Procedure

# Safety in Design Procedure

# Table of Contents



# Figures

# Revision details

| Version No. | Clause | Description of revision |
|---|---|---|
| 1 | All | New Document |
| 2 | Various | • Figure 1 – CHAZOP description added,<br>• update roles description and references throughout document to bring into line with current business structure/procurement methods and current relevant reference versions/documents,<br>• inclusion of requirements for SiD report to be provided at each design stage (rather than just detail design),<br>• inclusion of the requirement for documenting lessons learnt and improvement actions for updating Codes, Standard or Specifications,<br>• Addition of Appendix 1 – Safety in Design Stakeholder list, Appendix 2 – Guide to Effective Safety in Design Reviews, Appendix 5 – Guidewords. Format update |
| 3 | Various | • Clause 2 - Psychological and psychosocial health and hazards consideration requirements added.<br>• Clause 2.1 – Reasonably Practicable information added, Figure 1 – FMECA included, Checklist 3 added to options/concept and Note added.<br>• Clause 2.3 – Requirement for designers to refer to SWDelivery Portal and contribute to lesson learnt where available.<br>• Clause 2.5 - HB59-1994 Ergonomics and Safe Work Reasonably Practicable codes added.<br>• Clause 2.6 – Requirements added when design changes during safety review workshops, removal of requirement for facilitators to be independent, inclusion of Project Manager requirement to ensure facilitator has relevant experience, inclusion of requirements for a Safety in Design Register, and retention requirements for safety records/reports.<br>• Clause 2.7 – New Clause to replace previous clause 2.8 Post implementation Review.<br>• Clause 2.8 – Requirements as per WHS Regulations and retention requirements added.<br>• Clause 3 – Definitions for FMECA, PCBU, Safety in Design Register added, Reasonably Practicable amended and Project Engineer removed.<br>• Clause 4 – Accountabilities for Project Manager amended, Project Engineer removed, Designer amended.<br>• Clause 4.3 – Various references added under Policies and Procedures, Other Documents and Templates.<br>• Attachment 1 – Amended Stakeholder Register description to “provided for reference”, Designer to select appropriate stakeholders, amended to align with organisational structure.<br>• Attachment 2 – Clarified facilitator competency requirements, removed requirement for facilitator to be independent.<br>• Attachment 3 – Concept design added to Checklist 3.<br>• Attachment 5 – First two columns added. |

# 1. Overview

## 1.1 At a glance

### What

Sydney Water and its service providers undertake design work in constructing its assets. It is crucial that these assets are safe to construct, use, operate, maintain and dispose of at the end of their life.

Design decisions are required to ensure that Sydney Water's assets are free of hazards and risks so far as reasonably practicable. This procedure outlines the risk management process in ensuring an adequate safe design.

## 1.2 Scope

### Who

This procedure applies to all activities and projects involving the creation and modification of Sydney Water assets. An asset could include:

- structures,
- installations, plant and equipment, and
- the use of substances both during construction and in operation.

The procedure applies to the design of both permanent and temporary works.

All designs must be carried out by competent personnel as pertaining to, but not limited to, Sydney Water's Engineering Competency Standard (D0000833).

The risk management process described in this procedure must be used. However, the extent of the necessary documentary evidence may vary from project to project. The determining factors are the likelihood of hazards and the degree of harm to people and property that they can cause.

Sydney Water expects that there will be a balance between the required effort, time and cost, and the benefit derived from the process. For works with hazards of low risk and consequence, the process may be appropriately abridged.

## 1.3 Objective

The objective of this procedure is to ensure that robust methods of risk management are implemented to minimise safety risks through the design process.

### Why

Safety and wellbeing are our number one priority. We want a healthy, safe and productive workplace to be part of our everyday way of working.

We do safety differently and we trust that we have the right people for the job. We focus on putting our people at the centre of decision making and seek to learn not only from what goes wrong, but also from what goes right.

The Work Health and Safety (WHS) Act 2011 and Regulation 2017 imposes duties on designers to ensure, so far as is reasonably practicable, that structures are designed to be without risks to the health and safety of persons who:

- construct, alter, convert, fit-out, commission, maintain, refurbish, renovate, repair, demolish, dismantle, or dispose of the structure.
- use the structure as a workplace for the purpose for which it was designed.
- are at or in the vicinity and are exposed to the structure.

Similar requirements are also found in the WHS Act for the installation of plant and in the use of substances such as hazardous chemicals.

In addition to complying with legislation, early assessment during design helps to eliminate risks rather than mitigate them at a considerable cost later, during construction, operation, or maintenance.

