SA Water

Engineering

Technical Standard

TS 0101 - Safety in Design

Version: 2.2
Date: 28 June 2023
Status: Final

Document ID: SAWS-ENG-0101

Government of South Australia

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Application & Interpretation of this Document

It is the responsibility of the users of this Standard to ensure that the application of information is appropriate and that any designs based on this Standard are fit for SA Water's purposes and comply with all relevant Australian Standards, Acts and Regulations.

Users of this Standard accept sole responsibility for interpretation and use of the information contained in this Standard. Users should independently verify the accuracy, fitness for purpose and application of information contained in this Standard.

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

Significant/Major Changes Incorporated in This Edition

Changes include;

- Change of title from Design Lead to SiD Lead
- Acknowledgement of Engineering. Systems. Management. (esmconsulting.com.au) proprietary diagrams and systems with relation to Safety in Design.
- Inclusion of capitalised maintenance for SiD Short form use
- Benefits aligned with corporate strategy
- Emphasise Issue For Construction design package is to include SiD Report
- SiD Review Workshop Attendees
- SiD Program approach

Document Controls

Revision History

Revision	Date	Author	Comments
1.0	23.03.15	L Donisthorpe	Issued for Use
1.1	03.03.18	L Haigh	Update and re-numbered to align technical standards and other SA Water documentation.
2.0	20.01.20	L Haigh	Major update of process steps and inclusion of supporting documentation.
2.1	20.12.20	L Haigh	Acknowledge ESM Consulting SiD processes and diagrams, updated to rename Design Lead to SiD Lead, inclusion of capitalised maintenance for SiD Short form use and benefits aligned with corporate strategy
2.2	03.05.2023	L. Haigh	Updated with new documents and additional detail including program approach.

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SiD Working Group	SiD Working Group Members	2.0	14.11.2019
SiD Team	Heidi Turbill	2.1	20.12.2020
SiD Team	Jane Sutherland Melissa Sanchez	2.2	03.05.2023

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1 Introduction

SA Water is responsible for introduction and management of the asset lifecycle across an extensive amount of infrastructure

This standard has been developed to assist in the safe design for modification or the build of new assets including constructability across the asset lifecycle.

Safety in Design is defined as

"the integration of hazard identification and control measures early in the design process to eliminate or, if this is not reasonably practicable, minimise risk to health and safety throughout the life of the structure being design"

Adapted from the model code of practice safe design of structures

1.1 Purpose

This Technical Standard specifies the minimum mandatory requirements of the SA Water Safety in Design process.

This Standard specifies the process and minimum requirements that SA Water considers necessary to 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 the WHS legislation.
- Consideration of WHS Legislative requirements for PCBU, Designer, manufacturer, supplier.

This Standard is to allow key stakeholders to collectively identify and reduce health and safety risks associated with the design of assets for whole of life, including construction, installation, commissioning, operation, maintenance, repair, demolition, and recycling.

1.2 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 – a system used to manage and control capital project delivery at SA Water.
HAZID	A guideword process to review preliminary hazards associated with a project
HAZOP	Hazard & Operability Study - A series of hazard studies at various stages throughout the design process with a focus on the process operation and what occurs when operating outside of design intent.
IFC	Issued For Construction
PC	Practical Completions
PCBU	A Person Conducting a Business or Undertaking – SA Water, including contractors SA Water engage to operate, maintain or construct infrastructure for SA Water
RIVER	SA Water SharePoint® based document management system
SFAIRP	So Far As Is Reasonably Practicable
SiD	Safety in Design
TG	SA Water Technical Guideline
TS	SA Water Technical Standard

1.3 References

1.3.1 Australian and International

The following table identifies Australian and International standards and other similar documents referenced in this document:

Number	Title
	Work Health and Safety Act 2012 (SA) Revision 1.07.2017
	Work Health and Safety Regulations 2012 (SA) Revision 1.07.2017
	Code of Practice "Safe Design of Structures", Safe Work Australia Revision 2018
	How to manage health and safety risks code of practice
ISBN 978-1-74361-065-7	How to determine what is reasonably practicable to meet a health and safety duty
IEC 31010:2019	Risk management – Risk assessment techniques
Engineer Australia – resources/files	ESM Consulting - Safe Design 10 steps
TAPPI Journal, 80 (11), 69–74)	Construction Project Safety Planning. TAPPI Journal, 80 (11), 69–74)

1.3.2 SA Water Documents

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

Number	Title
SAWF-ENG-0007	Safety in Design Assessment Template (short)
SAWG-RM-0001	SA Water Corporate Risk Management Methodology
SAWL-ENG-0005	SiD Prompt List
SAWL-ENG-004	SiD Facilitator Register
SAWT-ENG-0001	Safety in Design Hazard Identification Workshop Template
SAWT-ENG-0003	Safety in Design Report Template
SAWT-ENG-0004	Safety in Design Hazard Register template
SAWT-ENG-0006	SA Water SiD Assessment Plan
TG 110	Safety in Design Guideline

1.4 Definitions

For the purpose of this document, the following terms and definitions apply. The definitions below are intended to provide a practical description of terms for the purposes of the SA Water SiD process and related documents.

Where definitions included here also have definitions in legally binding documents (e.g., legislation, regulations, standards etc.) the legally binding definition(s) shall take precedence from a contractual and/or legal perspective.

Term	Description
Asset	Structure, facility, plant, operating system / equipment.
Asset Planner	A position at SAW that contribute to the development of and planning for Asset Approaches, Business Cases and Asset Management Plans for SA Water's Assets. They support their implementation to ensure agreed levels of service are provided that optimise risk, performance and life-cycle costs, while providing customer centric outcomes.
Concept Design	The initial level of design undertaken to identify and address the major and/or critical elements of the asset being designed.
Design	The development of ideas & concepts to a suitable level of detail and production of documentation that can be used to construct or modify items or assets. The WHS Act defines design as follows: "Design, in relation to plant, a substance or a structure, includes- a) design of part of the plant, substance, or structure; and b) redesign or modify a design."
Designer	A designer is a person who effects design, produces designs or undertakes design activities as defined in the WHS Act and Regulations.
Detailed Design	The level of design undertaken to develop a concept design to a level of detail necessary to allow construction, modification or installation of the work.
Ergonomics	The scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance.
Guideword/s	Prompt/s to assist brainstorming processes / stimulate discussion.
Hazard	A situation or thing that has the potential to harm.
Lifecycle	All phases in the life of an asset. The specific phases present in an assets lifecycle will depend upon the type of asset but may include design, development, manufacture, construction, assembly, import, supply, distribution, sale, hire, lease, storage, transport, installation, erection, commissioning, use or operation, consumption, maintenance, servicing, cleaning, adjustment, inspection, repair, modification, refurbishment, renovation, recycling, resale, decommissioning, dismantling, demolition, discontinuance, disposal.
Project	Any engineering development work (including creation, expansion or modification to assets) for which an expenditure proposal is required.

Term	Description
Project Manager	An appropriately qualified person who has been given the responsibility to manage an asset design or modification on behalf of the client. The Project Manager may delegate these activities however remain responsible. I.e. Mr Bigg on behalf of Mrs Strong.
Reasonably Practicable	Subdivision 2 section 18 of the WHS Act 2012 SA – What is reasonably practicable. Additional guidance is available in the Safe Work Australia publication How to determine what is reasonably practicable to meet a Health and Safety duty
Residual Risk	Residual risk is the risk remaining after risk treatment.
Risk	Risk is the effect of uncertainty on objectives. Risk is often expressed in terms of the consequences of the event and the likelihood of its occurrence.
Risk Assessment	Risk assessment is the overall process of risk identification, risk analysis and risk evaluation.
Risk Control	Taking action to eliminate health and safety risks so far as is reasonably practicable and, if that is not possible, minimising the risks so far as is reasonably practicable. Eliminating a hazard will also eliminate any risks associated with that hazard.
Safe Design	Safe design means the integration of control measures early in the design process to eliminate or, if this is not reasonably practicable, to minimise risks to health and safety throughout the life of the structure being designed.
SiD Facilitator	A person trained or experienced person who will lead Safety in Design Review workshops.
SiD Hazard Register	Register of hazards, and means to address them, per hierarchy of controls.
SiD Lead	The person identified as responsible for the SiD process. They will have experience in line with the scale, scope and complexity of the package of work to be carried out. E.g. Connection and extensions – Customer Technical Services co-ordinator Small designs –Designer /Project Manager, Design Lead Larger projects – Senior Designer, Principal Designer, Design Manager, Head Designer
Standard Design	A standard design is a pre-existing design that is intended to be used without modification, except for site-specific hazards or new hazards introduced at the site.
Systematic Coverage (relating to SiD hazard review workshops)	Mapping the prompts for the workshops by noting the life cycle phases and activities being carried out in those phases. Can be mapped out in a list format or matrix model and a copy should be included in the Hazard Register for record.

