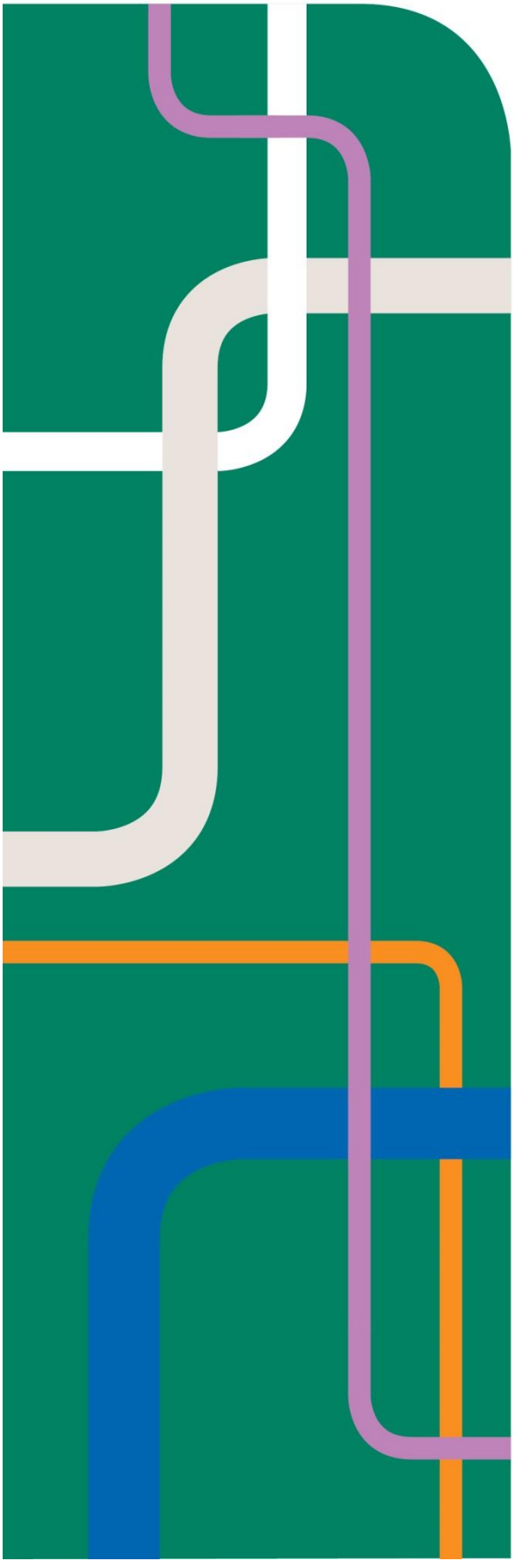
Government of South Australia

SA Water



Engineering Services

Technical Guideline
TG 110

Safety in Design

Revision: 1.0
Date: 23 March 2015

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Only the current revision of this Guideline should be used which is available for download from the SA Water website.

Significant/Major Changes Incorporated in This Edition

Document rewritten to be aligned with new Engineering Standard TS 155 – Safety in Design

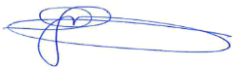
Document Controls

Revision History

Revision	Date	Author	Comments
1.0	23/03/15	L Donisthorpe	Issued for Use

Template: Technical Guideline Version 1.00 18/03/15

Approvers

Role	Signature and Date
Manager of Engineering Projects (Acting) Carl Franz	30/03/2015 X  Signer's Name Signed by: FR003033
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Contents

1 Glossary

The following glossary items are used in this document:

Term	Description
CHAZOP	Control System Hazards & Operability Study - A HAZOP study specifically on Control Systems
CPMM	Corporate Project Management Methodology
HAZOP	Hazard & Operability Study - A series of hazard studies at various stages throughout the design process
PCBU	A Person Conducting a Business or Undertaking – Practically, this means SA Water and contractors SA Water engage to operate, maintain or construct infrastructure
SA Water	South Australian Water Corporation
TG	SA Water Technical Guideline
TS	SA Water Technical Standard
SiD	Safety in Design

2 References

2.1.1 Australian

The following table identifies the standards, documents and/or articles that are referenced in this document:

Title/URL	Revision	Date
AS 4024 (all parts) – Safety of Machinery – control system related	July	2014
S.A. Work Health & Safety Act 2012		
S.A. Work Health & Safety Regulations 2012		
Adopted Codes of Practice in South Australia	N/A	N/A
Guide to Principles of Safe Work Commonwealth of Australia	May	2006
Code of Practice "Safe Design of Structures", Safe Work Australia	July	2012
How to Determine what is Reasonably Practicable to meet a Health and Safety Duty, Safe Work Australia	May	2013

2.1.2 SA Water

The following table identifies the standards, documents and/or articles that are referenced in this document:

Title/URL	Revision	Date
TS155 - Safety In Design		
Safety In Design Risk Assessment Template		
SA Water Corporate Risk Management Methodology	1.0	13/03/2014
SA Water Risk Heat Map		
HMS-004 - Hazard Management - Core Process	1.1	N/A

3 Scope

This Technical Guideline applies to the provision of Safety in Design in SA Water and should be read in conjunction with other SA Water Safety in Design (SiD) documents, TS155 – Safety in Design and the associated template.

