

GUIDELINES

Managing safety-in-design
in the HVAC industry



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INTRODUCTION

SAFETY-IN-DESIGN IS A STATUTORY RESPONSIBILITY FOR ALL THOSE INVOLVED IN BUILDING SERVICES DESIGN AND CONSTRUCTION, SO IT IS IMPORTANT THAT WE HAVE EFFECTIVE END-TO-END PROCEDURES THAT MANAGE OUR SAFETY-IN-DESIGN RESPONSIBILITIES.

While safety-in-design objectives are easy to understand, in practice, managing these responsibilities is difficult within a construction project context, especially with design and construction contracts. AMCA members engineering and site installation procedures and supporting work instructions need to detail processes to manage their safety-in-design responsibilities.

This paper provides additional practical guidance for the effective management of our members' safety-in-design responsibilities through the project bid and delivery phases.

We have a responsibility as designers, constructors, manufacturers, owners and operators to ensure, so far as is reasonably practicable, **that the health and safety of other persons is not put at risk**

UNDERSTANDING OUR SAFETY-IN-DESIGN RESPONSIBILITIES

WORK HEALTH AND SAFETY IS A RESPONSIBILITY OF STATE AND TERRITORY GOVERNMENTS. THEREFORE, SAFETY-IN-DESIGN OBLIGATIONS ARE COVERED BY THE RESPECTIVE ACTS, REGULATIONS AND CODES OF PRACTICE IN EACH JURISDICTION.
(see opposite page)

Most state and territory governments have adopted the Commonwealth Model Workplace Laws, which includes:

- Work Health and Safety Act 2011
- Work Health and Safety Regulations 2011
- Various Codes of Practice

It is the Model Workplace Health and Safety laws that will be referred to most throughout this guideline.

MODEL WORK HEALTH SAFETY ACT

SECTION 22: DUTIES OF PERSONS CONDUCTING BUSINESSES OR UNDERTAKINGS THAT DESIGN PLANT, SUBSTANCES OR STRUCTURES.

The designer must ensure, so far as is reasonably practicable, that the plant, substance or structure is designed without risks to the health and safety of persons:

In summary -

The designer must ensure, so far as is reasonably practicable, that the plant, substance or structure is designed without risks to the health and safety of persons:

- Who use the plant, substance or structure for a purpose for which it was designed;
- Who construct the structure
- Who manufacture or assemble the plant
- Who decommission or dispose of the structure, plant or substance.

MODEL WORK HEALTH SAFETY ACT

SECTION 19 PRIMARY DUTY OF CARE

In summary:

A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the health and safety of workers at work in the business or undertaking.

Safe Work Australia are responsible for maintaining the model WHS laws but they do not regulate or enforce them, that is done by an equivalent authority in each state.

The responsible authorities are:



As the act, regulations and codes of practice all originate from Safe Work Australia, the requirements are uniform across all states.



CODES OF PRACTICE

Confined spaces

Hazardous manual tasks

How to manage work health and safety risks of workplace hazardous chemicals

Managing electrical risks in the workplace

Managing noise and preventing hearing loss at work

Managing risks of hazardous chemicals in the workplace

Managing the risk of falls at workplace

Managing the risks of plant in the workplace

Managing the work environment and facilities of safety data sheets for hazardous chemicals

Safe design of structures

Work health and safety consultation, coordination and cooperation.



Codes of practice are practical guides to attaining the standard of work health and safety (WHS) required by WHS laws. Codes of practice do not have the same legal force as the WHS acts or regulations, although they are designed to be used in conjunction with these. In other words, a prosecution cannot be mounted simply on grounds of failing to comply with a code of practice.

However, an approved code of practice is admissible in the proceeding as evidence of whether a duty or obligation under the act has been complied with. Note that anyone with a duty of care should follow codes of practice unless they follow an alternative course of action that achieves the same or a better standard of WHS. Failure to observe a code of practice can be used as evidence in any proceedings that the person or corporation contravened or failed to comply with an act or its regulations.

Note: It should be noted that ignoring safety in design responsibilities may be deemed a clear act of negligence and therefore also uninsurable.