Term	Description
Typical Design	Typical drawings inform the Designer of SA Water engineering standards which may be one acceptable method, or our preferred method of complying with engineering standards. There is a SiD Hazard Register (SiD1 level) associated with each typical design that should be used with the associated design. Typical drawings are generally specific to types of infrastructure. They may be used by Designers as a base to develop their own designs. They are not to be used as construction documents and must be reviewed and modified, as required, by Designers to produce project specific design drawings for construction. "
WHS Act	Work Health and Safety Act 2012 (SA) Revision 1.07.2017
WHS Reg.	Work Health and Safety Regulations 2012 (SA) Revision 1.07.2017

2 Scope

2.1 General

This Technical Standard specifies the minimum mandatory requirements of SA Water Safety in Design process to eliminate hazards and where this is not reasonably practicable to minimise so far as is reasonably practicable the risk to health and safety of workers and those in the vicinity of the design.

This Standard is applicable to all design projects including those delivered in the capital or operations space. It is applicable for infrastructure designed, constructed, modified, decommissioned or demolished by or for SA Water (e.g. design activities performed by operations, design activities carried out for an external party etc.) and applies to project delivery either internal or external to SA Water and infrastructure including structures, plant and equipment, permanent, temporary, fixed or mobile.

Figure 1- Typical life cycle of an asset

There is a duty of care for anyone involved in any of the phases of the lifecycle of an asset with regard to whole of life safety and Safety in Design.

SA Water personnel, contractors, subcontractors, developers and their employees who perform work on behalf of SA Water shall comply with the requirements of this Standard.

Compliance with this Standard (and other SA Water Safety in Design (SiD) documents) will not, in itself, ensure compliance with WHS legislation or SA Water corporate WHS objectives. It is the designer's responsibility to ensure that designs comply with the WHS legislation.

2.2 Simple Designs and Capitalised Maintenance

SiD Process is to be applied to all designs. For designs that meet the following criteria the SiD Short Form process can be used.

- The design has been assessed as low risk

  And

- is single discipline

  Or

- has OPEX value under $10,000.

  Or

- Capitalise Maintenance, where SiD is used to identify the stakeholders and as a method of identifying and transferring constructability hazard information.

The "Short Form" is to be completed by the SiD Lead documenting the lessons learned and known hazards, stake holder's consultation, communication and co-operations, the activities being carried out to ensure a safe design SFAIRP and transfer of information to the relevant parties.

Independent of the delivery method there is a requirement to carry out the SiD process and ensure the design is free of hazards SFAIRP for whole of life.

2.3 Program Approach Designs

The SiD process is equally applicable to designs resulting from programs of work outputs. Programs typically have some commonality to group them as a program. In these circumstances a SiD Assessment Plan can be carried out at the program level, identifying the approach to Safe Design for the program. Where commonalities apply e.g. common design to apply across different sites or group of works to apply to one section of a site. The SiD process can be carried out for the common element then for the repeated component/s apply the findings and review by difference. Note findings of any subsequent reviews need to be fed back to the program level and into outputs currently in progress and review. The decision-making process of any variations needs to be recorded in the project approach documents. A specific SiD Report is required for each output.

The SiD Specialist or their delegate must be involved in the development of the SiD Program Approach. The Program Approach is to be mapped out and described in the corresponding sections of the SiD Assessment Plan (.

An important aspect of the program level approach to SiD is how lessons learned are to be captured and fed back into the program works.

Where designs within a program are one off and don't contain the common element the complete SiD process is to be followed for that design.

3 SiD Key Principles Overview

3.1 Design for Whole of Life

The most effective time to eliminate hazards or minimise risk is early in the design phase of an asset.

The activities in different phases of an asset lifecycle will have different interfaces and therefore different hazards. Identification of the hazards during early design gives greatest scope to design out these hazards. Where it is not reasonably practicable to eliminate the hazard, controls are to be used to reduce the risk SFAIRP.

Consideration is to be given to all phases of an asset's life cycle including but not limited to construction, commissioning, testing, operation, maintenance, (including major maintenance to remove assets) future uses or upgrades, refurbishing, decommissioning, mothballing, dismantling and reuse, recycling and disposal.

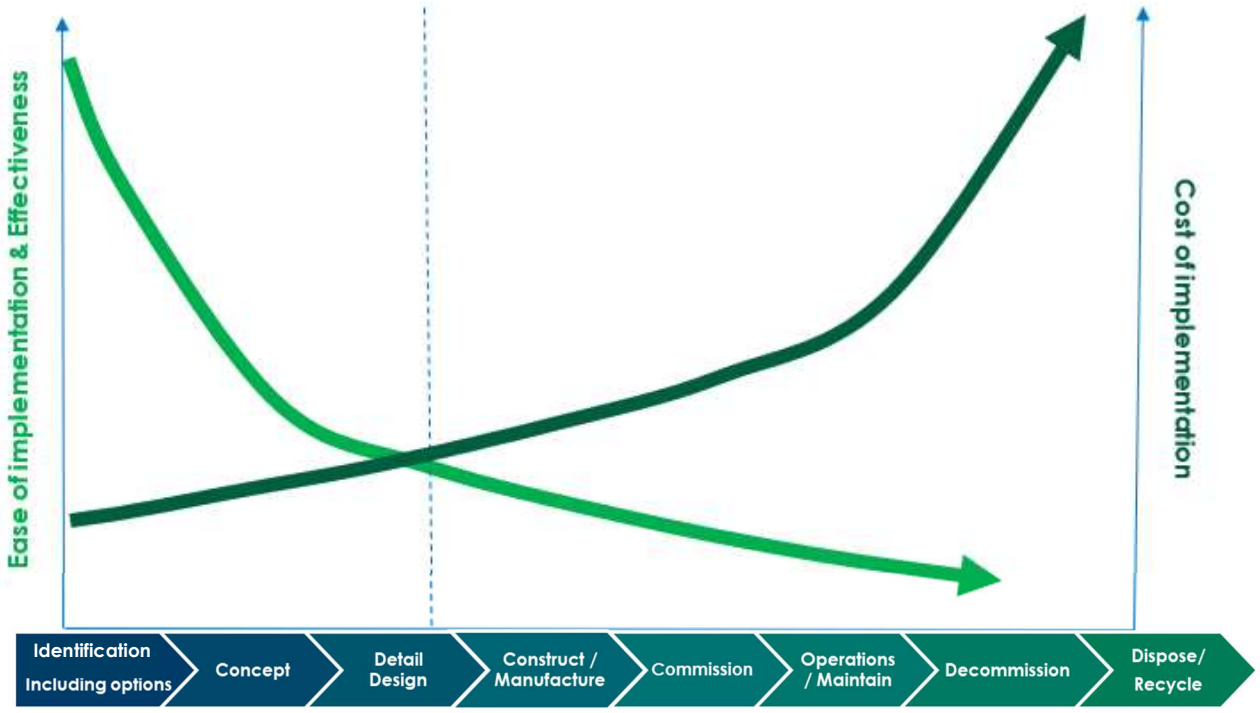

Figure 2: Impact of early engagement

Influence over product lifecycle(adapted from Symberszki, R, (1997) Construction Project Safety Planning. TAPPI Journal, 80 (11), 69–74)

3.2 Consultation Communication and Co-operation

The consultation, communication and co-operation with stakeholders to identify and eliminate hazards contributes to the development of a safer asset for whole of life. The legislative requirement for consultation with Stakeholders includes user groups as well as constructors, sub-contractors and other duty holders. Through early engagement of stakeholders their experience and knowledge can be drawn upon to identify hazards and produce informed decision on how best to effectively eliminate hazards and reduce risks SFAIRP.

Consultation, communication and co-operation also aids in the identification of hazards introduced or as a result of different groups activities or simultaneous works

The WHS legislation requires Duty Holders to work together to identify and eliminate hazards.

These include and are not limited to;

- PCBUs
- Designers, manufacturers, importers and suppliers of plant, substances or structures
- Officers
- Workers
- Subject matter experts and others.

Clear lines of communication for SiD matters shall be established (and recorded in the SiD Assessment Plan) by the designer to ensure that this information is transferred at the appropriate time and decisions which have been made by the responsible parties are documented and communicated.

The duty for consultation, communication and co-operation is also important in the construction phase where different PCBUs maybe working in the vicinity and may introduce hazards not known to other PCBUs.

3.3 Information Transfer

Information relating to identified hazards, lessons learned, control measures, action taken or required to control risks, are to be recorded and transferred through all phases to those involved in later stages of the lifecycle. Communicating this information makes other duty holders aware of residual risks and minimise the likelihood of safety features incorporated into a design being altered or removed by those engaged in subsequent work.

When requesting design work providing designers with information relating to the hazards and risks of the site and vicinity where the works are to be carried out commences the information transfer flow. The design information relating to SiD is to be transferred from one phase to the next.

Transfer of information between parties is one of the duties of designer as stated in the WHS Act Section 22.

3.4 Knowledge and Capability

In addition to core design capabilities relevant to the designer's role, a designer is required to have:

- knowledge of work health and safety legislation, codes of practice and other regulatory requirements, and/or seek information from subject matter experts
- an understanding of the intended purpose/s of the structure
- knowledge of hazard identification and risk management processes
- knowledge of technical design standards
- an appreciation of construction methods and their impact on the design, and
- the ability to source and apply relevant data on human dimensions, capacities and behaviours. (human factors)

Many design projects are too large and complex to be fully understood by one person. Various persons with specific skills and expertise may need to be included in the design team or consulted during the design process to fill any knowledge gaps, for example ergonomists, engineers and occupational hygienists.