SiD principles are applicable to all SA Water infrastructure that is constructed and/or modified. It applies equally to construction and/or modifications undertaken under a capital project and by SA Water operations (or SA Water's alliance partners). It is applicable to project delivery undertaken by parties both internal and external to SA Water.

This guideline is intended to assist SA Water to provide safe designs that will ensure that:

- SA Water delivers on its key corporate value of "Putting safety above all else"
- SA Water meets its WHS legislative obligations as a "person conducting a business or undertaking" (PCBU) under WHS legislation.

Compliance with this guideline (and other SA Water SiD documents) will not, in itself, ensure compliance with the WHS legislation or SA Water corporate WHS objectives. It should however assist with such compliance by providing information and references to other relevant documents.

This Guideline has been developed to support the need to identify safety hazards and risks at all stages in the life of the asset and to eliminate or control the risks throughout the life of the asset including construction, operation, modification and demolition of infrastructure owned and operated by SA Water.

It is primarily written for use by SA Water staff to assist them to comply with SiD requirements and to satisfy TS 155.

4 Common Safety in Design Questions

4.1 What Is Safety in Design?

4.1.1 Safety in Design

SiD is the terminology used to describe a designer's responsibility under the WHS legislation to achieve a safe design.

4.1.2 Safe Design

Safe design is the integration of control measures early in the design process to eliminate or, if this is not reasonably practicable, minimise risks to work health and safety throughout the life of the infrastructure being designed. It encompasses all design including facilities, hardware, systems, equipment, products, tooling, materials, energy controls, layout, and configuration.

4.2 What are the Benefits of Safe Design?

A safe design can result in many benefits, including:

- more effective prevention of injury and illness
- improved useability of assets and infrastructure
- improved productivity and reduced costs
- better prediction and management of operational costs over the lifecycle of the asset
- ensuring compliance with current legislation.

4.3 What are the key Principles of Safety in Design?

The overarching principle of SiD is that the designer is required to consider the intended purpose of infrastructure and to identify, eliminate or control all risks using the Hierarchy of Control methodology, refer to clause 8.2.

The integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of the product being designed is a key feature of providing a safe design under the WHS legislation. The safe design methodology encompasses all designs including facilities, hardware, systems, equipment, products, tooling, materials, energy controls, layout, and configuration.

SafeWork SA Code of Practice for the Safe Design of Structures details five (5) specific principles to be applied in order to ensure a safe design.

In brief these principles are:

- use a risk management approach – The application of hazard identification, risk assessment and risk control process to achieve a safe design
- consider the life cycle – Safe design applies to every stage in the lifecycle, from conception to de-commissioning and disposal of the asset. It involves eliminating hazards or preventing or minimising risks as early as possible in the project's lifecycle

- knowledge and capability – Should be either demonstrated or acquired by persons with control over the design
- consultation, co-operation and co-ordination – By utilising knowledge and experience of other people, including workers/operators, more informed decisions can be made about how the project/structure can be designed to eliminate or minimise risks
- information transfer – Effective communication and documentation of design and risk control information between all persons involved in the stages of the lifecycle is essential to provide a safe design.

4.4 When is Safety in Design Applied?

The ability to influence safety versus time is indicated in Figure 1 which shows that the ideal time to influence safety is during the concept and design phase and the ability to influence safety diminishes as the schedule moves further toward project handover.