Each state and territory's principal WHS (or OHS) act sets out the legal status of codes of practice in that jurisdiction. In Victoria, codes of practice are known as 'compliance codes', while in the ACT, they are notifiable instruments. A code of practice is not considered to be in effect unless it has been approved by the minister responsible for WHS. That said, to be safe, consider them a legally binding requirement to be followed.

WHO IS RESPONSIBLE?

THE REQUIREMENTS WITHIN THESE ACTS ARE SIMILAR AND GENERALLY BASED ON THE MODEL WORK HEALTH AND SAFETY REGULATIONS PREPARED BY SAFE WORK AUSTRALIA THAT DEFINE SAFETY-IN-DESIGN RESPONSIBILITIES AS FOLLOWS:

"A person or corporation who designs a new building or structure or part of a building or structure to be used as a workplace must ensure, so far as is reasonably practicable, that it is designed to be safe and without risks to the health of persons using it as a workplace for a purpose for which it was designed".

Workplaces include both construction sites, as well as completed facilities.

It is also important to note that the Work Health and Safety Act specifically defines the obligations of designers in section 22: *"duties of persons conducting businesses or undertakings that design plant, substances or structures"*. This continues through to section 26: *"duty of persons conducting businesses or undertakings that install, construct or commission plant or structures"*. In all cases the obligation includes passing on information to people who will use the plant, and as the obligation exists, there is an obvious requirement to record the execution of the obligation.

Also note that there are obligations within the Work Safety acts to provide adequate information in connection with the use of plant if there are any residual risks.

The key requirement is that designers have a statutory obligation that they *"must ensure, so far as is reasonably practicable, that the plant, substance or structure is designed to be without risks to the health and safety of persons"*.

Also, designers must: *"give adequate information to each person who is provided with the design" ... "any conditions necessary to ensure that the plant, substance or structure is without risks to health and safety when used for a purpose for which it was designed or when carrying out any activity referred to in subsection (2) (a) to (e)."* These purposes referred to in subsection (2) (a) to (e) include use, handle, store, construct, decommission, dismantle and disposal.

Worksafe Australia guidance notes suggest that **"reasonably practicable"** means that what can be done to provide a safe work environment without risk to the health or safety of persons using the workplace should be done unless it is reasonable in the circumstances for the duty-holder to do something less.

Tests for whether 'reasonably practicable' have been met from a safety-in-design perspective can include compliance with relevant Australian technical standards, authority guidelines and industry established practices and knowledge. In some cases, the application of risk management principles can also fulfil this requirement.

It should be noted that ignoring safety in design responsibilities may be deemed a clear act of negligence, and therefore uninsurable. Provided we have undertaken a documented safety in design process, whether judged ultimately to have not met a test of 'reasonably practicable' is at least likely to assure we have professional indemnity insurance cover

One of the key challenges is determining who is the designer as design is generally a collaborative process that can involve many parties including:



THE OWNER



ARCHITECT



CONSULTING ENGINEER



HEAD CONTRACTOR



CONSTRUCTION ENGINEERS/
SHOP DRAWERS



SITE INSTALLATION TEAM



SUPPLIERS

In many cases, important design decisions that have safety in design consequences are effectively locked in before the mechanical contractor becomes involved in the project. This however does not mitigate a member's responsibilities in relation to assuring safety in design outcomes are met.

KEEPING RECORDS

THE IMPORTANCE OF MAINTAINING SAFETY IN DESIGN RECORDS INCLUDING RISK ASSESSMENTS, RISK MITIGATION ACTIONS AND CORRESPONDENCE CANNOT BE UNDERSTATED.

It is considered good practice to create a safety-in-design register, but where does this requirement originate?

The code of practice, *How to manage Work Health & Safety Risks*, includes a section titled 'Keeping Records' where it is suggested that "keeping records of the risk management process demonstrates potential compliance with the WHS Act and regulations". Remember that following a code of practice is taken as demonstration of compliance with the Act, if an alternative course of action is taken it will need to demonstrate that it achieves the same or a better standard of WHS.