3.5 Risk Management Approach

The only level of safety risk that is considered acceptable to SA Water is one which satisfies the so SFAIRP principle in accordance with Section 18 of the WHS Act.

The SiD process is not intended to reduce safety risks to a particular risk level but rather one which satisfies the So Far As Is Reasonably Practicable (SFAIRP) principles and requirements of the WHS Legislation.

There are three broad sources of hazards

- Hazards relating to the design
- Hazard relating to the way the design is used
- Hazards relating to the environment where the design will be used

Where it is not reasonably practicable to eliminate the hazard the risk therefore is to me minimised SFAIRP.

Figure 3: Risk management approach

Image from Safe Work NSW "A risk management approach to work-related stress: Tip sheet 2"

The elimination of the hazard is always the most effective control. Where it is not reasonably practicable to eliminate the hazard the method of controls will be determined by reference to the hierarchy of controls below:

- elimination of the hazard, removal of the hazard removes the risks.
- substitution of the hazard with less hazardous plant, process, or substance
- reduction of the risk through isolation (separate the hazard from the person)
- reduction of the risk through engineering controls (e.g. automation, guarding, design and ventilation)
- reduction of the risk through administrative controls (e.g. training, instruction, supervision and systems of work)
- reduction of the risk through personal protective equipment (PPE). The use of PPE is a last resort.

Where reasonably practicable SA Water require hazard control measures to be "above the line" This philosophy minimises reliance on human behaviours to reduce exposure to hazards using administrative controls and PPE. Administrative controls & PPE can be used to support control measures further above the pyramid. The first choice should be the obvious choice when interfacing with assets.

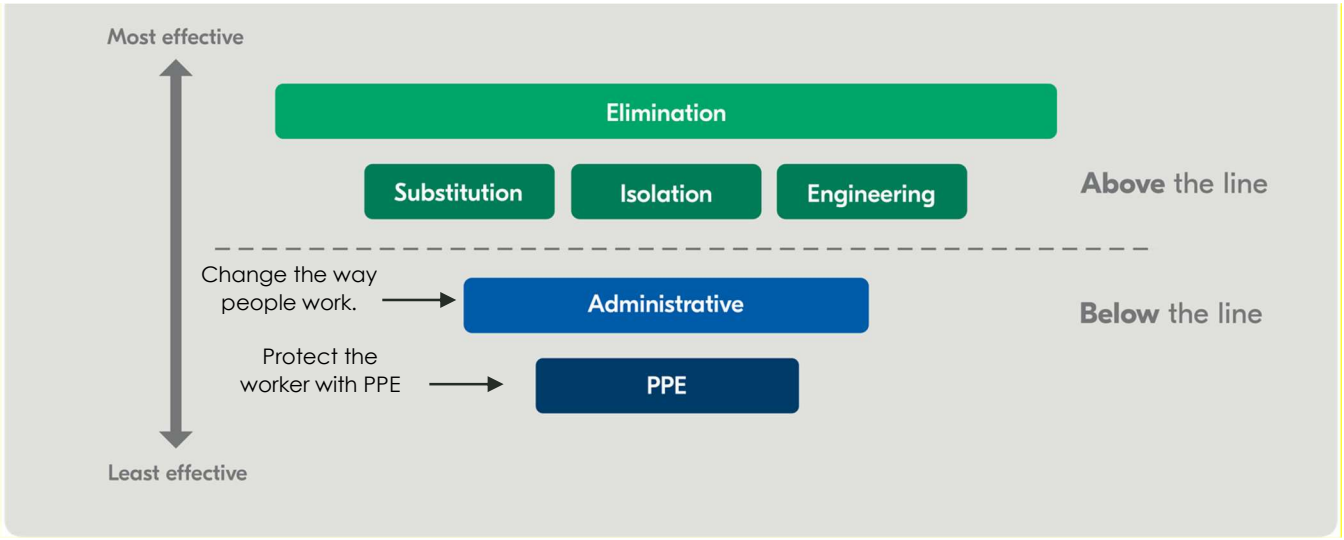

Figure 4: Hierarchy of controls

3.6 Reasonably Practicable

"reasonably practicable, in relation to a duty to ensure health and safety, means that which is, or was at a particular time, reasonably able to be done in relation to ensuring health and safety, 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; and

(c) what the person concerned knows, or ought reasonably to know, about—

(i) the hazard or the risk; and

(ii) ways of eliminating or minimising the risk; and

(d) the availability and suitability of ways to eliminate or minimise the risk; and

(e) 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. "

Source: South Australia Work Health and Safety Act 2012

When considering the benefits against the cost of implementation they can be broken into three categories. These are:

- "Just do it" – when it is inexpensive/easy and provides safety benefit. This also applies to low risk hazards where control measures can be further improved.
- "Further analysis required" additional analysis is required to make judgement. This can be carried out through a combination of tools and methods including so far as is reasonably practicable assessment, multi criteria analysis, fault tree analysis, whole of life cost benefit analysis may be required before making a decision. The decision process is to be recorded along with the outcome.
- "Check for gross disproportionality- The safety benefit throughout the life of the asset does not justify the cost/complexity of implementation of the nominated control. Alternative controls, using the hierarchy of controls to minimise the risk SFAIRP need to be identified and implemented. The decision process is to be recorded along with the outcome.

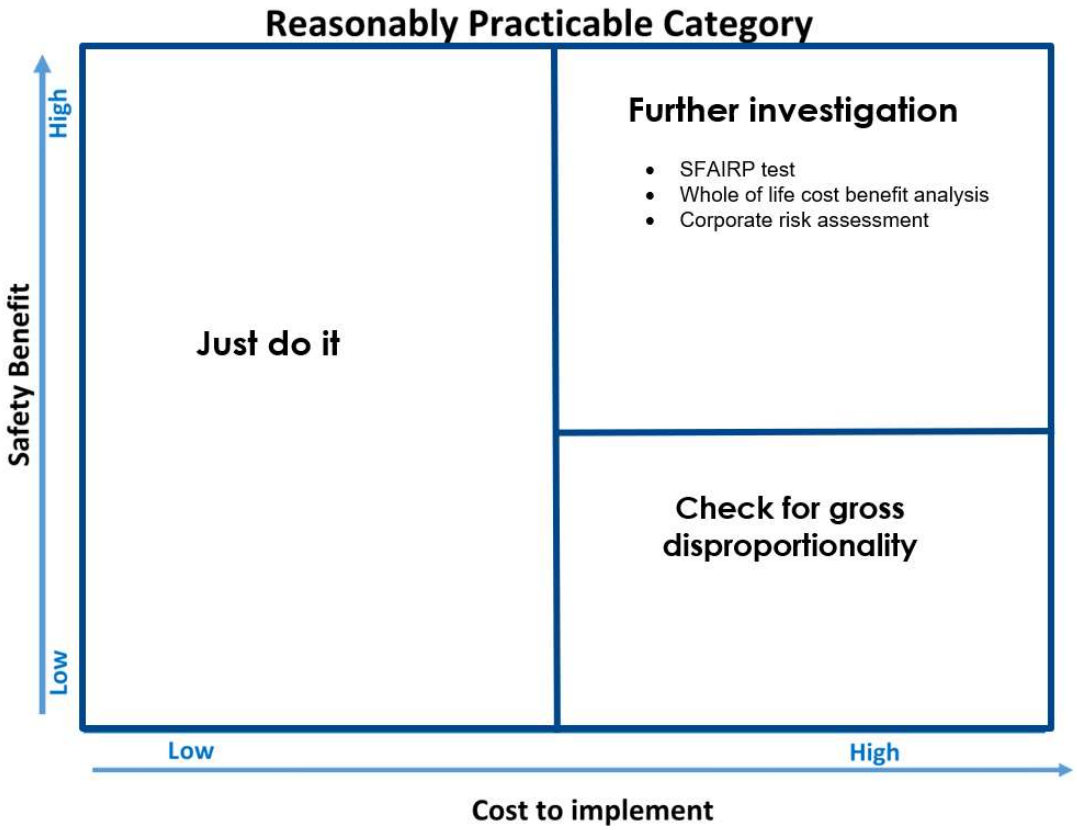

Figure 5: Reasonably practicable category

ESM consulting

3.7 Benefits

In addition to increased safety, Safety in Design delivers benefits which align with SA Water corporate strategy;

Safe
- prevents injury, illness and disease
- supports obvious action the safe action to take
- Supports compliance with legislation

Smart
- promotes innovation, build upon, not recreate
- useability of products, systems and facilities
- better predict and manage production and operational

Reliable
- get it right first time
- stakeholders involved to get their buy in
- increased designer reputation and credibility

Affordable
- reduces costs
- improved efficiency and productivity
- minimises redesign and retrofitting