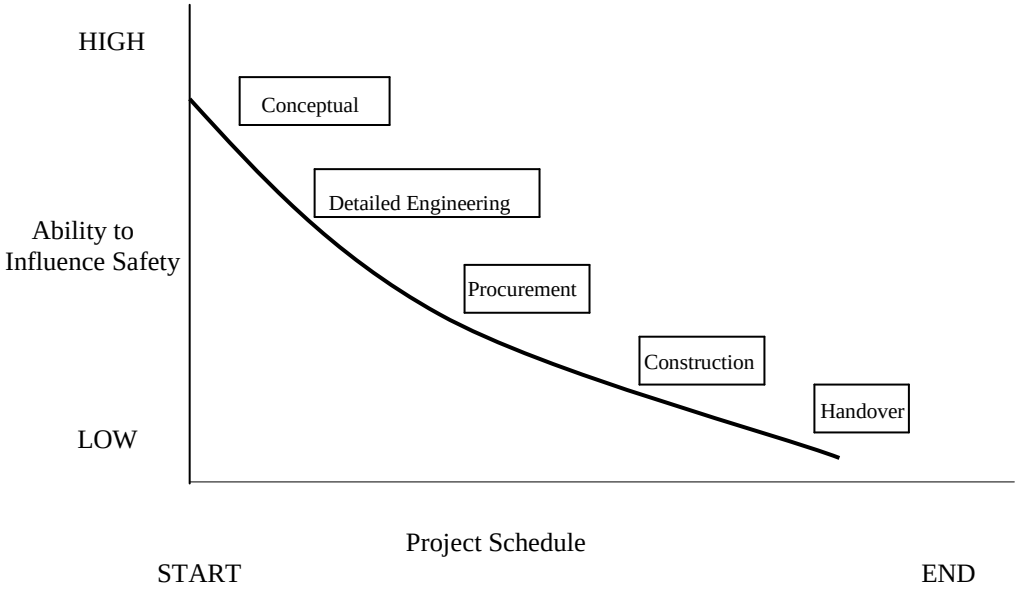


Figure 1 - Time/Safety Influence Curve
(Szymberski, 1997 as cited in Behm 2005)

The most cost effective way to create a safer work environment is to identify hazards in the earliest phases of the design process of a project with the aim of eliminating the hazards.

Eliminating hazards is the most effective risk control measure (refer hierarchy of control clause 8.2) and generally is more practical, easier and cheaper to achieve at the planning and concept design phases, rather than making changes later in the project's lifecycle when the hazard becomes a real risk which has potential to cause harm or injury to an employee/end users etc.

For these reasons, SiD begins at the planning and conceptual phases through to detailed design of a project when making decisions about:

- the design and its intended purpose
- materials to be used
- possible methods of construction, maintenance, operation, demolition or dismantling and disposal
- what legislation, codes of practice and standards need to be considered and complied with.

4.5 Who has the WHS Duty of Care in Relation to Design?

The duty of care is largely defined in sections 16, 19, 20, 22, to 26 & 27 to 29 of the WHS Act.

These clauses of the Act define that effectively all parties have a duty of care with respect to the WHS Act, including PCBU, officers, workers and other persons (although at different levels).

Section 22 defines the primary duties of a designer under the Act (refer to clause 5.2.2 for details).

4.6 What does 'Reasonably Practicable' mean?

4.6.1 WHS Act Definition

Section 18 of the WHS Act defines *reasonably practicable* as it relates to what is reasonably practicable in ensuring health and safety while taking into account and weighing up all relevant matters including (but not limited to):

- the likelihood of the hazard or the risk concerned occurring
- the degree of harm which might result from the hazard or the risk
- what the person concerned knows, or ought reasonably to know, about:
    - the hazard or the risk
    - ways of eliminating or minimising the risk
- the availability and suitability of the ways to eliminate or minimise the risk
- after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

Reasonably practicable is determined objectively in the legal system which means that a duty holder (SA Water) must meet the standard of behaviour expected of a reasonable person.

4.6.2 How Can Reasonably Practicable Be Determined?

Two elements should be considered when determining what is reasonably practicable to ensure health and safety:

- what can be done? - what is possible in the circumstances
- whether it is reasonable, given the circumstances do all that is possible.

In practice, this means that what can be done to eliminate a hazard or make it safer (e.g. lowering a risk rating) should be done unless it is reasonable, in the circumstances, to do something less.

This process should result in provision of the highest level of protection (or risk control/reduction) that is both possible and reasonable in the circumstances.

SiD is the application of these principles to designs and to document the process and outcomes in order to demonstrate that the principles have been applied.

4.6.3 How is Cost Considered in Determining Reasonably Practicable?

Although the cost of eliminating or minimising risk is a factor in determining what is reasonably practicable, the WHS legislation has a clear presumption in favour of safety ahead of cost.

For this reason, the cost of eliminating or minimising safety risks must only be taken into account after identifying the extent of the risk (generally by applying likelihood and degree of harm principles) and the available ways of eliminating or minimising the risks.

In identifying whether a particular expenditure is reasonable in the circumstances, the following should be considered:

- the likelihood and degree of harm of the hazard or risk
- the reduction of the likelihood and/or degree of harm that will result if the control measure is adopted.

The more likely the hazard or risk is, or the greater the harm that may result from the hazard, the less weight should be given to the cost of eliminating the hazard or risk.

Implementing more expensive risk control options may not be required to minimise a risk that is low in likelihood or severity of harm.

Implementing a low-cost option that provides less protection simply because it is cheaper is unlikely to be considered a reasonably practicable means of eliminating or minimising risk.

If the degree of harm is significant (e.g. death or serious injury is moderately likely), then it is unlikely that the cost of implementing available and suitable safety control measures to eliminate or minimise the risk would ever be so disproportionate as to justify not doing so.