# 2. Procedure in detail

Designers shall consider how their design will affect the physical and psychological health and safety of those who will interact with the asset throughout its life. This means thinking about design solutions for reasonably foreseeable hazards that may occur as the asset is built, commissioned, used, maintained, repaired, refurbished, modified or re-purposed, decommissioned, demolished, or dismantled and disposed or recycled.

The Safety in Design process must also take into consideration situations that may cause psychosocial hazards which in turn can cause a psychological or physical harm stemming from the equipment, the working environment and or the requirements to undertake duties in physically hazardous environments.

For example, when designing a watermain the designer should consider the location of the valves for their future operation as well as access requirements for maintenance work.

## 2.1 Risk Management Process

A risk management process is a systematic way of making an asset as safe as reasonably practicable and it shall also be used as part of the design process. It involves the following broad steps:

- identify reasonably foreseeable hazards associated with the design,
- assess the risks arising from the hazards,
- eliminate or minimise the risk by designing control measures,
- re-assess the risk with the identified control measures implemented, and
- monitor and review the control measures.

Designers must integrate risk identification, assessment, and control into the design process.

Designers must follow the systematic approach represented in Figure 1 or an alternative equivalent process that meets the intent of the Work Health and Safety Act.

**What does ‘Reasonably Practicable’ mean?**

Section 18 of the WHS Act defines reasonably practicable as it relates to what is reasonably practicable in ensuring health and safety while considering 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 (Sydney Water) must meet the standard of behaviour expected of a reasonable person.

### 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.

### 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 considered 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. Refer to the Sydney Water Risk Management Framework. Design should not progress with any risk above LOW as per the Sydney water Corporate Risk Matrix in relation to safety. If LOW is not reasonably practicable the risk framework provides guidance for assessing risk and escalation of approval or acceptance.

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.

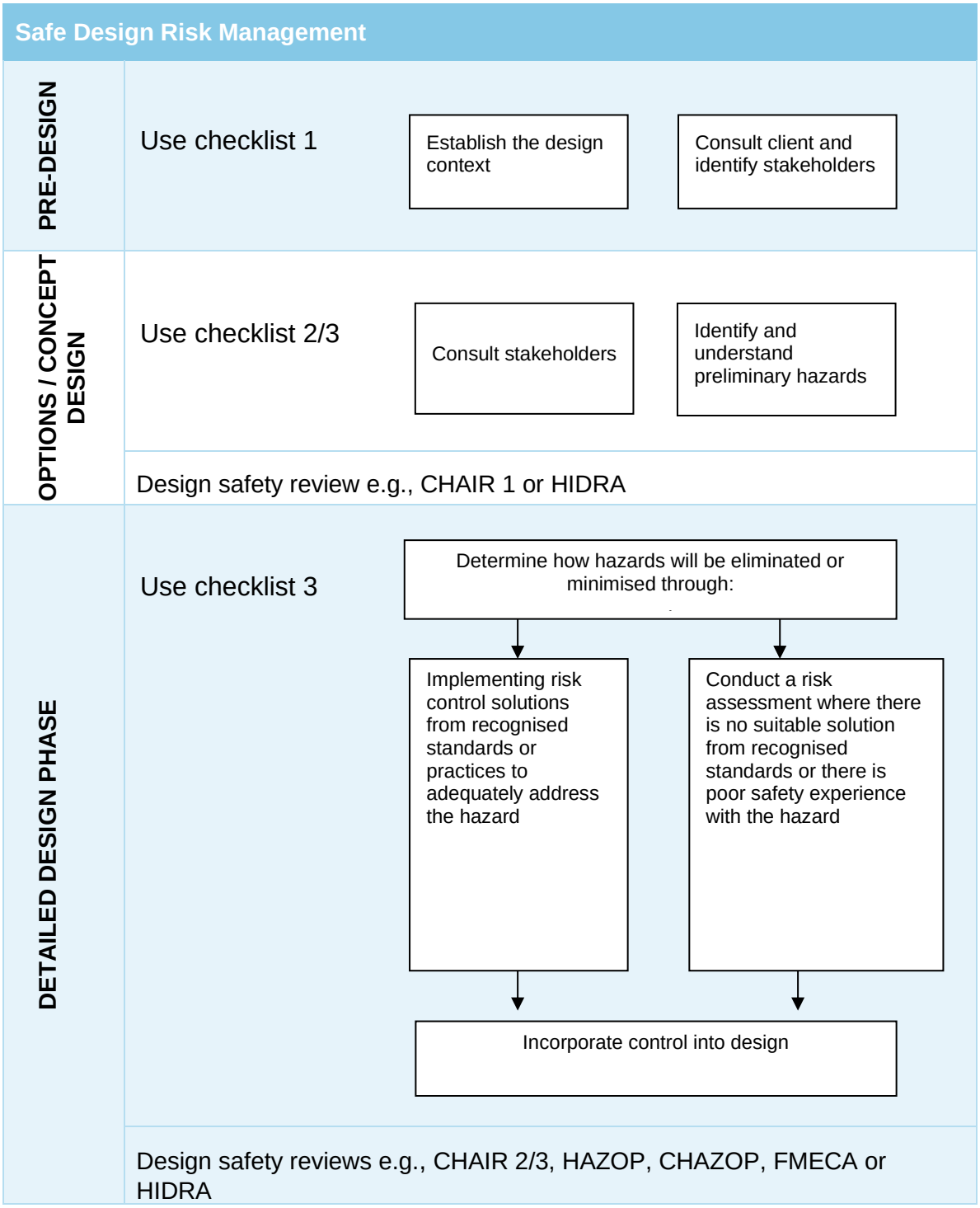
Implementing a low-cost option that provides less protection simply because it is cheaper is unlikely to be considered a reasonably practicable means of eliminating or minimising risk.

