, the level of risk is unacceptable then further action must be taken to reduce the risk to a more acceptable level. This is risk control.

There are three main options for risk control:

- Reduce the likelihood of the hazardous event.
- Reduce the consequences of the hazardous event.
- Reduce both likelihood and consequence.

If you recall the risk rating matrix that was introduced in the Module 2, you will remember that:

Risk = Likelihood × Consequence

So a lower risk rating can be achieved by changing one or both of the starting numbers.

Reducing Likelihood

This means introducing risk controls that make it less likely that a hazardous event will take place, e.g.:

- Fit a guard to a dangerous moving part of machinery (such as a circular saw blade) so that it is less likely that anyone will come into contact with that dangerous part.
- Make a worker wear a face visor when handling a corrosive chemical, making it less likely that the chemical will splash in their eye.
- Warn people about a particular hazard (such as a slippery step) in the hope that they will then take extra care.

The limitation of reducing the likelihood is that it does not tackle the consequences. So if a person does interact with the hazard then they will still get hurt to the same degree.

A worker wearing a protective face visor

Reducing Consequence

This means introducing risk controls that make the outcome of the hazardous event less severe, e.g.:

- A steel erector working at height might wear a fall-arrest harness. This does not stop them from falling from height, but it does minimise the severity of their injuries if they do fall.
- Substitute a corrosive chemical with one that is classified as an irritant. Both chemicals are hazardous, but if one is spilt on the skin it will cause mild irritation rather than a chemical burn.
- Put a handrail on either side of the steps so that if people do slip they have something to hold on to to stop them hitting the floor.

A steel worker wearing a safety harness

The limitation of this approach is that it does not reduce the likelihood that a hazardous event will occur in the first place.

Reducing Both Likelihood and Consequence

This approach combines the benefits of both of the previous options, e.g.:

- Replace an existing company car with a newer model on the basis that the newer model has a better braking system (e.g. Assisted Braking System (ABS)) and better in-built safety features, such as side-impact airbags. These safety features make it less likely that the car will be involved in a collision and may also reduce the severity of injury to the driver.

Residual Risk

Jargon Buster

Residual Risk

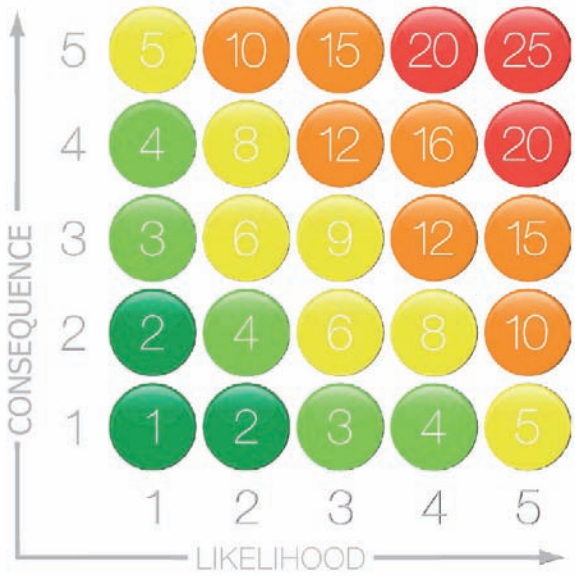
Residual risk is the risk that remains once you have implemented your chosen risk control option(s).

Whatever control option is selected, there will almost always be some risk remaining. Nothing at work (or in life in general) is completely risk free.

Obviously we want the residual risk to be as low as possible and we must ensure that any residual risk is acceptable. There is no point in implementing costly and time-consuming risk controls if they will not be effective in reducing the risk to an acceptable level.

The level of residual risk can be estimated using:

Risk = Likelihood × Consequence



To illustrate this idea we can consider a few of the examples given above:

- In the example of the guard fitted to a dangerous moving part of machinery (such as a circular saw blade):
  - The risk rating before the guard was fitted might be 3 × 4 = 12.
  - When the guard is fitted, the likelihood of the hazardous event might be reduced from 3 to 1.

- The consequence stays the same at 4.
- The risk rating with the guard fitted (the residual risk) is 1 × 4 = 4.

- In the example of the steel erector working at height without a fall-arrest harness:
  - The risk rating might be 3 × 5 = 15.
  - With the fall-arrest harness the risk rating might be 3 × 2 = 6.
- In the example of the existing company car:
  - The risk rating might be 3 × 5 = 15.
  - With a newer model the risk rating might be 2 × 4 = 8.