Where the cost of implementing risk controls is grossly disproportionate to the risk (e.g. the cost of engineering changes will be high and there is only a slight risk of a minor injury) this may mean implementing those controls is not reasonable and therefore not required. However, this does not mean that nothing should be done to minimise the risk as far as is reasonably practicable. It may simply mean that a less expensive way of minimising the likelihood or degree of harm may be implemented.

If there are several available options for eliminating or minimising a risk, and they would achieve the same level of reduction in the likelihood or degree of harm, a duty holder may choose to apply one or more of the least costly options. Using more expensive control measures may not be required to minimise a risk that is low in likelihood or severity of harm.

4.7 More Information

Additional information is available from Safe Work Australia in the following publication “How to determine what is Reasonably Practicable to Meet a Health and Safety Duty”.

5 Legal Obligations

5.1 Overview

The South Australian Work Health and Safety laws are governed by a national harmonised framework which consists of the Act, Regulations, and Approved Codes of Practice, plus supporting industry guidance material such as Australia/New Zealand Standards.

The WHS laws impose specific duties/responsibilities on a range of parties to ensure health and safety in the workplace.

WHS Act 2012 – has been designed to provide a broad framework which will allow PCBUs (i.e. SA Water), officers and workers a level of flexibility in their approach to achieving the standards set out in the legislation. The Act itself is limited to stating objectives and outlining general duties as well as providing the necessary details required to establish a framework for standards development and enforcement. Everything in the Act is law and therefore must be followed.

WHS Regulations – provide specific details on how to comply with the WHS Act and they set out the general principles and practical steps that should be followed in order to prevent injury and/or illness

at the workplace. The Regulations are an extension of the Act itself and, as everything in the Regulations are law, they must be followed.

Codes of Practice – provide practical guidance on how to comply with the specific requirements of the Regulations and should be used in addition to the Act and Regulations.

Industry Guidelines – such as Australian/New Zealand Standards and general industry guidelines are not considered "law" unless an A/NZ Standard has been referenced in a specific Regulation. They should be seen as providing general information about the Act and Regulations and are there to assist in meeting WHS obligations.

5.1.1 Application of Codes of Practice

Codes of practice have been produced at a federal level as part of the harmonised federal WHS legislation. Individual states may adopt the harmonized legislation and codes of practice.

The South Australia legislation adopted the federal harmonised WHS legislation in 2012.

The South Australian legislation has not adopted all federal codes of practice, although they have adopted the vast majority of them. Any "un-adopted" codes are therefore not mandatory or enforceable by Worksafe SA under the SA legislation, however "un-adopted" codes of practice are considered useful guidelines by designers to assist in delivering safe designs that comply with the Act (see reference documents above for a link to adopted codes of practice in SA).

Codes of Practice are admissible in court proceedings under the WHS Act and Regulations. Courts may regard a Code of Practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstance to which the code relates. Compliance with the WHS Act and Regulations may be achieved by following another method, such as a technical or industry standard so long as that it can be demonstrated that it provides an equivalent or higher standard than that of the code.

One such Code of Practice not currently adopted in SA is the Code of Practice for Structures. This is a widely used document throughout Australia to underpin the requirements for safe design of any structure. The vast majority of infrastructure owned, operated and constructed by SA Water is considered a structure under the WHS legislation, and includes items such as:

- buildings
- pumping stations
- pipework (both in ground and aboveground)
- items of equipment (pumps, valves etc.)
- etc.

As such, this Code of Practice is considered by SA Water as a very good reference document for designers of SA Water infrastructure with respect to WHS.

5.1.2 Application of the Building Code of Australia

There are other documents governing the design of buildings and structures (e.g. the Building Code of Australia (BCA). The BCA is the principal instrument for regulating architects, engineers and others involved in the design of buildings and structures and shall be applied on SAW designs. The BCA provides minimum standards to ensure the WHS of building occupants (such as structural adequacy, fire safety, amenities and ventilation); however, it does not cover the breadth of WHS matters which may arise during the construction phase or in the use of buildings and structures as workplaces.

These other uses must be considered as part of the design being undertaken and considered as part of the SiD process for a particular design.

5.2 Significant Safety in Design Sections of WHS Legislation

5.2.1 General

The more significant WHS legislation sections in relation to safe design are detailed here for reference.

5.2.2 WHS Act

Section 16 – Defines that more than one person has a duty of care with respect to the WHS Act and each person retains responsibility for their duty and must discharge it to the extent to which the person has the capacity to influence or control the matter.

Section 19 - Describes the requirements for the PCBU who has the primary duty of care. The PCBUs duty, in short, is to ensure that, so far as reasonably practicable, workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

Sections 20 to 26 - Define the duties of the PCBU with respect to its primary duty of care.