The code of practice suggests including in records:

- the identified hazards, assessed risks and chosen control measures (including any hazard checklists, worksheets and assessment tools used in working through the risk management process)
- how and when the control measures were implemented, monitored and reviewed
- who you consulted with
- relevant training records
- any plans for changes

There are specific record-keeping requirements in the WHS regulations for some hazards, such as hazardous chemicals. If such hazards have been identified at your workplace, you must keep the relevant records for the time specified.

Keeping records of the risk management process:

- allows you to demonstrate how decisions about controlling risks were made
- assists in targeting training at key hazards
- provides a basis for preparing safe work procedures
- you to more easily review risks following any changes to legislation or business activities
- demonstrates to others (regulators, investors, shareholders, customers) that work health and safety risks are being managed

Other consideration to note with respect to records:

- The WHS Act requires that you consult, co-operate and co-ordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable
- The WHS Act requires any risks that cannot be eliminated to have document control measures and that these be communicated to workers installing and maintaining plant
- The WHS regulations require any risk control measures to be maintained and reviewed
- The WHS regulations require the provision of information, training and instruction to workers installing and maintaining plant.



RISK IDENTIFICATION & MITIGATION

HAZARD IDENTIFICATION			CONSTRUCTION RISK						
Design Discipline/ Category Name	Risk Ref	Hazard	Consequences & Impact	Risk Evaluation			Mitigation Strategy & Action	Owner	Consequences and Impact
				Likelihood	Consequences	Risk Rating			
Architectural Fall Prevention	A1	Fall from roof	Death or serious Injury	3	5	High	Safety Rails to be fitted during construction	Client	Death or serious Injury
Architectural Material Handling	A1	Gas suppression bottles fall during movement through building Injuring others		1	1	Low		Contractor	Potentially serious injury and/or damage to equipment

THE KEY AREAS OF FOCUS FOR SAFETY-IN-DESIGN RELATED TO HVAC SERVICES TEND TO BE:

INSTALLATION SAFETY

- Plant access and clearance zones
- Life cycle plant replacement
- Material handling
- Electrical safety
- Electrical isolation

PLANT SAFETY IN DESIGN SAFETY HAZARDS CAN INCLUDE:

- Persons falling
- Falling objects
- Noise
- Damage to sight – chemicals, ultraviolet light or flying objects
- Flammable or combustible substances
- Hazardous atmospheres
- Hazardous chemicals
- Biological hazards
- Airborne contaminants
- Electricity
- Extreme temperatures
- Moving machinery
- Manual tasks – overexertion or repetitive movement
- Stored energy – electricity, air or water pressure, compressed springs.