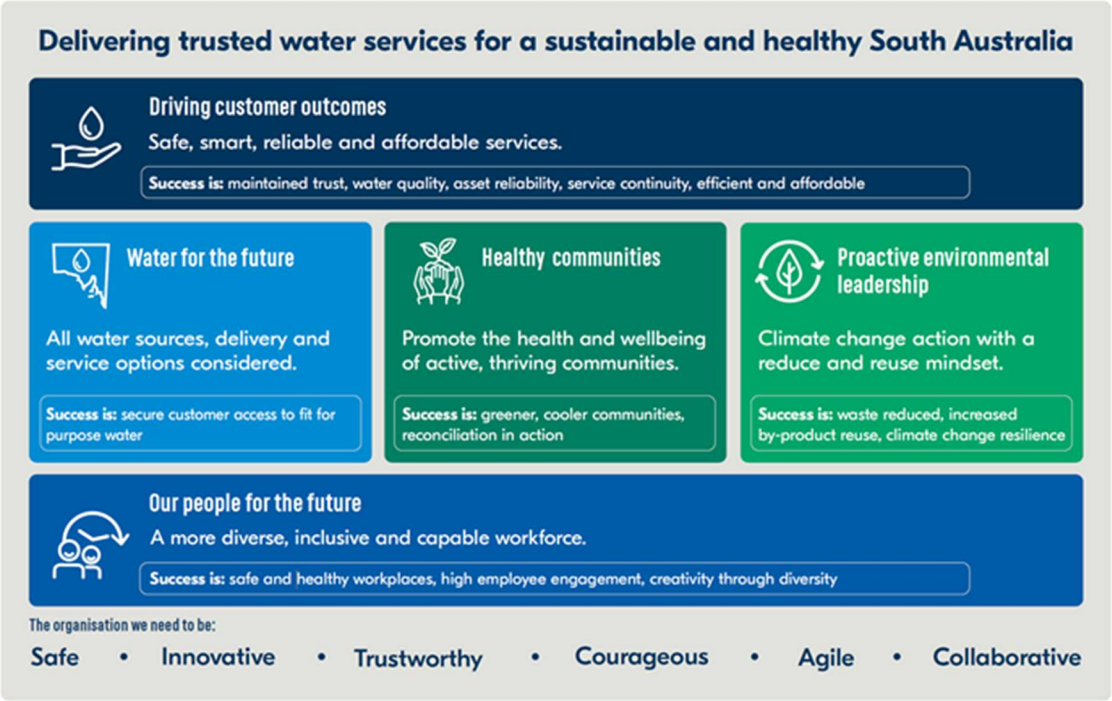

Figure 6:Our Strategy on a page, SA Water

4 Safety in Design Process

4.1 General

The following are parts of project delivery related to this Standard and the related sections (in brackets) of the SA Water CPMM system:

- Identification – CPMM Initiate Phase (Project Brief)
- Options Development & Evaluation – CPMM Develop Phase (Options)
- Concept Design – CPMM Develop Phase (Develop Concept Design)
- Detailed Design – CPMM Deliver Phase (Detailed Design)
- Construction – CPMM Deliver Phase (Build)
- Commissioning - CPMM Deliver Phase (commissioning)
- Project Operational Handover – CPMM Practical Completions

Figure 7: Typical life cycle of an asset

This section provides an overview of the activities to be undertaken to support the delivery of a safe asset SFAIRP through safe design. SiD activities are sequential and commence in the Identification phase and are built on through options, design, construction and the life of asset. In the event the SiD Process has not been activated it is the duty of the designer to bring it to the current level. Including any activities that should have occurred prior to the given point.

In the event a phase of design is expedited the expedited phase SiD activities are still required to occur at the earliest time. The approach is to be noted in the design SiD Assessment Plan.

A SiD Assessment Plan, is to be completed at the initial stage of the concept phase with the establishment of a SiD Hazard Register if it hasn't been created prior.

The SiD Hazard Register along with the SiD Report for the phase is to be carried through the project as a live document updated with new hazards and control methods through the project cycle and asset life cycle.

Where a design meets the requirements in section 2.2 the SiD Short Form is to be completed at the initiation stage of the concept phase to establish the approach to SiD.

The following process has been developed, to not only be more likely to deliver a safe design SFAIRP, but also to address requirements of the WHS Legislation in South Australia. Where projects or designs are applied outside the state of South Australia different legislative requirements may be required and should be reviewed. Contact SiD support for further information.

4.1.1 Programs of Work

Programs of work generally follow the same structure as a project however there is a level of commonality that result in the outputs being delivered through the program process. The SiD Process applies equally to programs of work with the SiD Assessment Plan playing a pivotal role in identifying the approach to the development of a safe design and other legislative requirements.

When developing program approach, it can be beneficial to develop program specific documents or templates to ensure best efficiencies. Section 2.3 Program Approach details more considerations for programs of work.

4.1.2 Operational Single Discipline Designs

A "SiD Short form" can be used where

- The design is low risk

  And

- Single Discipline or OPEX value under $10,000.

4.1.3 Typical and Standard Designs

During the development of Typical and Standard designs, they are to undergo a SiD1 Hazard Review, and for Standard Designs a SiD 2 also, prior to finalising the design pack. The corresponding SiD register must be referenced in the notes section of the design pack and issued with the design pack to those the designs are issued to.

All design, whether using standard, typical or bespoke design must go through the SiD process.

Typical Designs the SiD Hazard Register is to be reviewed and in a SiD1 any impact to changes to the typical design, site specific hazards that are introduced either from the local environment or from the design to the local environment are to be recorded in a project/design specific SiD Hazard Register building on the SiD Register issued with the Typical Design.

Standard designs should undergo a minimum of a SiD2 for identification, control and record of site-specific hazards that are introduced either from the local environment or from the design to the local environment. Hazards are to be recorded in a project/design specific SiD Hazard Register building on the Register issued with the Standard Design.

4.2 Preliminary Hazard Identification and Lessons Learned Transfer.

(Asset Sponsor)

Preliminary Hazard Identification (HAZID) and identification of lessons learned shall be undertaken during the initiation process prior to concept design phase. A list of preliminary hazard and lessons learned sources can be found in Appendix A. This information is to be captured in the Insight, Safety in Planning and Design ribbon.

A HAZID workshop may be the best means to succinctly identify and record hazards and A-typical features for consideration of the designer/s.

Any hazards identified during this stage of the project shall be carried forward to the Options and Concept design phase where they shall be addressed in more detail. Instances that have known effective control measures can also be recorded.

SA Waters Project Management Tool, Insight, SiD in Planning and Design ribbon is used to capture and transfer this information.

4.3 Options Considerations

(Designer)

Options analysis considerations for safety are to be included in options considerations and recorded in the options report.

4.4 Identification of SiD Lead

(Project Manager and design team)

At the commencement of any phase (concept, detail design, program initiation, construction) a SiD Lead is allocated and is accountable for ensuring the SiD Process and associated activities are carried out. The SiD Lead will be agreed upon by the design group prior to commencing the SiD process. The SiD Lead is typically the most senior designer and may be the Project Engineer, Design Manager. For smaller more simple designs the Engineer or in some cases where the Project Manager is also the designer the Project Manager will take on this role. The role holder will depend on the scale, scope and complexity, and is to be the most senior designer.

For programs of work a program level SiD Lead is identified and then the deliverable level SiD Lead is identified documenting the role and responsibilities in relation to Safety in Design in a program of work in the SiD Assessment Plan (4.5)

4.5 SiD Assessment Plan

(SiD Lead)

At the commencement of concept design the identification of activities that will contribute to SiD will occur through the completion of the SiD Assessment Plan , SAWT-ENG-0006.

The SiD Assessment Plan records the applicable considerations and activities that will contribute toward whole of life safe design for the given designs' scope, scale and complexity. The SiD Assessment Plans identify which activities sit under the "SiD Umbrella"

A summary of some of the available tools, techniques and guidance on when they are to be applied for the identification of hazards, risk assessment and risk control is in Appendix B. This is to be referred to when completing the SiD Assessment Plan, SAWF-ENG-006.

Sign off and confirmation of available funding for the SiD activities occurs by the SiD Lead, PM, Asset Sponsor and other relevant parities as identified at concept and detail design phases (or equivalent) A copy of the signed document or email is to be filed with the SiD documents

Where a program approach is being taken a program level SID Assessment Plan and SiD plan is to be developed. See section 2.3 and 4.1.1 Program Approach for SiD Program Approach.

Version control of the SiD Assessment Plan is recorded on the document with major versions issued following development and signoff in concept phase and review and sign off in detail design phase.