Section 22 - Describes the requirements for designers with respect to their duty of care, which includes:

- A structure is designed, so far as is reasonably practicable, to be without risks to the health and safety of persons who construct, carry out expected activities (e.g. manufacture, maintain etc.), demolish and dispose of it
- Ensure that adequate information is provided to the person who is provided with the design, which includes the purpose for which it was designed, the results of any calculations, results of testing, analysis or examination as well as the conditions necessary to ensure that the structure is without risks when used for a purpose for which it was designed.

Section 27 to 19 - Define the duty of care that lies with officers, workers and other persons who also have responsibilities to others.

Section 47 - Describes the requirements for consultation requirements the PCBU have which include, workers who carry out work for the business or undertaking who are (or are likely to be) directly affected by a work health and safety matter.

5.2.3 WHS Regulations

Regulation 61 – Describes the requirements for a structure to be designed to eliminate the need to carry out a hazardous manual task and, where this is not reasonably practicable, the risks of musculoskeletal disorders arising from hazardous manual tasks must be minimised.

Regulations 294 to 296 – Describes the requirements for consultation between parties who undertake and commission designs and construction work (i.e. SA Water and their designers).

Regulation 294 – Describes the requirements for consultation between the PCBU (i.e. SA Water) who must consult with the designer about how to ensure that risks to health and safety arising from the design during the construction work are eliminated or minimised.

Regulation 295 – Describes the requirements for consultation in the form of a written safety report from designers to the PCBU (i.e. SA Water) that specifies the hazards relating to the design of the structure that, create a risk to the health or safety of persons who carry out construction work on that structure associated with that particular design.

Regulation 296 - Describes the requirements for the PCBU who commissions a project (i.e. SA Water) who must provide the principal contractor with any information in relation to hazards and risks at or in the vicinity of the workplace where the construction work is to be carried out.

6 Duties of Respective Parties

6.1 General

All parties (e.g. PCBU, designers, contractors, operators etc.) are responsible for delivering a safe design as mentioned earlier.

SA Water as the PCBU has the primary duty to ensure that this is done.

This clause is intended to provide some examples of duties of the respective parties that are typically requited to provide a safe design and satisfy the WHS legislation but is not an exhaustive list.

Safe design can only be achieved effectively when all the parties who control and influence the design outcome collaborate with each other on incorporating safety measures into the design. This includes staff that operate and maintain the new and/or modified infrastructure.

6.2 Duties of SA Water in Safe Design

6.2.1 Prior to Construction

SA Water staff play a major role in safe design as they can substantially influence the design outcomes, for example by specifying the budget, a particular layout or the use of certain materials for a product.

Under WHS legislation and relevant codes, the person who commissions the work (i.e. SA Water) must consult with the designer about how to ensure that risks to WHS arising from the design during the construction work are eliminated or, if not reasonably practical to eliminate, then minimised.

Consultation includes providing the designer with as much information as possible that they have in relation to the hazards and risks at the workplace where the construction work is to be carried out. These could include things such as location of services or power-lines, information about topography, any soil contamination or information or any neighbours who might be exposed to risks from the workplace etc.,.

Where the design involves the modification of existing infrastructure, the information could include providing drawings of the existing structures detailing any potential hazards related to that site. Examples of potential hazards could include things like unsafe buildings, buried services and infrastructure or buildings containing asbestos etc.

It is also SA Water's responsibility to provide information in relation to the hazards or risks of the construction work i.e. Safe Design Report and any risk assessments and current known risks to the principal contractor and the project manager.

6.2.2 During Design Development

SA Water, as the PCBU, has a significant interest in design and have a responsibility to ensure that all parties are consulted, hazards are identified, risks are assessed and the risks are either eliminated or reduced to acceptable levels (i.e. a risk management process conducted) to ensure that a Safe Design is provided.

If the design is undertaken by a designer engaged under a contract to SA Water, the designer will be responsible to facilitate the risk assessment process under their design responsibilities.

If the design is undertaken by SA Water operations (e.g. SA Water Engineering, SA Water Operations or an alliance partner such as Allwater etc.) the hazard identification and risk management process must be undertaken by the designer, who in this case is SA Water or its alliance partners.

Irrespective of who conducts this process, the hazard identification and risk management process used shall comply with the requirements of the Safety in Design standard TS155 which specifies the minimum requirements for these processes.

6.2.3 Following Construction

As the PCBU, SA Water is responsible for maintaining records of hazards and risks for each site in order to allow this information (i.e. the current risks) to be provided to the next designer who undertakes design on this particular infrastructure.

This information will be maintained in the SiD Risk register for each site and/or Asset. The SiD Risk Register for each site and/or Asset will be filed in SA Water's SharePoint® filing system *RIVER* in accordance with TS 155.