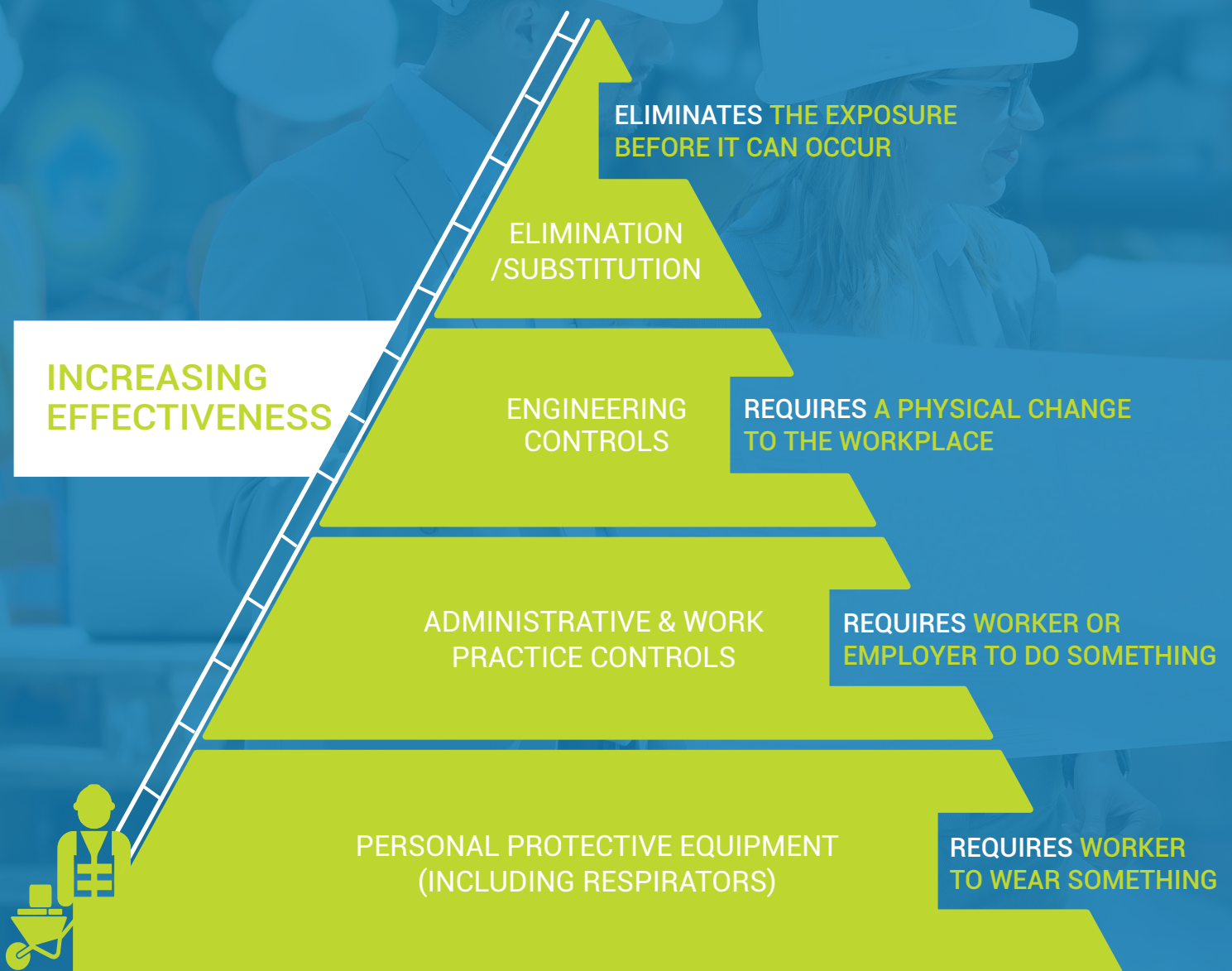


OPERATIONAL RISK					RESIDUAL RISK						
Risk Evaluation			Mitigation Strategy & Action	Owner	Due to be actioned by	Action Status	Risk Evaluation			Risk Open/Closed	Comments
Likelihood	Consequences	Risk Rating					Likelihood	Consequences	Risk Rating		
5	3	Extreme	Team decision that roof would be non accessible, plant relocated accordingly, gutter cleaning vis cherry picker. Hazard signage to be fitted	Client	Design Completion	Agreed Mitigation Status	3	1	High	Closed	Medium rating indicates importance of appropriate hazard signage
5	3	High		Contractor	Concept Design	Complete	5	3	Low	Closed	



The safety-in-design risk mitigation hierarchy describes the methods available to reduce risk and is illustrated in the following diagram.

FROM A DESIGN PERSPECTIVE – HIERARCHY OF MITIGATION STRATEGIES IS KEY



Our ability to influence the choice of mitigation strategies is generally determined by the extent of our involvement in the design development process.

Examples of safety in design actions using this hierarchy include:

Elimination	<ul style="list-style-type: none"> Relocate roof mounted air conditioning plant to ground level eliminating entirely the risk related to falls from the roof.
Engineering controls	<ul style="list-style-type: none"> High level isolation valves moved to low level so that they can be operated from ground level. Use of prefabricated risers to minimise shaft installation work. Shortening of condenser water floor take-off branches to reduce risk of Legionella infections.
Administrative and work practice controls	<ul style="list-style-type: none"> Provision of hazard signage and confined space SWMS within the O&M Manuals. WH&S instructions provided in the O&M manuals.
Personnel protective equipment	<ul style="list-style-type: none"> Construction PPE and maintenance PPE including respirators for certain cooling tower maintenance activities and hearing protection in generator plant rooms.