In each case a real reduction in the level of risk can be demonstrated. However, in each case some residual risk remains.

In the next part of this module we will look at the main factors which have to be considered when trying to decide which risk control option(s) to use.

Revision Questions

1. List the three main risk control options that can be used to reduce risk.
2. What is residual risk?

(Suggested Answers are at the end of the course)

Deciding on Risk Control

Key Information

- When trying to decide which risk control option to use, a useful tool is the risk control hierarchy:
  - Eliminate the hazard.
  - Reduce the hazard.
  - Prevent people coming into contact with the hazard.
  - Safe systems of work.
  - Personal protective equipment.
- Any risk control option that relies on personal human behaviour is likely to be less reliable than a risk control option that does not.
- Reducing risks so far as is reasonably practicable means that the cost of the risk controls measured in **time,** money and effort has to be proportionate to the level of risk.

If risk assessment shows that a particular task or activity has an unacceptable level of risk associated with it, then some additional risk controls must be introduced to reduce the risk down to acceptable levels. In some cases there may be only one way to do this, but in many cases there may be a variety of different options available that reduce likelihood, consequence, or both. When making the decision about which particular risk control to use, there are several factors that should be considered:

- How effective will the risk control be in reducing the risk?
- What will the influence of human behaviour be on the effectiveness of the control?
- Will the risk be reduced to a level that meets legal requirements, i.e. down to **as low a level as reasonably practicable**?

When answering the first of these questions, it's a good idea to make use of a list of control options called the **risk control hierarchy**.

Risk Control Hierarchy

The risk control hierarchy is a list of five risk control options:

- Eliminate the hazard.
- Reduce the hazard.
- Prevent people coming into contact with the hazard.
- Safe systems of work.
- Personal protective equipment.

Jargon Buster

Safe system of work

A formal procedure that sets out how an activity can be carried out so that risks are eliminated or controlled.

Personal protective equipment

Equipment or clothing worn by a worker to protect them against one or more risks to their health and safety.

The options at the top of the list are the most effective and therefore are the preferred options. Those lower down the list are less effective because they tend to rely on individual personal behaviour. They are, therefore, more prone to human error and should be considered in combination with higher options or when the higher options are impractical or unrealistic.

In this way the list forms a hierarchy with the best risk control option at the top of the list and the less effective options at the bottom.

1. **Eliminate the hazard**

   The very best option would be to get rid of the hazard that gives rise to the risk in the first place. This might be done by changing a work activity, e.g. changing from wet-paint spraying to powder coating in order to eliminate the solvents used in the wet-paint spraying operation. Alternatively it might be done by automating or mechanising a process, e.g. mechanising the handling of sheets of laminate material in a workshop in order to eliminate the manual handling of those sheets.

Eliminating the hazard goes right to the source of the problem – the thing that generates the risk in the first place.

2. **Reduce the hazard**

   If the hazard cannot be completely eliminated then it may be possible to reduce the hazard at source - the hazard will still remain but it will inherently generate less risk. This might be done by modifying the existing hazard, e.g. a large load might be split up into smaller loads for manual handling purposes. Alternatively one source of the hazard might be substituted with another that generates less risk, e.g. one hazardous chemical might be substituted with another that is less of a health risk. Likewise, a noisy item of plant or machinery might be substituted for another that does the same job but generates less noise.

3. **Prevent people coming into contact with the hazard**

   If the hazard itself cannot be eliminated or modified then it may be possible to separate people from the hazard in order to prevent contact. This might be done by placing the hazard in a very inaccessible location, e.g. high voltage power lines are sited on high pylons with barbed wire on the legs to prevent any person from coming into contact with the lines. Alternatively the hazard might be put under lock and key to prevent unauthorised access, e.g. flammable liquids might be stored in a locked compound that only authorised workers have the key to. Or the hazard might be enclosed in some form of enclosure to prevent contact, e.g. a guard on a dangerous moving part of machinery.

4. **Safe systems of work**

   A safe system of work is the set of procedures and rules that govern a particular work activity. This might include any permit-to-work systems that apply to the work activity. In some instances the safe system of work is a simple set of instructions for performing a task or operating a piece of equipment, e.g. the operating instructions for an office printer. In other instances a safe system of work is a complex set of rules and procedures developed to control high risk work activities such as the maintenance of large, complex industrial plant. Safe systems of work are very reliant on personal behaviour; people have to do things the right way every time.