6.3 Duties of the Designer in Safe Design

Designers (irrespective of who that is) have a duty under the Act and Regulations to consider that the infrastructure is designed without risk at any time that it is to be used as a workplace.

The designer is obliged to be familiar with the WHS Act and Regulations, Codes of Practice and Standards that are applicable to the design. These should all be used as a practical guide to achieving the requirements of WHS under the Act and Regulations.

The designer is required to ensure that the infrastructure is designed to eliminate or minimise the need for any hazardous manual task to be carried out and to give information to each person who is provided with the design about any features that eliminate the need for these tasks to be carried out (Regulation 61) and must provide a safety report to SA Water which must specify the hazards relating to that particular design (Regulation 295).

If the design being undertaken involves modifications to existing infrastructure, the original design, undertaken by another designer, is being modified and the new designer is required to take into account the safety related information prepared by the previous designer and maintained by SA Water as described in clause 6.2 and consider these in the new or modified design. The intent of this process is to ensure that any existing safety issues and risks for that site are "carried forward" and addressed as part of the new or modified design.

The designer's primary responsibility is to initiate SiD at each development phase of the project that they are involved with.

7 Safe Design

7.1 Key Stages of Safety in Design

Continuous review of safety related project issues and revision/updating of associated documentation throughout the development of a project is a feature of the SiD process.

Hazard identification and risk assessment at each stage/phase should take place to eliminate the risks, or reduce the risks so far as is reasonably practicable (SFAIRP) through the implementation of appropriate control measures.

7.2 Design Approach

A safe design approach begins in the conceptual and planning phases with an emphasis on making choices about design, materials used, and methods of manufacture or construction to enhance the safety of the finished product.

The safe design methodology encompasses all designs including facilities, hardware, systems, equipment, products, tooling, materials, energy controls, layout, and configuration.

The integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of the product being designed is a key feature of providing this and satisfying the SiD requirements of the WHS legislation.

In practice, a safer design will result if the hazards and risks that could impact on users during the lifecycle are eliminated or controlled during design, manufacture or construction. In these early phases there is greater scope to design-out hazards and/or incorporate risk control measures while maintaining the functional requirements.

To achieve the desired safe design, the designer must consider how safety can best be achieved in each of the lifecycle phases and determine what is reasonably practicable.

Design often involves competing objectives. Safe design requires successfully achieving a balance of these competing objectives, without compromising the WHS of those potentially affected by the product over its life.

7.3 Design Phases

7.3.1 Consultation

Consultation during all design phases and all parties (e.g. client, operator, designer and constructor) is essential to achieve a successful outcome.

7.3.2 Initiation and Optioneering

It is important to seek the views of parties who will eventually interact with the product or system at this stage.

Identification of hazards applicable to the options being considered is an important part of the SiD process as the respective hazards applicable to each option may influence the preferred option and will also ensure that any hazards applicable to the preferred option are adequately considered from the commencement of the design development.

These high-level risks are generally identified under the SA Water project options analysis process undertaken at the early project options phase in accordance with the SA Water corporate risk assessment procedure. Risks identified at this phase of the project should be included in the design phase.

It is important to embrace and consider key project learnings of past projects as not only a tool to benefit the project delivery but also as a key part of the SiD process (this information can typically be found in the Operations Issues Registers and in past Lessons Learned Registers).

7.3.3 Detailed

Consultation between SA Water and the designer at this stage is important to inform the designer's understanding of the requirements, and to enable the designing-out of hazards.

The design phase involves the development of design plans which includes:

Assessing the risk in each of the lifecycle phases, including:

- developing risk control options
- developing a trial or evaluation plan
- providing instructions for safe construction/ manufacture, supply/installation
- commissioning/use, maintenance, de-commissioning, and disposal or recycling.

7.4 Construction

During the construction and manufacturing phase, it is common for people involved with the construction and manufacturing process (where they are not the original designers) to experience or identify new hazards and risks encountered that were not previously known to the designers. Such new information including any plant modifications to control the risks should be documented and communicated back to the designers.

7.5 Commissioning

In the commission phase, the person with control of the workplace should check and verify that the product is erected, installed or set up for use in accordance with the designer's or manufacturer's specifications as well as any safety requirements that are unique to the site or location. Appropriate training, information and supervision should be provided to users.

7.6 Maintain, Modify & Decommission

The WHS Act and regulations uses a lifecycle approach which is intended to ensure that any modifications made to a design during life of infrastructure will ensure that it remains within its original design limits to ensure that the original design integrity and a safe design is maintained.

This approach requires risk information about the assets to be maintained as defined in the WHS legislation and requires risk assessments to be conducted through the life of the asset which is based on the information obtained through the lifecycle about the residual risk and risk control measures.

Any modification of a product requires re-application of the risk processes detailed in the concept and design phases as defined in clause 6.2.3.