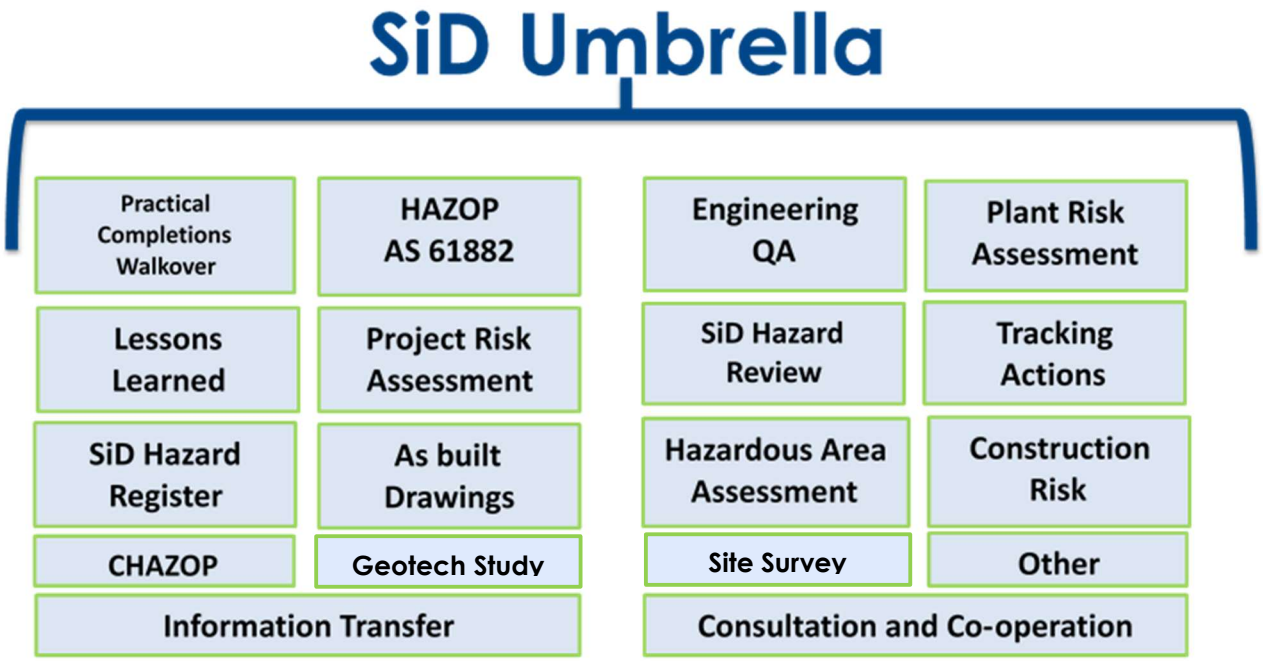

Figure 8: SiD Umbrella

Graphic adapted from ESM Consulting

4.6 SiD Meeting

(SiD Lead)

The communication of the agreed approach and activities contributing to a safe design is to take place with the design and project team during a minuted meeting at kick off or shortly after.

The SiD Assessment Plan is distributed and discussed. The team members are responsible for familiarising themselves with the content.

Subsequent project meetings are to include SiD agenda items to raise:

- major scope changes or design changes that will require revisiting the SiD Impact assessment
- track identified hazards and how they are being controlled
- monitor progress of action items relating to Safe Design.

4.7 SiD Hazard Review 1 – SiD1 (Operations and Maintenance)

(SiD Lead)

SiD1 hazard identification review workshop draws upon participants experience to identify and eliminate SFAIRP hazards associated with the interfaces of the design over whole of life including construction, commissioning, operations and maintenance, shutdown, future works, decommissioning demolition recycle disposal etc.

Through reviewing the tasks/activities, to be carried out during the life phases, the hazards can be identified and eliminated. Where it is not reasonably practicable to eliminate a hazard, using the hierarchy of control the risk is to be minimised SFAIRP.

Any WHS issues and hazards identified during the project initiation and options stage that have not been eliminated shall be reviewed at the SiD1 hazard review and shall be expanded to a higher level of detail, if necessary, in order to thoroughly identify all hazards that may occur throughout the life of the asset.

The SiD Lead is responsible for organising the SiD hazard review workshop, engaging an independent SiD facilitator, a scribe and use SAWT-ENG-0004 SA Water SiD Hazard Register template.

The Concept Design Review must have occurred prior to SiD1 review taking place.

Attendees must include the following stakeholders;

- SiD Lead
- Designer (Design Manager/Design Lead or representative and where required specific discipline designers)
- SA Water/Asset Operations
- SA Water / Asset maintenance and service providers
- Owners Engineer (when an owner engineer allocated to the work)
- Technical Experts where required

The following are to be invited and strongly recommended their attendance;

- Asset Planner/ Project Sponsor
- Project PM,
- Constructor/ commissioning
- WHS Business Partner/Advisor
- sidworkshops@sawater.com.au
- Maintenance Reliability
- Additional attendees may include Environment Team, Security Team or others

A SiD1 review **cannot go ahead** without participation from;

- operations and /or maintainers
- project design team (DM or other).

The facilitator shall lead a pre-mapped systematic coverage, "brainstorming" process to reduce the likelihood of overlooking any hazards within the design. SAWT-ENG-0001 SiD Hazard Review Workshop Introduction Template is to be used at the beginning of the workshop to align participants understanding of the workshop scope, project overview, interfaces, and the workshop process.

For large or complex designs multiple SiD review workshops may be needed to address different packages of deliverables, nodes or portions / disciplines of the design.

SiD2 review takes place following the first design review in the detail design (or equivalent) phase with SiD Hazard Register actions and changes closed out prior to issue for construction.

Where available 3D designs and VR are be used to aid workshop participants to understand the interfaces and identify hazards or opportunities for improvement.

Appendix C SiD Hazard Review details more information relating to requirements for SiD Hazard Review Workshops.

4.8 Other Safety in Design Activities

(SiD Lead)

Other safety in design activities identified in the SiD impact assessment and plan are to be carried out as soon as the level of design is sufficient to complete the activity. Appropriate stakeholders are to be identified and engaged.

Specific designs will require additional SiD activities and the appropriate departments and subject matter experts are to be consulted when identifying applicable activities. When designing plant containing chemical dosing systems, biogas, safety critical systems, security or other speciality areas there are specific requirements to consult relevant business partner. As a minimum carry out a HAZOP, CHAZOP and review of chemical licensing and hazardous area requirements.

A control System hazard review (CHAZOP or equivalent) is to occur on any control system, local or connected to SCADA following the HAZOP and the development of the process logic unit (PLU) functional descriptions.

Further information on other safety in design activities and when they must occur is in 0 Appendix B – Hazard and Risk Management Tools

4.9 SiD Hazard Review 2 – SiD2 Construction and Commissioning

(SiD Lead)

SiD2 review takes place following completion of the first design review in the detail design (or equivalent) phase. SiD2 is to be timed that the design has captured applicable changes as a result of the design review.

The process of SiD2 is the same as SiD1 with a focus on the interface hazards during construction and commissioning. The object being again to identify any engineering safeguards or features that can be incorporated into the design to eliminate hazards and minimise risk to construction and commission personnel.

Where possible 3D designs and VR are be used to aid workshop participants understand the interfaces and identify hazards or opportunities for improvement.

The SiD Hazard register is to be tracked updated and monitored throughout the design. The SiD Hazard Register will be used to feed into the construction and commissioning risk registers and operational risks.

Attendees must include the following stakeholders;

- SiD Lead
- Constructor and Commissioner representative
- Designer (Design Manager/Design Lead or representative and where required specific discipline designers)
- SA Water/Asset Operations
- SA Water / Asset maintenance and service providers
- Owners Engineer
- Technical Experts where required.

The following are to be invited and strongly recommended their attendance;

- Asset Planner/ Project Sponsor
- Project PM,
- WHS Business Partner/Advisor
- sidworkshops@sawater.com.au

- Additional attendees may include Environment Team, Security Team, or others

A SiD2 review **cannot go ahead** without participation from

- Operations and or maintainers,
- Constructor representative
- Design team representative.

Appendix C SiD Hazard Review details more information relating to requirements for SiD Hazard Review Workshops

4.10 SiD Audit

(Project Manager)

Section 7.0 of the SiD Impact Assessment form, SiD Audit, is completed to identify the status of the SiD activities identified to produce a Safe Design (SFAIRP), confirm they are completed and closed out. This will include a review of the SiD Hazard Register and other actions (e.g. HAZOP) for the design phase are closed out. This activity is carried out by the Project Manager or where the Project Manager is also the SiD Lead a peer Project Manager, prior to the completion of the SiD Report.

4.11 SiD Report

*(*SiD Lead*)*

The SiD Report is to be completed following final design review, completion of the SiD Audit and prior to issue for construction. It is the responsibility of the SiD Lead to complete the SiD report with the current updated SID Hazard Register an important component of the report where controls SFAIRP have been applied and the status of any residual hazards noted. The SiD Report Template SAWT-ENG-0003 is to be used for SA Water SiD reports.

The SiD Report, and associated SiD register, is to be included in the Issued For Construction (IFC) package of documents.

Where stage wise approach to design and construction is applied, each stage will need to have a safety report associated with the packages. This can be a document that is built on as the construction progresses however prior to construction each stage must have a safety report issued to SA Water and others who give the design effect such as constructors and design approvers.

4.12 Issue for Construction - SiD Report Handover and Distribution

(SiD Lead and Project Manager)

The SiD Lead is responsible for the handover of the SiD report to the PM with the Issue For Construction (IFC) package of work. The PM conveys the SiD Report and other relevant information to the PM Construction, Operations, Maintenance and other that will be giving effect to the design as identified in the SiD Assessment Plan.

The SiD Report is an important document in the development of the construction management plan, the constructability hazards inform the construction risk assessment and likewise, if applicable, for the commissioning management plan and the commissioning risk assessment.

4.13 SiD Hazard Review 3 (SiD3) - SiD Validation and Verification

(SiD Lead)

SiD3 is the verification and validation that the items on the SiD Hazard Register have been incorporated into the design as actioned. Where operational, maintenance or other residual hazards and corresponding control strategies have been incorporated as part handover, these are to be documented in the appropriate work instructions and O & M Manuals.