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.

Figure 1 A systematic approach to integrating design and risk management




Notes: HIDRA – is the most basic form of risk assessment required and should be used when there is any change to the form, fit or function of an asset

CHAIR – is used where there is construction involved and should be carried out at both concept and detailed design phases.

HAZOP – is a structured and systematic technique for examining a defined system, section by section, usually based on flow/process and instrumentation diagrams. It should be used when there is a facility/plant design aspect.

CHAZOP – is a risk assessment technique used to determine the risk level of a plant's Control System or Safety System.

FMECA –FMECA is used to chart the probability of failure modes against the severity of their consequences.

Note: The design safety review examples in Figure 1 are not limited to the design phase as shown. The options/concept design phase can incorporate additional design safety reviews so any safety issues that are identified can be incorporated into the detail design requirements.

## 2.2 Consult Client

In the pre-design stage, clients must instruct the designer regarding:

- the intended purpose of the asset
- any known health and safety related information that they have from the Pre-Tender Hazard Identification
- any hazard and incident information relevant to the proposed asset
- any targeted work health safety risks that need to be addressed in the design
- any previous similar risk assessments relevant to the asset.

This is required to be undertaken early in the project process. The Pre-Tender Hazard Identification must be compiled with appropriate stakeholder input from Networks or Treatment to provide site specific hazard assessments for existing operational sites or facilities.

Designers must work in consultation with clients about how to ensure risks are eliminated or minimised.

## 2.3 Consult Stakeholders

The designer must consult with stakeholders. These shall include the stakeholders responsible for different phases of the asset life cycle including constructors, operators, and maintainers. This should also include any specialist engaged for specific components of the design or construction. This may also include external agencies/authorities, or the community impacted by the works.

A safe design is more easily achieved when people involved at the design stage communicate with each other about potential risks and work together to find solutions. To improve the quality of design, where available the designers must reference the SWDelivery Portal Lessons Learnt module to identify opportunities for design enhancement prior to commencement of design and throughout the design process.

The designer is encouraged to contribute to this database throughout the design process.

By drawing on the knowledge and experience of stakeholders, including constructors and users, more informed decisions can be made about how assets can be designed to eliminate or minimise risks.

A typical (not exclusive) list of current stakeholders supplying stakeholder input for the consultation process are detailed in **Attachment 1** for reference.

## 2.4 Hierarchy of Controls

During the development of the design, the designer shall minimise risk by considering controls in the following specific order.

- Elimination – The most cost-effective control measure involves eliminating the hazard and associated risk. By designing-in or designing-out certain features, hazards may be eliminated.

If it is not reasonably practicable to eliminate a hazard the following control measures should be considered:

- Substitution – replace a hazardous process or material with one that is less hazardous to reduce the risk.
- Isolation – separate the hazard or hazardous work practice from people
- Engineering controls – use engineering control measures to minimise the risk

- Administrative controls – if engineering controls cannot reduce the risk sufficiently, then administrative controls should be used
- Personal protective equipment (PPE) – Personal protective equipment (for example hard hats, respiratory protection, gloves, earmuffs) should be used to protect the worker from any residual risk.

In many cases a combination of control measures will be required to minimise the risks to health and safety.

## 2.5 Codes of Practice, Guidance Material and Standards

A code of practice provides detailed information on how a person conducting a business or undertaking can achieve the standards required under the work health and safety (WHS) laws. These do not replace the WHS laws but provide practical guidance on how compliance may be achieved in relation to the subject matter of the code.

Under the Work Health and Safety Act 2011, codes of practice are admissible in court proceedings. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control, and rely on it to determine what is 'reasonably practicable' in the circumstances to which the code relates.