5. **Personal protective equipment**

   Personal protective equipment is the equipment and clothing that a worker might wear to protect them from one or more risks to their health and safety, e.g. hard hats, goggles, hi-visibility jackets, safety boots and gloves. In some instances personal protective equipment must always be worn by the worker to ensure their safety during a particular work activity, e.g. a welder will always wear a head shield or visor to protect their face and eyes from harmful UV radiation given off during the welding process. In other instances personal protective equipment will only be worn in an emergency, e.g. chemical resistant gauntlets might only be used when cleaning up a spill of hazardous chemical following a leak.

Influence of Human Behaviour

One of the reasons why control options at the top of the hierarchy are more reliable and control options towards the bottom of the hierarchy are less effective is the influence of human behaviour.

Simply put, options at the top of the hierarchy are less reliant on personal human behaviour. Options at the bottom of the hierarchy are very reliant on personal human behaviour.

People are not robots. They do not behave perfectly all of the time. Sometimes people are prone to human error; they make mistakes and get things wrong even though they are trying to do the right thing. Other times they break the rules knowingly; people wilfully do things the wrong way because they want to.

Safe systems of work and personal protective equipment are particularly vulnerable to human error and wilful disobedience.

For example, if you give a worker who works in a high noise area some hearing protection (ear plugs or ear defenders) they may or may not wear them. Whether they wear them or not will depend on many factors such as:

- How well you have trained them.
- Whether they remember to carry them and put them on.
- How uncomfortable they are to wear.
- Whether or not they will get disciplined for not using them.
- Whether or not everyone else wears hearing protection (peer group pressure).

A worker in a high noise area chooses to wear ear defenders

So the personal protective equipment risk control option is not perfect; its effectiveness is heavily influenced by personal human behaviour. If this risk control option is used then it will require significant management commitment to make it work properly. Management will have to provide the hearing protection and the training to ensure the worker understands how to use it correctly. Management will also have to supervise and enforce the use of the hearing protection. This takes time and effort.

If the noise source itself had been eliminated or substituted with one that produces less noise then the hearing protection option would not be necessary.

So Far As Is Reasonably Practicable

The risk control hierarchy is a very useful tool to use when you are trying to decide which risk control options to implement during the risk assessment process. However, you also need to think about health and safety law and what the legal requirement for risk reduction is.

In most cases, health and safety law requires you to reduce risks **so far as is reasonably practicable**.

As we pointed out earlier in the course, there is no such thing as zero risk. There is risk associated with all activities in work and in life in general. Even looking at a computer screen you are being bombarded by invisible background radiation that carries with it a small but real health risk. Health and safety law does not, therefore, require you to create a risk free workplace because such a thing cannot exist. Instead the law usually requires you to reduce risks so far as is reasonably practicable.

This legal phrase means that you have to make a judgement of the level of risk and you have to balance that risk with proportionate risk controls. To do this you should consider the time, cost and difficulty of those risk controls.

Here are two extreme examples:

- The risk presented by paper cuts in an office is very small. Paper cuts happen occasionally but when they do they are of little consequence. You might therefore describe the risk as minor or trivial. Health and safety law does not require that any time, cost or effort has to be spent on controlling the risk of paper cuts in an office.
- The risk presented by explosive decompression in a deep sea diving operation is very high. Without proper controls, accidents would happen fairly often and when they did, people would die. You could not describe the risk as minor or trivial. Health and safety law requires that a lot of costly, time-consuming and difficult controls are put in place to reduce the risk to an acceptable level. Even with these controls in place some residual risk remains that is higher than the risk presented by paper cuts in an office.

These two extreme examples help to illustrate the principle behind the phrase "so far as is reasonably practicable". It is the idea that the level of risk has to be balanced against the cost in time, money and effort of the risk controls.

In most workplaces extreme examples do not exist and we find ourselves in the middle ground. There are some risks which are not extremely high or extremely low and we have to decide which risk control options are proportionate and which are not. This can be a difficult judgment to make - we want to comply with legal standards but we do not want to waste time, money and effort putting controls in place that are excessive and unnecessary.