SiD3 will be performed following project construction and prior to operational handover to ensure that the completed asset is safe to operate and maintain SFAIRP. This can be achieved by incorporation into the Practical Completions (PC) Safety Walk.

Depending on the size and complexity of the design, a post construction design review could be performed by a small team with;

- knowledge of the final design and the operating and maintenance requirements of the design
- A thorough understanding of the function of the completed asset.

Any new hazards are so far as is reasonably practicable eliminated or the risk reduced. Updates are to be made to the SiD Hazard register.

The SiD documents will form part of the O&M Manual a requirement for project practical completion sign off. Without the relevant up to date SiD documents Practical Completions Certification will not be received.

4.14 Capturing Lessons Learned and Continuous Improvement

(Project Manager)

Capturing of lessons learned will be through the project Lessons Learned process. This is to reflect both positive and opportunities for improvement of the project.

A SiD Review including, the SiD Hazard Register, should occur following construction (SiD3) to identify safety related design issues that were addressed, and improvements made as part of the SiD process with the view to incorporate these improvements into future project designs, common or standard designs and SA Water technical standards.

This information is to be transferred as part of the lessons learnt sessions conducted during the finalisation phase of the project and shall be documented in the lessons learnt report.

Where a design is part of a program of works relevant lessons shall be communicated to the design team as documented in the Program Level SiD Plan.

The safety issues identified as part of this review shall also be communicated by the project manager via the lessons learned report for the project which shall be distributed to the following:

- SA Water's Asset Management team for incorporating into project briefs for new or modified assets
- SA Water's Senior Manager Engineering Services for incorporation into the design of new projects, technical specifications and standards.

4.15 Changes and Change Management

(SiD Lead and Project Manager)

Any changes made to the design or operation outside of design specifications, are to be managed such that there is systematic identification of the impact of the change, identification of hazards and control of the hazards using the SFAIRP principle.

This is applicable at any phase of an asset life cycle. The SiD Principles are to be applied to all changes and will require reviewing or revisiting SiD activities to fully identify and control hazards.

4.16 Live Hazard Tracking

(Asset Manager)

The SiD process applies for whole of life of an asset. The live tracking of hazards is an integrated component of the construction, commissioning, and operations through to decommissioning, demolition, recycling and disposal.

Where an atypical hazard is newly identified (at any time in the whole of life) the hazard is to be entered into the SiD Hazard register and hierarchy of control employed to ensure the interface is safe so far as is reasonably practicable. Where the hazard is identified in any phase following hand over the hazard is to be entered into SAAM.

Where deviation from design, including change of use or work methods are applied, the duty holder for that task or phase needs to establish if the change presents new hazards as per 4.16 changes and change management.

Any design shortcomings identified during the operation and maintenance of an asset which affect the safe operation or maintenance of that asset shall be recorded in SAAM and communicated by operations staff at any time to the following:

- SA Water's respective Asset Manager for incorporating into project briefs for new or modified assets
- SA Water's Senior Manager Engineering Services for incorporation into the design of new projects and technical specifications, standard and guideline reviews and updates.

4.17 SiD Process Overview for a Design Process

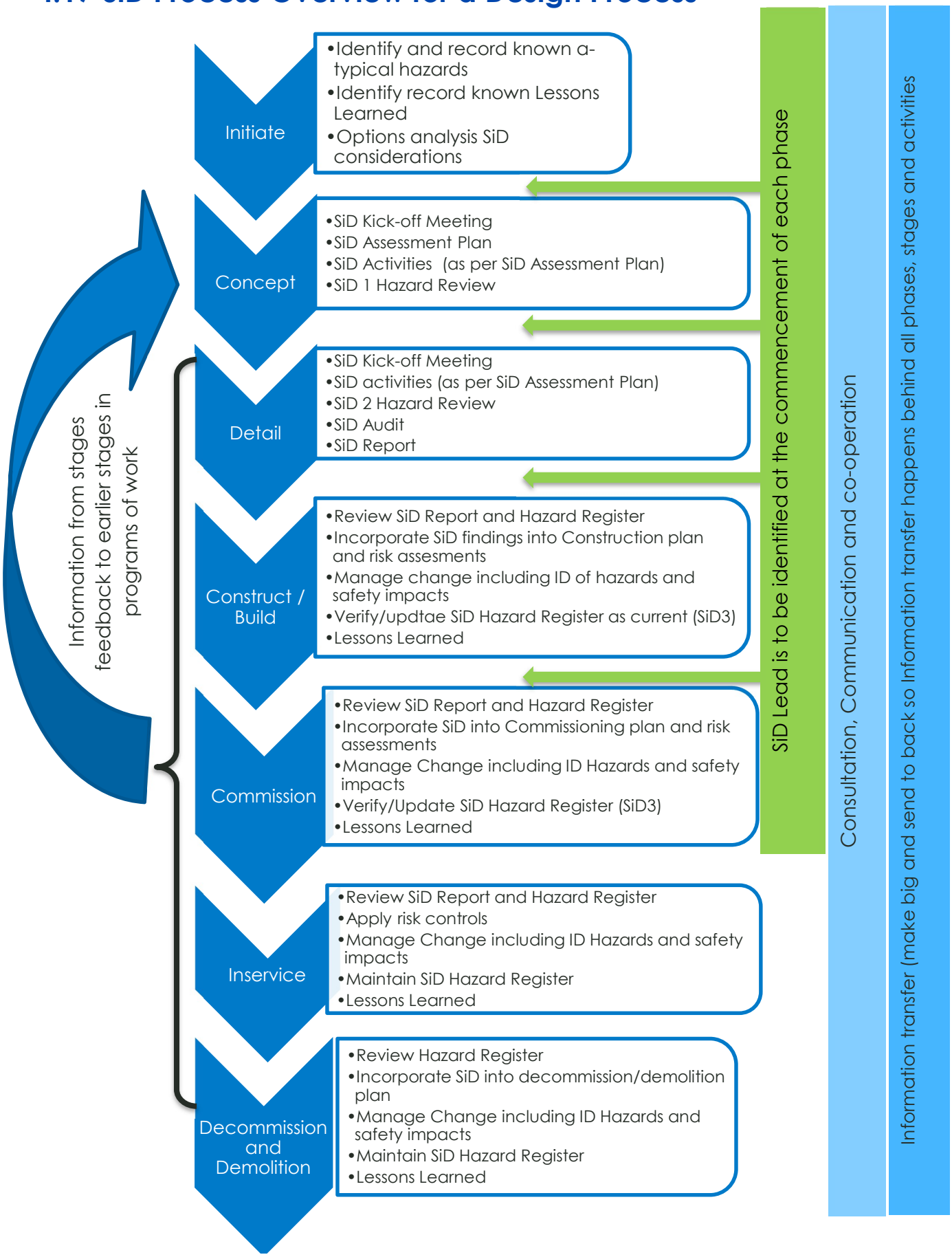

Figure 9: High level SiD process

5 Documentation and Records

5.1 General

SiD records may include (but are not limited to):

- SiD Assessment Plan
- SiD Hazard Register
- options analysis
- risk assessments, including risk ratings and actions
- risk reduction/control methods considered in the SFAIRP process
- reasons for selection of any risk reduction/control method (i.e. document the SFAIRP decision process)
- options investigations and findings
- SiD (in) meeting minutes (record of design decisions, change management, SiD discussions etc)
- SiD and safety changes identified in the lessons learnt process (refer to clause 4.14 Capturing Lessons Learned and Continuous Improvement).
- Change management reviews

All SiD records shall be maintained in accordance with this clause.

Requirements apply to records created by or on behalf of SA Water as well as documents returned to SA Water from partner or third-party designer.

5.2 Design Carried Out by Designers External to SA Water

All designs carried out by external parties as a minimum shall comply with this Standard and the requirements of the WHS Legislation.

SiD documents will be transferred back to SA Water with the corresponding design packages at the following stages where the PM will transfer the documents to the relevant fling storage systems.

- Concept Design
- Detail Design
- IFC
- Practical Completions

5.3 Safety in Design Templates

The following templates are provided by SA Water for use in support of the SiD process;

Table 1: Safety in Design templates

Number	Title
SAWF-ENG-0007	Safety in Design Assessment Template (short)
SAWT-ENG-0001	Safety in Design Hazard Identification Workshop Template
SAWT-ENG-0003	Safety in Design Report Template
SAWT-ENG-0004	Safety in Design Hazard Register template
SAWT-ENG-0006	SA Water SiD Assessment Plan Template

Design and delivery partners should request most recent templates from the PM or OE. who can access them from the hyperlinks or through the SiD BMS Page available through the Engineering BMS page.

5.4 Record Format

The SA Water templates are available and are to be used where applicable.

Native version of the files are to be saved and transferred to the next phase of design. Due to the live whole of life nature of Safety in Design the documents are not to be transferred solely as PDFs.

5.5 Identification of SiD Hazard Register Records

All SiD Hazard documents shall be identified using the following naming convention.

"xxxx -XXX-MUL– SiD YYYY - ZZZZZ".