It is recognised that equivalent or better ways of achieving the required work health and safety outcomes may be possible. For that reason, compliance with codes of practice is not mandatory providing that any other method used provides an equivalent or higher standard of work health and safety than suggested by the code of practice.

Where designers require further guidance in relation to the design of structures, plant or use of substances, the following codes of practice may be consulted (not exhaustive).

- Safe design of structures - Code of Practice – SafeWork NSW
- Hazardous manual tasks - Code of Practice – SafeWork NSW
- Managing the risk of falls at workplaces - Code of Practice – SafeWork NSW
- Managing the risks of plant in the workplace – Code of Practice – SafeWork NSW
- Guide for safe design of plant – Safe Work Australia
- Managing risks of hazardous chemicals in the workplace – SafeWork NSW
- HB59-1994 Ergonomics – The human Factor – A practical approach to work systems design
- “How to determine what is Reasonably Practicable to Meet a Health and Safety Duty” - SafeWork Australia

In addition to codes of practice, standards and guidelines produced by government authorities, Standards Australia and other professional bodies may also be used. Designers must be aware that these standards and guidelines may not in themselves adequately control all risks, particularly if applied in situations outside those contemplated in them. Designers must show due diligence in managing foreseeable risks and not indiscriminately follow standards and guidelines.

Sydney Water also produces WHS standards and procedures for high consequence risks commonly encountered by its staff and contractors such as confined spaces and hazardous chemicals. Designers can refer to these to understand how Sydney Water typically manages these risks. These can be found on Sydney Water’s intranet, iConnect and SWDelivery Portal or obtained from the Project Manager.

## 2.6 Design Safety Review

As the design progresses and details are developed to the next level, there are opportunities for reviewing and validating the decisions to confirm the effectiveness of controls adopted in the design solution. It is usually easier to correct or eliminate risks at the earliest possible time. Where a design changes during a safety in design workshop further risk assessment is needed to review the safety of the new design. Controls must be implemented to address any new hazards as far as reasonably practicable.

These design safety reviews shall involve people who will eventually construct, use and maintain the assets. The review shall focus on the various stages of the life cycle, including:

- design for safe construction
- design to facilitate safe use
- design for safe maintenance
- design for modification, demolition, dismantling and disposal.

Tools available include, but not limited to CHAIR, FMECA, HAZOP, CHAZOP, HIDRA and others. Designers shall utilise the tools most appropriate to the design phase and complexity. These tools should be discussed by a multi-disciplined team.

The Project Manager must ensure that the design safety review workshop facilitator has experience in workshop facilitation of comparable safety in design activities for projects of similar scale and risk.

Some guiding principles for delivering effective safety in design reviews are included in (**Attachment 2**).

Checklists (**Attachment 3**) have been developed for each of the design phases to assist designers, stakeholders, review leaders and facilitators in the process.

Key information about identified hazards and action taken or required to control risks should be recorded and transferred from the design phase to those involved in later stages of the lifecycle as a Safety in Design Register. The safety actions developed during design safety reviews should be addressed by the next design review by mutual agreement between the relevant review stakeholders and designers. Some safety actions, such as those identified during the CHAIR workshops, may not be able to be addressed until the construction phase. All safety actions must be verified and closed before project completion. Communicating this information to other duty holders, such as constructors and operators, will make them aware of any residual risks and minimise the likelihood of safety features incorporated into the design being altered or removed by those engaged in subsequent work.

To meet the requirements of the WHS Regulation, the designer must provide the PCBU client with a safe design report outlining potential hazards unique to that design that may pose a hazard to people carrying out construction work.

Retention of safety in design records/reports must be kept together for each project in a readily accessible location in accordance with the Sydney Water Records Management Policy. All safety related documents must be stored in the Sydney Water Information Management (SWIM) system.

*It should be noted that Safety in Design is more than just conducting, for example, a CHAIR workshop at a specific point in the design phase. Consideration of the safety aspects of a design are integral with the whole design process.*

## 2.7 Validation of Safety Actions

The effectiveness of safety in design control measures must be evaluated to enable identification of improvement to control measures in place. Safety actions developed through the course of the design must be implemented and monitored during construction and commissioning to verify and validate the performance of the controls. If any controls are found inadequate, the cause must be addressed and the component of the asset re-designed and rebuilt or modified to ensure the risk has been minimised as far as is reasonably practicable.

This validation must be completed before asset handover.

Safety lessons learnt must be documented and any improvement actions conveyed for updating Codes, Standards or Specifications.

## 2.8 Safe Design Report

The designer must prepare a safe design report for all designs as per WHS Regulation 295 for Structures. This report must focus on unusual or atypical features which present hazards and risks that are unique to the particular design. The report is to be prepared and submitted with the completion of the design phase.