This process is designed to ensure that no new hazards have been introduced and that the safety features incorporated into the design have not been affected. Additional design issues identified in these phases should be passed back to the designer.

Designers should provide information and instructions to users on the safe dismantling and disposal of products, for example how to safely dispose of a product that is made of environmentally hazardous materials or materials that can be recycled.

7.7 Monitoring Control Measures

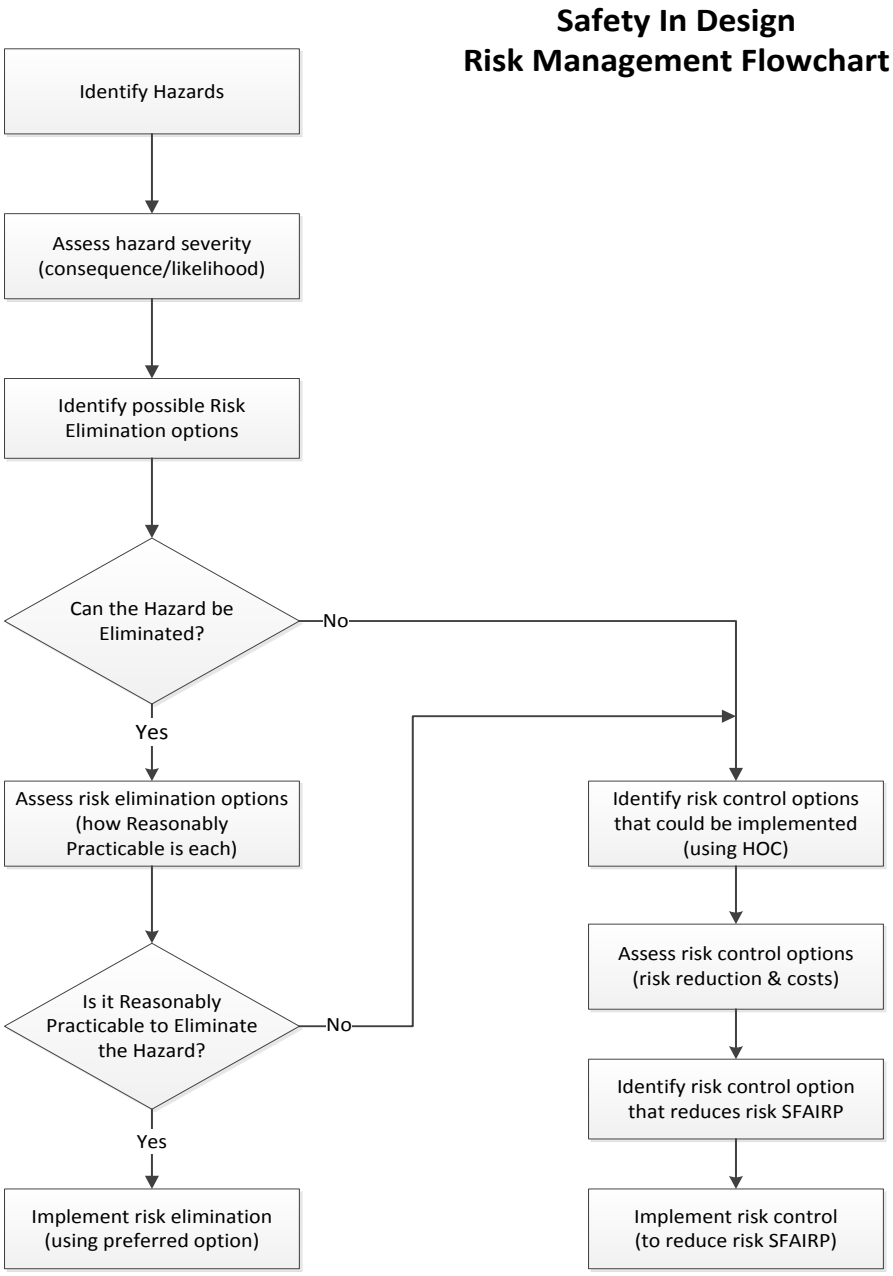
Monitoring and control relates to the phases of the project after operational handover.

It involves monitoring, on an ongoing basis, whether the control measures have eliminated the hazards or reduced the risks, and whether any new hazards have been introduced. Ongoing monitoring and review at each phase of the lifecycle ensures that data is collected for feedback into the system to enable continuous improvement.

8 Safety in Design Processes and Documents

8.1 Safety in Design Hazard Reduction/Control Process

The general process for hazard management which should be applied to each hazard can be summarised in the following flowchart.



NOTES:
HOC = Hierarchy of Controls
SFAIRP = So Far as is Reasonably Practicable

8.2 Risk Management and Hierarchy of Controls

Designers should check that any control put in place does not create another risk or introduce a new hazard for users.