Where:

- xxxxx-xxxx = Maximo Asset ID number when known or Unique output identifier during project
- yyy = Unique SiD document number

zzz = Document description eg Hazard Register, Assessment Plan, SiD Report Examples:

- A0028-1234-MUL-SID-0301 SiD Assessment Plan
- A0028-1234-MUL-SID-0302 SiD Register
- A0028-1234-MUL-SID-0303 SiD Report
- A0028-1234-MUL-SID-0304 Risk Assessment
- A0028-1234-MUL-SID-0305 HAZOP
- MA3235 – A0028-1234-MUL SiD 0302 SiD Hazard Register –

5.6 Location of Records

SiD records for all SA Water assets shall be filed, in project locker under Manage> Safety in Planning and Design folder.

A library of SiD Hazard Registers at Practical Completions can be accessed via http://river.sawater.sa.gov.au/workspaces/wsr/ws0099 or SA Water River > Workspaces > Workspace Register > Safety in Deign. Under Libraries on the left side of the page select Workspace documents and add documents using the "add document" function.

At handover Practical Completions the SiD documents (in native format) shall be included in the O&M Manual Appendix G WHS.

5.7 Documents Modified External to SA Water

An additional version of the SiD Hazard Register shall be produced whenever the SiD Hazard Register document is developed or reviewed by parties external to SA Water. Details of who has custody of the live version of the document is to be recorded on the document History Tab prior to it being checkout.

At each design milestone (as a minimum Concept Design, Issued For Construction, As-built) the current, updated SiD documents are to be issued and uploaded into river.

This is required to allow SA Water to record the status of the SiD documents issued to the 3rd party designer for review and the status of modified documents returned to SA Water by the 3rd party designer. The SiD documents returned to SA Water supersedes the document issued for development by the 3rd party designer.

The SA Water Project Manager for each contract shall be responsible for management of these documents in accordance with the SA Water CPMM system, with assistance from SiD support in Engineering Services as required.

5.8 Documents Modified internal to SA Water

The current version of the SiD documents shall be used as the basis for all SiD Reviews undertaken and modified by SA Water for that asset.

6 Standard Update and Reviews

Where opportunities for efficiencies and innovation in the SiD process, tools, application of the SiD process or interfaces between business groups have been identified please contact the document owner.

This document will be reviewed within 24 months of issue.

Appendices

Appendix A – Hazard Information Sources

Consider the following Sources of Lessons Learned

Table2: Sources for lessons learned or hazards identification

• OLDM Checklist • Incident Information (SAAM / IMS other) For changes to existing designs: reported (of that design) • Operational Issues Register • Similar designs or design changes • Talk to O&M (field) staff and Asset Owner • Environment and Heritage • Internal Design/Construction standards • Ergonomic assessments Internal Safety Bulletins • Design guidelines • Safe Work SA Bulletins / Safety Alerts • State regulators Bulletins / Safety Alerts • Bulletins / Safety Alerts from other utilities • Bulletins / Safety Alerts from industry • Industry Forums • Technical Networks • Supplier Notifications	• Site visit • Existing drawings of the 'standard' or "common" design • Previous works / Lessons Learned database (CPMM, Engineering Other) • Observations from stores, e.g. material compliance issues • What other water or service network organisations are doing for this type of design • Suppliers' history • Client's Design / Construction Manuals • Manufacturers' histories: product changes • Historical SiD Registers • Lessons learned with respect to land usage: site clearance lessons, landowners lessons, lessons from trying to build on another person's land

Appendix B – Hazard and Risk Management Tools

IEC 31030 is a good source for further information on the tools and techniques available for identification of hazards and analysis of risk and controls.

Table 3: Example hazard and risk assessment tools

Method/tool	Description of tool
Hazard Identification (HAZID)	The HAZID review shall identify hazards that may exist or occur during all or specific phases of the project or may influence the preferred option selected. Identifying and understanding these risks at the earliest possible time in the project lifecycle will make it easier to eliminate or control them in further stages of the design process. All hazards identified during this HAZID process shall be documented and carried into the SiD Reviews that will be undertaken during all future stages of the project development including design, construction, operations and demolition phases. It is a requirement for SA Water to provide to designers (either internal or other) the reasonably known hazards and lessons learned applicable to the design. Safety in Design Hazard Review Workshop Hazard identification shall be undertaken during development of the project brief and/or options investigations/analysis or at the earliest opportunity.
Risk Assessment	A systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking. A given risk ranking does not indicate if a hazard has been reduced so far as is reasonably practicable. (risk is two of the considerations in determining if something is reasonably practicable in relation to WHS) however, can be used as one of the tools to analyse the whole of life cost benefit analysis or as a comparison. Risk management "helps decision makers make informed choices, prioritize actions and distinguish among alternative courses of action." (ISO 31000:2009).
Hazard and Operability study (HAZOP)	The purpose of HAZOPs is to systematically evaluate each part of a system to identify any hazards or obstacles to operability that could arise, particularly through deviations from the design intent. The consequences of deviations are identified and where necessary appropriate corrective actions initiated. As per AS IEC 61882:2017. HAZOPS must occur for designs involving the creation or modification of operational or chemical processes. E.g. water, sewage and wastewater treatment plants, chemical injection / dosing systems/processes and other systems. HAZOPs will be based on mature diagrams/process and instrumentation drawings (P&IDs) that have undergone design review and on proposed operating strategies/procedures.
Control Hazard and Operability Study (CHAZOP)	The purpose of CHAZOP is to find possible causes of process upset due to control system failure. Similar to a HAZOP the output of this study is a detailed list of all possible consequences of control system failure, optionally including assessment of the frequencies and severities of the outcomes and further actions where required. A systematic review of the system is carried out following the HAZOP study principles. The review is to cover the hardware and configuration including instrumentation as well as any control logic or PLUs (process logic units). Where there are multiple systems or critical systems involved CHAZOP study is to occur. When instrumentation is used a review of the instrument and control logic is to take place. CHAZOP is to come after a HAZOP study in the project timeline.

Method/tool	Description of tool
	HAZOPS must occur for designs involving the creation or modification of operational or chemical processes. E.g. water, sewage and wastewater treatment plants, chemical injection / dosing systems/processes and other systems.
Ergonomic and Human Factors Assessments	Ergonomic and Human Factors Assessment examines the 'fit' between people and their work. It puts people first, taking account of their capabilities and limitations. Ergonomics aims to make sure that tasks, equipment, information and the environment fit the worker Where there is a common design established or where the design will be repeated an ergonomic review is to occur during detail design when activities and interfaces are understood.
Major Hazard Facility	Specific duties are placed on operators of Major Hazard Facilities to manage the risk of a major incident. Specific duties under the WHS Regulations including but not limited to the development of a Safety Case and •identification of all major incidents that could occur. •identification of major incident hazards. •preparation of a safety assessment Identification of changes to chemical/reagent manifest should occur in the concept phase and understanding of impact and requirements is to occur. Reagent and chemicals relating to a new design should not be considered in isolation. See WHS Regulations Division 2, 535—A major hazard facility must be licensed, for further details.
Chemical licensing	Where chemicals are incorporated in a design or changes made to existing chemical dosing or storage system a review of the licensing requirements is to occur. Contact SA Water Environmental Management Officer for further information or assistance in determining requirements. Changed or new licences can take up to 6 months to process including applications / notification to SafeWork SA. This should occur as soon in the process as possible to identify any additional requirements.
Bow Tie Analysis	A diagrammatic way of describing and analysing the pathways of a risk/event from hazards to outcomes with the ability to review controls. The event represents the knot in the bow tie, the left side of the bow represents the causes and indicates prevention and escalation controls. The right side of the bow(event) represents the consequences and indicates the mitigation and recovery controls. The focus on the bow0tie is on the barriers between the causes and the risks and the risk and the consequences. This method is used to analyse risk, analyse controls or describe risk. Often used in Safety Cases. Method can be applied to assess existing controls or identify required controls to an event throughout the life of an asset
Hazardous area review/report	Refer to SA Water Technical Standard Hazardous Areas TS0376 for Hazardous Area Requirement's. Where it is suspected a hazardous area may be present a hazardous area review is to be instigated. Identification of hazard area is to occur at the earliest opportunity either in initiation or early concept phase. Applying the hierarchy of controls the most effective manner to manage hazardous zones is eliminating through design the hazardous area where reasonably practicable.