The report should be brief and concise to ensure hazards and risks are clearly communicated. The level of detail in the report must be appropriate for the client, the nature of hazards and degree of risk. Do not produce undue lengthy documents.

If another designer is to be engaged to carry out the detailed design following the completion of the concept design, the designer completing the concept design must also prepare a safe design report on the concept design for handing over to the succeeding designer.

The information in the safety design report is not to dictate the way the asset is to be constructed or operated. It should not tell the contractors or operators what to do but should tell them about the safety issues, the expected hazards and risks, and the incorporated control measures. Examples are confined space, steep roof, hazardous chemicals, hazardous building materials (asbestos), etc.

As per the WHS Regulation, the safe design report must give adequate information including:

- concerning the purpose for which the asset was designed
- about the results of calculations, analysis, testing and examination, if any, relating to safety risks
- on conditions under which the asset would be constructed or used without safety risks
- outlining any unusual or atypical hazards during construction, use, maintenance, modification, and demolition.
- about special hazards that are associated only with the particular design and not with other designs of the same type of asset such as poor ground conditions, site constraints, hazardous substances/ materials, complex/ special construction and/or O&M methods, public safety, TBA, add further unusual/ atypical hazard examples for guidance – refer checklists and guidewords for examples

To assist this, a template has been developed to assist designers (**Attachment 4**).

*Designers must also include safety notes on construction drawings such as intended use, design loadings, assumptions, or instructions on staging of construction/installation used in the basis of the design, etc. These help in conveying safety information that is immediately available to construction workers and provides a record of the information on the as constructed drawings.*

A consolidated Safe Design Report must be kept as a record in a central and readily accessible location in accordance with the Sydney Water Records Management Policy. All safety related documents must be stored in the SWIM system.

Project Risk registers must also be updated and maintained through the project life cycle by the Project Manager.

# 3. Definitions

| Term | Definition |
|---|---|
| Asset | All pipes, associated maintenance structures/appurtenances, fittings and equipment, pumping, treatment, storage and disposal facilities (including mechanical, electrical and electronic equipment) employed directly in conveying and/or processing water, wastewater, recycled water and stormwater. (Asset Creation Policy AMQ0033.02 July 2015) |
| Client | A person conducting a business or undertaking that commissions construction work. For the purpose of projects delivered on behalf of Sydney Water and the application of this procedure, the Client shall be the nominated Project Manager. |
| CHAIR | CHAIR (Construction Hazard Assessment Implication Review) is a tool to assist designers, constructors, clients, and other key stakeholders to come together to reduce construction, maintenance, repair, and demolition safety risks associated with design. The primary aim of a CHAIR is to identify and eliminate or minimise risks in a design as soon as possible in the life of an asset. |
| CHAZOP | Control Systems Hazard and Operability Study, is a form of HAZOP with specific focus on the control system used to control the process. |
| Designer | A Designer is a person conducting a business or undertaking whose profession, trade or business involves them in:<br>• preparing sketches, plans or drawings for a plant or structure, including variations to a plan,<br>• making decisions for incorporation into a design that may affect the health or safety of persons who construct, use or carry out other activities with the plant or structure.<br>A person who alters or modifies a design without consulting the original or subsequent designer will assume the duties of a designer. |
| FMECA | Failure Mode and Criticality Analysis. FMECA is a systematic methodology for evaluating and analysing potential failure modes within a system, assessing their effects on the system's performance, and determining the criticality of each failure mode. The result highlights failure modes with relatively high probability and severity of consequences, allowing remedial effort to be directed where it will produce the greatest value. |
| Hazard | Any situation or thing that has the potential to cause harm (physical or psychological) or damage to people, property and the environment. |
| HAZOP | Hazard and Operability Study. Is a form of hazard identification used to examine components within a system to determine what would happen if the component were to operate outside its normal design mode. It requires the comprehensive and systematic scrutiny of a facility, section by section, usually on the basis of flow/process and instrumentation diagrams (P&IDs), in most cases using guide words. AS IEC61882 provides guidance for conducting HAZOP studies. |
| HIDRA | Hazard Identification and Risk Assessment – a risk management tool used to assess the risks associated with a particular activity. |