Any issue where the resolution involves administrative and work practice controls and personnel protective equipment will require these residual risks to be identified to end users and appropriate training and information provided. Where a safety in design issue is identified, it is important that the measures taken to facilitate its resolution are fully documented. Steps that may be appropriate include:

Steps that may be appropriate include:

- Issue of a request for information requesting resolution of a safety in design issue
- Issue of a safety-in-design risk register on larger projects
- Issue of a request for a workshop with the project designers.

In most cases, this should lead to an appropriate resolution noting that the project team have a collective responsibility to resolve an identified hazard as far as reasonably practical.

Each project should have a hazards register covering both short-term construction issues and long-term usage issues, include safety-in-design issues or reference the safety-in-design register. The register serves the obvious purpose of identification of risks, but also provides evidence that the designers have undertaken their statutory assessment obligations, noting that creation of a safety-in-design register has become accepted industry practice.

SAFETY-IN-DESIGN REQUIREMENTS THROUGH THE PROJECT BID AND DE- LIVERY PROCESS

THE FOLLOWING PROVIDES GUIDANCE TO THE MANAGEMENT OF THE SAFETY-IN-DESIGN REQUIREMENTS THROUGH EACH PHASE OF PROJECT BID AND DELIVERY PROCESS.

PROJECT BID PHASE

Tender documentation should have been subject to a safety in design process prior to issue. The outcomes of this process should be a design that incorporates reasonably practicable measures to assure a safe work environment during construction and operation.

Outputs of the safety-in-design process, in addition to the specification and design drawings, should include a safety-in-design risk.

As part of the bid process a review of the documentation should be undertaken to identify any hazards and determine whether the hazards can be:

- managed through normal project design and delivery processes (including safety in design procedures as well as OH&S procedures);
- addressed through changes in the design or use of other controls with / or without provisional sums for their mitigation.
- addressed by others through changes in their design or other forms of controls.

Identification of the hazards should be undertaken as a minimum by the appointed estimator and where there are concerns these should be reviewed and discussed with engineering and project management.

Safety-in-design hazards that need to be addressed through additional work by us or by others need to be identified in our offer. It is better to resolve safety-in-design concerns with the client, project manager or builder during the bid negotiation award. If there are significant risks that cannot be resolved it may, in some instances, be better to withdraw an offer.

Common safety in design issues include:

- Inadequate spatial to allow for safe plant maintenance and replacement
- Electrical switchboard and equipment safe access provisions
- Separation of ELV and LV electrical cabling and switchgear
- Structural certification
- Cooling tower maintenance access
- Poor consideration of life cycle maintainability over initial capital cost
- Roof access to packaged equipment and proximity to live edges
- Pipework support systems
- Filter replacement access
- Inadequate safety signage provisions
- Inadequate provision of administrative procedures and PPE information at handover.



PROJECT MANAGEMENT

Once the project has been handed over, responsibility for safety-in-design primarily rests with engineering to manage the safety in design process with support provided by drafting, project Management and, in some cases, site management.

For areas under our control, the process outcomes are generally incorporated in our equipment selections, construction shop drawings and safe work method statements, but may also include:

- Site hazard signage
- Material safety data sheets
- O&M manual work instructions
- O&M manual safety-in-design register
- Issue of a safety-in-design risk register on larger projects
- Issue of a request for a workshop with the project designers.

In most cases, this should lead to an appropriate resolution noting that the project team have a collective responsibility to resolve an identified hazard as far as reasonably practical.

Where the safety in design hazard has not been resolved, in our view, to the level of reasonably practicable, then we have a duty of care and statutory responsibility to:

- Formally advise the **client and head contractor** that we are not able to complete the works in a safe manner and cannot proceed with the installation or commissioning
- Formally advise the **client and head contractor** that there are unresolved safety in design issues related to plant access for maintenance or replacement.

Each firm should develop a safety-in-design checklist and guidelines based on requirements set out in relevant Australian standards and guidelines that relate to safety.

Where possible, photos of poor installations and good practice can be powerful aid memoirs.

Particularly relevant are Australian regulations, standards and codes of practice that set out requirements related to:

- Access platforms and ladders
- Electrical design
- Plant design







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