Method/tool	Description of tool
Event Tree	Event tree analysis can be used qualitatively or quantitatively to help analyse potential scenarios and sequence of events following an initiating event, and to explore how potential outcomes are affected by various controls. It can be applied at any level of an organisation and to any time of initiating event.
Fault Tree Analysis	An undesirable state is defined, and the fault tree shows graphically the logical relationship between the particular system failure (undesirable state) and all its contributing causes. The fault tree process aids in determining all possible ways in which the undesirable event can occur.
Failure mode effect analysis (FMEA) Failure mode effect and criticality analysis (FMECA)	FMEA (Failure Mode and Effect Analysis) is a technique which identifies failure modes and mechanisms, and their effects. There are several types of FMEA: Design (or product) FMEA which is used for components and products, System FMEA which is used for systems, Process FMEA which is used for manufacturing and assembly processes, Service FMEA and Software FMEA. FMEA may be followed by a criticality analysis which defines the significance of each failure mode, qualitatively, semi-qualitatively, or quantitatively (FMECA). The criticality analysis may be based on the probability that the failure mode will result in system failure, or the level of risk associated with the failure mode, or a risk priority. FMEA should be used when required to understand the impact of component failure. *From AS IEC60812*
Human Reliability Analysis (HRA)	The concept of Human Reliability Analysis (HRA) reflects an understanding that people and systems are not error-proof, and that improved reliability requires an understanding of error problems, leading to improved mitigation strategies. Essentially, HRA aims to quantify the likelihood of human error for a given task. These methods allow to identify weak areas and implement targeted, data-driven interventions that will ultimately reduce accident and injury rates. HRA are used for elimination of historical events or to identify reoccurring trends in human performance and system deficiencies. Process can be used at any phase of the life cycle with greatest benefits when changes can be incorporated into the design phase.
Layer of Protection Analysis (LOPA)	Layers of Protection Analysis (LOPA) Allows controls and their effectiveness to be evaluated. Layer of Protection can provide a more detailed, semi-quantitative assessment of the risks and layers of protection associated with hazard scenarios. LOPA allows the safety review team an opportunity to discover weaknesses and strengths in the safety systems used to protect employees, the plant, and the public. LOPA is a means to identify the scenarios that present the most significant risk and determine if the consequences could be reduced by the application of inherently safer design principles. LOPA can also be used to identify the need for safety instrumented systems (SIS) or other protection layers to improve process safety. LOPA occurs in the detail design phase and is a semi-quantitative process.

Appendix C – SiD Hazard Review Workshop

C1 - SiD Hazard Review Workshop

The SiD Lead is responsible for the SiD Hazard Review Workshops and documenting the outcomes.

The SA Water SiD Hazard Register is to be used for the capture of accurate record of the SiD Hazard Review workshops.

The outcomes shall include details of attendees, methodology, guidewords used, hazards identified, eliminated, control measures implemented, and findings documented.

Where a SiD Hazard Register exists for the project, group of assets or asset the existing document is to be built onto, updated and maintained.

For large or complex designs multiple SiD review workshops may be needed to address different nodes or packages of deliverables or portions / disciplines of the design. When a design is divided into packages for review the interfaces between the packages must be identified and reviewed.

Workshop must not go ahead unless the corresponding phase design review has occurred. All discipline designs must partake in for the design review.

C1.1 - Workshop Structure

A SID workshop for a given design can span between four(4) hours through to three (3) days or more depending on the scope, scale and complexity of the design.

The order of priority for assessing safety of interfaces during the life of the asset is;

- SiD 1 focusses on operation and maintenance for the lifetime of the asset(s) as well as constructability, future works, decommissioning and disposal.
- SiD 2 focusses on construction and commissioning while also reviewing changes and the previous SiD register.

Hazards from any lifecycle phase should be identified and managed as soon as picked up. If an atypical construction hazard is identified during SiD 1 it should be noted and control measures identified where applicable. It is not required to be left until SiD 2 review.

Consideration should be given to the most efficient way to structure the workshop; one which is tailored to the needs of the project. SiD Hazard Reviews can be split into nodes, area or discipline-specific sessions if required.

In consultation with the DM or equivalent the design is to be broken up into appropriate groups or nodes. Prompt words are to be pre-determined for a systematic coverage approach to support identification of hazards. For each section/group of the design a process similar to the below in Figure 9 is to occur which corresponds with the SiD Hazard Register.

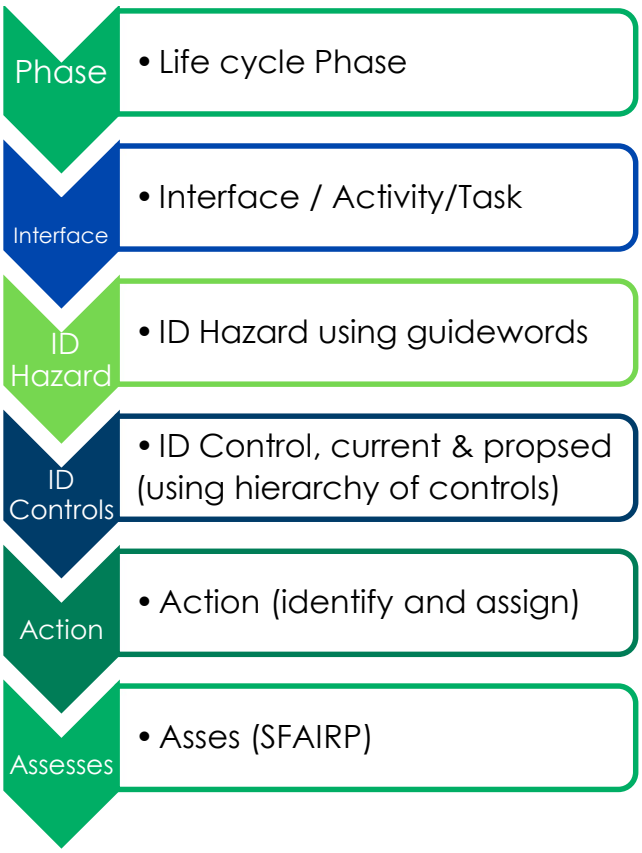

Figure 10: SiD Hazard Review Workshop process

Support from appropriate life cycle phase personnel can be used to develop the systematic coverage prompts. E.g. Operators can assist in developing the activity list and corresponding prompt words for the operations phase.

C1.2 - Workshop Facilitator

The Facilitator will impact the success of SiD Hazard Reviews by facilitating the experience and expertise of the study team to critically evaluate the design. Therefore, the selection of a trained or experienced facilitator is important.

For SiD Hazard Reviews undertaken by SA Water, completion of the SA Water SiD facilitator training course is considered suitable training. A register of SiD Facilitators can be found on the SiD BMS page.

The Facilitator should encourage workshop participants to identify the activities and interfaces, the hazards associated with these interfaces and constructively challenge the design to eliminate the hazards so far as is reasonably practicable and where elimination is not practicable reduce the hazards applying the hierarchy of controls.

For best results a SiD facilitator shall be selected and engaged at least 2 weeks prior to the SiD Hazard Review workshop.

The facilitator shall have knowledge of SA Water's SiD Review process (as per this document). They can be a SA Water employee or an external resource and must be independent and impartial of the project to prevent influence.

In a timely manner prior to the workshop, the SiD Lead will need to provide or work with the Facilitator to provide ;

- information regarding the project scope including atypical hazards
- workshop scope
- the SiD Hazard Register including actions
- list of activities or tasks (interfaces) for the different phases and disciplines.
- the design drawings related to the project
- information regarding workshop participants (number, disciplines and responsibilities)
- location and timing of the workshop
- Between the SiD Lead and SiD Facilitator it is to be agreed who provides any required printed materials for the day.

The SiD Facilitator in consultation with the SiD Lead shall develop the Systematic Coverage approach for the prompt words of the workshop. Systematic Coverage will include all asset lifecycles and activities/interfaces.

C1.3 - Workshop Scribe

A Workshop Scribe also needs to be assigned. The Scribe should be proficient in the use of Microsoft Excel, familiar with the SiD Hazard Register and a fast typist.

It is beneficial to use a Scribe who has a basic knowledge of engineering terminology and process. The Scribe will allow the Facilitator to focus on getting the best outcome from the participants.

It is the SiD Leads Responsibility to organise the scribe.

C1.4 - Workshop Participants

Note: Participants should be given three (3) weeks' notice of the workshop time, date and venue.

The minimum mandatory participants for SiD Reviews include are included in 4.7 and 4.9 above.

Consideration should be given for attendees where the asset is new to the organisation, or the given work area have minimal experience in the operation/maintenance of the type of asset. In these instances In addition to the minimum mandatory participants for a SiD Review, the following specialist are also required.

FOR SiD REVIEW 1 WORKSHOPS (O&M): Representatives of those who will interface with the new or modified asset(s) shall attend. These are primarily operations, maintenance and networks, but could include: other utility owners, road users and the general public.

FOR SiD REVIEW 2 WORKSHOPS (Construction & Commissioning): Constructors who understand the construction methods that will be used for each discipline shall attend. If a construction organisation has not been assigned, the SiD Lead, in consultation with the SA Water Design Manager (DM) and or PM, shall organise for representative construction staff to participate.

FOR SiD REVIEW 3 (Post Construction & Pre-operation): The post construction SiD review is to be performed by a team (2 or more) that have detailed understanding of the existing SiD Hazard Register, knowledge of final design, operating and maintenance requirements of the project, and a thorough understanding of the completed asset(s) function.

The workshop is to be scheduled at a time when the mandatory participants can participate.

To minimise cost and maximise efficiency for larger SiD Reviews, the discipline-specific staff (i.e. any SMEs and specialist detail designers) should be invited only to the sessions that they need to attend. However, there must also be cross-discipline consultation for inter-disciplinary interfaces. The 'safest' approach is to ensure that all discipline SMEs attend all sessions. Another approach may be to have discipline SMEs 'on-call' to join the workshop whenever relevant interfaces are discussed.

A list of prompt words and systematic coverage example can be found in the SiD Hazard Register. Location is listed in the SiD Hazard Register "Instructions for Use" tab at the beginning of the spreadsheet.