| Term | Definition |
|---|---|
| Plant | The WHS Act defines plant as including:<br>• any machinery, equipment, appliance, container, implement and tool, and<br>• any component of any of those things, and<br>• anything fitted or connected to any of those things. |
| PCBU | Person conducting business undertaking – Includes persons involved in specific kinds of activities like:<br>• the management and control of workplaces, or fixtures, fittings or plant at workplaces<br>• the design, manufacture, import or supply of plant, substances or structures<br>• installation, construction or commissioning of plant or structures. |
| Project Manager | For this procedure, the Project Manager is any person that commissions the design and construction and commissioning work on behalf of Sydney Water. They shall act as the Client on behalf of Sydney Water and accept the accountabilities of the Client as outlined in this procedure. For Developer delivered works, the Project Manager is the Water Servicing Co-ordinator. |
| Reasonably practicable | Deciding what is 'reasonably practicable' to protect people from harm requires considering and weighing up all relevant matters including:<br>• the likelihood of the hazard or risk concerned occurring; and<br>• the degree of harm that might result from the hazard or the risk; and<br>• what the person concerned knows, or ought reasonably to know, about the hazard or risk, and about the ways of eliminating or minimising the risk; and the availability and suitability of ways to eliminate or minimise the risk; and<br>• 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.<br>• The designer must ensure, so far as reasonably practicable, that the structure is designed to be without risk to the health and safety of persons who manufacture or construct any component of the structure, who use the structure for the purpose for which it is designed or are involved in the maintenance or disposal of that structure. The term 'reasonably practicable' is also used in relation to consultation with other duty holder and between designers and clients on how risks to health and safety during construction can be eliminated or minimised. Please refer to the Sydney Water Risk Management Framework. Design should not progress with any risk above LOW as per the Sydney water Corporate Risk Matrix in relation to safety. If LOW is not reasonably practicable the risk framework provides guidance for assessing risk and escalation of approval or acceptance. |
| Safety in Design register | Key information about identified hazards and action taken or required to control risks. All safety actions must be closed before project completion. |
| SiD | Safety in Design. The SiD acronym is commonly used in the construction industry for similar procedures. |

| Term | Definition |
|---|---|
| Structure | The WHS Act defines a structure as anything that is constructed, whether fixed or moveable, temporary or permanent. A structure includes:<br>• buildings, masts, towers, framework, pipelines, transport infrastructure and underground works (shafts or tunnels), for example noise reduction barriers on a freeway, communications masts or towers, electricity transmission towers and associated cables, flying cables and supports, guyed towers such as a ski-lift tower<br>• any component of a structure<br>• part of a structure. |
| SWIM | SWIM is the official records management system for Sydney Water managed by Information Management. It is the only system in Sydney Water that meets all the requirements of State Records and is designed to create, maintain and retain corporate records in a secure and accountable way. |

# 4. Context

## 4.1 Accountabilities

| Position | Accountabilities |
|---|---|
| Project Manager | Acts as Client on behalf of Sydney Water and has specific duties under the WHS Regulations to:<br>• consult with the designer about how to ensure that health and safety risks arising from the design during construction are eliminated or minimised, and<br>• provide the designer with any information that the client has in relation to the hazards and risks at the site where the construction work is to be carried out<br>• ensure that the design safety review workshop facilitator has experience in workshop facilitation of comparable safety in design activities for projects of similar scale and risk<br>• Ensures retention of safety in design records/reports are kept together for each project in a readily accessible location in accordance with the Sydney Water Records Management Policy. All safety related documents must be stored in SWIM.<br>• Ensures the effectiveness of the Safety in Design process through the project lifecycle, ensuring appropriate tools and resources are applied, hazards and risks are identified and addressed, and design products are prepared accordingly. |
| Designer | Undertakes safe design in accordance with this procedure including:<br>• consulting with the client and stakeholders<br>• communicating any risks that may be inherent in the design to the client and constructors<br>• prepares the Safe Design Report<br>Ensure, so far as is reasonably practicable, that structures are designed to be without risks to the health and safety of persons who:<br>• construct, alter, convert, fit-out, commission, maintain, refurbish, renovate, repair, demolish, dismantle or dispose of plant or structures<br>• use the structure as a workplace for the purpose for which it was designed<br>• are at or in the vicinity and are exposed to the plant or structure. |
| Client | Provides pre-design and ongoing risk, hazard and review input directly or by way of organisational Asset Class stakeholders and Subject Matter Experts. |
| Facilitator | Provides effective management of the Safety in Design review forum to ensure outcomes are achieved. |

## 4.2 Training and competencies

| Position | Training or competency |
|---|---|
| Project Managers | In addition to core project management capabilities, a project manager shall also have:<br>• knowledge of work health and safety legislation, codes of practice and other regulatory requirements<br>• knowledge of risk management processes |

| Position | Training or competency |
|---|---|
| | • knowledge of Sydney Water's work health and safety standards and procedures |
| Designers | In addition to core design capabilities relevant to the designer's role, a designer shall also have:<br>• knowledge of work health and safety legislation, codes of practice and other regulatory requirements<br>• an understanding of the intended purpose of the plant or structure<br>• knowledge of risk management processes<br>• knowledge of technical design standards<br>• knowledge of Sydney Water's work health and safety standards and procedures<br>• an appreciation of construction methods and their impact on the design<br>the ability to source and apply relevant data on human dimensions, capacities, and behaviours. |
| Facilitator | Facilitators must demonstrate experience in workshop facilitation of comparable safety in design activities for projects of similar scale and risk. |