One factor that should be taken into account when making this judgement is the level of risk estimated during the risk assessment and the risk reduction that might be achieved by putting different risk control options in place.

For example, controlling the risk of slips and trips on a construction site must be done so far as is reasonably practicable. This might be done by setting out designated pedestrian walkways; ensuring that these walkways are level and free of significant potholes; keeping them clear of debris and stored materials; and ensuring that they are adequately lit if the site is used during the hours of darkness.

Controlling the risk of slips and trips in a care home for the elderly must also be done so far as is reasonably practicable. It won't look like a construction site but all pedestrian walkways must still be kept very tidy and free of all slip and trip hazards. This is because the elderly are far less able to avoid slip and trip hazards and the consequences of a fall could be very severe.

In the examples given above, even though the same legal phrase is used in both workplaces, in practice it means a very different set of controls have to be adopted to ensure that the risk is controlled by proportionate means.

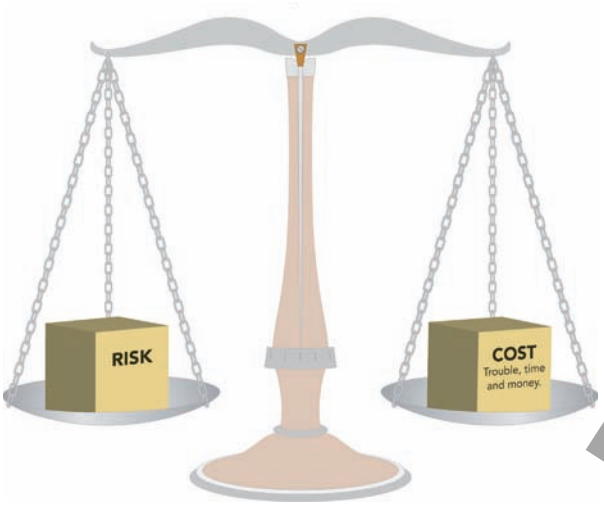


Illustration of 'Reasonably Practicable'

Case Study

A small electrical company sells electrical control systems for industrial workplaces. These control systems are built inside metal boxes. As part of the manufacturing process, the company cuts, folds, welds and paints the metal boxes so that the electrical control systems can be fitted inside. These are then shipped to the customer where they are installed.

One of the main hazards associated with the manufacture of the metal boxes is the paint spraying operation. This involves the use of isocyanate solvent-based paint. The isocyanate solvent can cause long term and severe occupational asthma if the vapours are inhaled. It can also cause dermatitis on contact with the skin.

The company can apply the risk control hierarchy to the paint spraying operation in a number of ways:

Eliminate the hazard

- Buy the metal boxes pre-assembled and painted. The company would not have to manage any of the risks associated with the assembly and paint spraying operations. They could simply build their electrical control systems into the finished boxes; or

Or

- Manufacture the metal boxes but send them to a specialist for paint spraying, then ship them back for the next stage of the process. The company would still have to manage the risks inherent in the manufacturing process but not the risks involved in the paint spraying operation itself.

Reduce the hazard

The company could find an alternative way of applying a durable finish to the metal boxes that would not involve the use of isocyanate solvents.

If the company decides to keep the isocyanate paint spraying operation, then:

Prevent people coming into contact with the hazard

- It must be enclosed in a spray booth that has an exhaust ventilation system built into it. This keeps the solvent vapours away from everyone except the individual doing the job – it also keeps that person away from the majority of the vapours.

Safe system of work

- A set of rules and procedures will have to be developed for the safe use, handling and storage of the solvents.

Personal protective equipment

- The worker in the spray booth will have to wear overalls, gloves and breathing apparatus to prevent skin contact and inhalation of the solvent or its vapours.

The company decides that the additional costs associated with outsourcing the work make the first two options unrealistic. After some investigation it also decides that substitution of the isocyanate paint is not possible because the quality and durability of the finish cannot be maintained.

The company therefore decides to retain the isocyanate paint spraying operation but must then implement all three of the remaining risk control options (a spray booth with extraction, safe systems of work and personal protective equipment) because the health risks from the isocyanate paint are so significant.

If you are trying to decide exactly how far to go in reducing risk so far as is reasonably practicable, the HSE produce a lot of guidance documents that can be very useful in identifying the recommended risk controls for a particular type of workplace or work activity.