If it is not practical to eliminate the hazard (e.g. it is not reasonably practicable to eliminate), the designer should use the hierarchy of controls principles to reduce the risk to the lowest level that is reasonably practicable (i.e. reduce it SFAIRP).

A more detailed explanation and further details on the hazard management process and Hierarchy of Controls is available in the SA Water Corporate Hazard Management Standard HMS-004 - Hazard Management - Core Process.

SA Water SiD Risk Assessment Template should be used to facilitate an assessment of safety during phases of the design undertaken for SA Water.

The detail or depth of this process will depend on the type and complexity of the project; however, the requirements of TS155 shall be followed in the design process for all projects.

8.3 The HAZOP Process

Hazard and operability studies are a methodology for identifying and dealing with potential issues in process related system, particularly those which would create a hazardous situation or a severe impairment of the process.

The need for, or use of, the HAZOP process will be dependent on the type of system being designed and with respect to SA Water designs, generally relate interactive systems.

A HAZOP required for designs that involve construction and/or modification to any of the following processes including (but not limited to):

- a chemical storage or dosing system
- a water or wastewater treatment process
- a water supply scheme with interactions between systems (e.g. a pumping system feeding multiple tanks, etc.)
- a wastewater system with interactions between systems (e.g. a cascading pumping network, etc.)
- a network pressure control station
- etc.

It is generally considered that any process that designers have seen the need to produce a Process and Instrumentation Diagram should be seriously considered for a HAZOP.

A HAZOP should be conducted when the design review has been undertaken and Process and Instrumentation Diagram (P&ID) have been produced so that (if needed) the design can be changed without major costs.

8.4 The CHAZOP Process

The CHAZOP process follows a process identical to HAZOP studies with a specific focus on the control system used to control the process.

The control system operation is as important as the actual process design (requiring a HAZOP as described in 8.3) as correct control design is required to ensure correct operation of the equipment and as such must be addressed and documented for all projects where a HAZOP is conducted.

The CHAZOP studies may be addressed as part of the HAZOP study or as a separate dedicated CHAZOP study.

8.5 The Safety in Design Report

This report is designed to maximise the safety of the site during future stags (e.g. operations, maintenance, demolition etc.).

Reports are required to specify (as far as reasonably possible) the hazards relating to the design of the infrastructure, that:

- create a risk to the persons who are to carry out the construction work
- are associated only with that particular design and not with other designs of similar types and infrastructure.

This information should include the following:

- the purpose for which the plant or infrastructure was designed
- the results of any testing and analysis undertaken to verify designs
- conditions required to ensure that the infrastructure is without risk for the purpose it was designed or when carrying out related activities such as construction, maintenance and demolition
- any risk to the health and safety of persons in the vicinity of the workplace e.g. neighbours
- any hazardous material or structural features and assessment of the risks to WHS resulting from these hazards
- any actions taken to reduce the risk (e.g. design changes)
- changes to construction methods
- any parts of the design where hazards have been identified but not resolved.

The format and requirements for SiD documents to be provided to SA Water is defined in TS 155.

A SiD report is required for every design undertaken. SiD documents should be managed in accordance with TS 155.

9 Safety in Design Management in Project Delivery

9.1 Project Management System

SA Water Project Mangers use the CPMM Project Management system for management of capital projects.

This system includes prompt and/or hold points at relevant project delivery stages to assist project managers ensure that the SiD Risk assessments have been conducted by designers and that SiD reports have been received and are managed in accordance with TS 155 (e.g. reports received, reports transmitted to correct SA Water staff, etc.).

9.2 Storage of Risk Assessment Reports

The management of SiD Risk Assessments and reports is an important part of the SiD process as it is the mechanism that allows residual risks for assets to be managed during operations, demolition and new and modified designs for that asset.

SiD risk assessment information, reports and Risk Assessments for each site and/or Asset will be filed in SA Water's SharePoint® filing system "RIVER" in the SiD workspace to allow easy access to all SA Water staff for ongoing review throughout the asset life.

10 Minimum Safety System Standards

10.1 General

SA Water has determined minimum requirements for some safety related systems in order to achieve consistency across infrastructure.

This clause provides background information (refer to TS 155 for specific details).

11 Emergency Stop Systems

Determination of the requirements for emergency stop (and similar protection systems) has two components, as follows:

- determination of the need for Emergency Stop controls - based on the risk of injury determined as part of the risk assessments 1, 2 or 3 as part of the safe design risk assessments process.
- minimum electrical design requirements of any such system installed– based on an assessment process to determine the required “Performance Level” of the Emergency Stop control system design determined in accordance with AS 4024.1501 (a dedicated standard for electrical control system design).

In order to eliminate these inconsistent outcomes with respect to the need for Emergency Stop systems, SA Water has set minimum requirements.