## 4.3 References

| Document type | Title |
|---|---|
| **Legislation** | Work Health and Safety Act 2011 (NSW)<br>Work Health and Safety Regulation 2017 (NSW) |
| **Policies and procedures** | Safety and Wellbeing Policy<br>Sydney Water Safety Minimum Requirements<br>Sydney Water Failure Mode Effect and Criticality Analysis (FMECA) D0001045<br>Asset Creation Policy<br>Work Health and Safety Management System<br>WHS Risk Management |
| **Other documents** | Safe Design of Structures - Code of Practice – SafeWork NSW August 2019<br>HB59-1994 Ergonomics – The human Factor – A practical approach to work systems design.<br>Hazardous manual tasks - Code of Practice – SafeWork NSW<br>Managing the risk of falls at workplaces - Code of Practice – SafeWork NSW<br>Guide for safe design of plant – Safe Work Australia – July 2014<br>Managing the risks of plant in the workplace – Code of Practice – SafeWork NSW – August 2019<br>Managing risks of hazardous chemicals in the workplace - SafeWork NSW – August 2019 |
| **Templates** | HIDRA Template<br>FMECA Template |

# Ownership

## Ownership

| Role | Title |
|---|---|
| **Group** | Asset Life Cycle |
| **Owner** | Engineering Manager, Engineering and Technical Support |
| **Author** | Jason Smith, Senior Mechanical Engineer, Engineering and Technical Support |
| **BMIS No.** | D0000653 |

## Review

| Stage | Date |
|---|---|
| **Original procedure** | 27 September 2017 |
| **This review** | 28 February 2025 |
| **Next review** | 28 February 2028 |

## Change history

| Version No. | Prepared by | Date | Approved by | Issue date |
|---|---|---|---|---|
| 1 | Tony Petrevski | 26/09/2017 | Ken Wiggins | 27/09/2017 |
| 2 | Jason Smith | 28/02/2022 | Norbert Schaeper | 28/2/2022 |
| 3 | Jason Smith | 28/02/2025 | Norbert Schaeper | 28/02/2025 |

## Attachments

| Attachment | Title |
|---|---|
| **1** | Asset Class stakeholder register |
| **2** | Guide to Effective Safety in Design Reviews |
| **3** | Checklists |
| **4** | Safe Design Report Template |
| **5** | CHAIR Guidewords (Contextual prompts) |

# Attachment 1 – Stakeholder Register

The following is not an exclusive list but is provided for reference. The designer needs to select appropriate stakeholders for the safety reviews.

| Group | Business |
|---|---|
| **Water & Environmental Services** | **Engineering and Technical Support** |
| | *Engineering Modernisation* |
| | *Engineering Integration* |
| | *Maintenance & Reliability Engineering & Condition Assessment* |
| | *Design Development* |
| | **Systems Planning and Land Acquisition** |
| | **Water Resource Recovery** |
| | *Hub Teams* |
| | *Capital Interface* |
| | *Maintenance* |
| | **Water Supply and Production** |
| | *Metro Hub (Chemical Dosing)* |
| | *Process Integration* |
| | *Production Safety* |
| | *Systems Water Quality* |
| | *Water Supply and Production Hubs* |
| | *Water Grid* |
| | **Growth and Development** |
| **Infrastructure Delivery** | **Program Delivery** |
| | **Major Projects** |
| **Customer Operations** | **Network Maintenance** |
| | **Network Operations** |
| | **Optimisation Programs** |
| **People & Governance** | **Safety, Health and Wellbeing** |
| **External Stakeholders** | **Councils, utilities, etc. as needed.** |

# Attachment 2 – Guide to Effective Safety in Design Reviews

## Purpose

Safety in Design (SiD) reviews are critical touchpoints for stakeholder engagement and ensuring designs achieve project outcomes. Successful engagement with attendees of these design reviews can be difficult and is dependent on good planning by the organisers and an effective meeting chair. This guide provides some simple tips for engaging meetings. You may take the opportunity here to do a design review and other workshops/risk assessments, however the main purpose of the workshop is for Safety in Design. A facilitator experienced in workshop facilitation of comparable safety in design activities for projects of similar scale and risk must be engaged to ensure that the safety in design objectives are met.

## General Concepts

Below are some key concepts to consider when planning a design review.

| Aspect | Considerations |
|---|---|
| Stakeholder/ Attendee Selection | • Should represent a range of stakeholder groups – Planning, Operation and Maintenance, Design Personnel, Commissioning, Construction, Safety, Environmental, Communications etc. relevant to the topic.<br>• Try not to over represent in any one area. Too many attendees lead to ineffective meetings. Consider running the meeting for different groups if required, to ensure input is received. |
| Maintaining Engagement | • **Length –** Long meetings require good planning to maintain effective engagement. Consider splitting into multiple shorter meetings or a more targeted agenda.<br>• **Location –** Should be convenient to majority of attendees. Consider that not all stakeholders have flexibility to attend offsite meetings (Operators etc.). Use virtual meetings (e.g., Microsoft Teams and other collaboration tools... etc)<br>• **Timing –** Running design reviews and SiD reviews concurrently or back-to-back may be more convenient, but can lead to rushing, meeting overload and lower levels of engagement. Consider running these reviews separately to ensure the best outcomes are achieved.<br>• **Audience** – Make the review interesting and engaging, targeted to the audience. Not all stakeholders are able to read detailed Engineering Drawings or reports, so utilise technology (3D Models, VR etc.) to enable the broad audience to understand what is being presented.<br>• **Effective Facilitator –** Maintaining engagement and getting the best input from all stakeholders requires a good Chair or Facilitator. They will keep the meeting on track and focussed on achieving outcomes…avoid getting into details and solving the issues at hand unless it can be done in a short timeframe without impacting agenda. If required, park the matter for further consideration by the design team…… |

# Planning and Delivering an Effective Review

**Plan (-10 Days)**

- Identify the target audience, engage with subject matter audience and write a stakeholder list.
- Plan on making the content 'engaging' - use technology where appropriate.
- Organise a Facilitator and an 'assistant' for taking minutes and operating any visual aides.
- Finalise supporting documents, drawings or briefing notes.
- Issue meeting invite.

**Prepare (-5 Days)**

- Issue supporting material and agenda to stakeholders.
- Pre-populate minutes, worksheets, attendance sheets etc.
- Confirm attendance of key stakeholders.
- Confirm supporting equipment (Projector, Room, Catering etc.)
  - *Consider two projectors - one for drawings, the other for minutes.*

**Deliver (Meeting)**

- Arrive early (min 15-30 mins) with assistant. Setup and test all visual aides.
- **Be engaging** - Stop and take a break or other activity if you notice attention drifting.
- **Summarise Actions**
- Schedule next meeting (if required) while stakeholders are together.

**Follow-Up (+2 days)**

- Issue future meeting invitation (If Required)
- Issue meeting minutes, with Actions and Timeframes clearly articulated.
  - *Include clear outline of any follow-on activities by the convenor with timeframes (design updates, report finalisation etc.).*

# Facilitator Competency

Safety in Design Review Facilitators must have an appropriate level of experience and demonstrated competency, commensurate with the level of risk.

## General Requirements and Competency

Some general requirements may include:

- Facilitators must be experienced in workshop facilitation of comparable projects of similar scale and risk. A facilitator helps the review group of people to work together better, understand their common objectives, and plan how to achieve these objectives, during meetings or discussions. In doing so, the facilitator remains "neutral", i.e., does not take a particular position in the discussion
- Facilitator should attend the preceding meeting, review or risk assessment to understand the project context.

# Attachment 3 - Checklists

### Checklist 1 – Pre-design stage

**Designer:**_____ **Date:** _____

| Item | Description | State Yes or NA, and provide details or describe actions (if required) |
|---|---|---|
| • Purpose of the plant or structure | Understand intended function, scope and complexity of the plant or structure | |
| • Permanent plant, equipment and machinery | Assess availability and impact on safety. Consider alternatives if needed. | |
| • Temporary heavy construction plant and equipment | Assess availability and impact on safety. | |
| • Potential users and anticipated activities | Identify users and activities and potential misuse opportunities | |
| • Industry safety profile and statistics relating to similar structures (consult health and safety authorities if necessary) | Collect key information about hazard controls, hazard alerts/reports from relevant statutory authorities; industry statistics regarding injuries and incidents. | |
| • Consultation, co-operation and co-ordination | Obtain from client safety issues and requirements. Identify stakeholders | |
| • Breadth of hazards | Consider major hazards the structure may be exposed. Note usual safety issues and impact. | |
| • Research | Collect past research or testing data done on similar designs, if applicable. | |
| • Legislations, code of practice and standards | Identify codes and standards that need to be considered and complied with. | |
| • Design disciplines, skills and competence required | Ensure the design team members have the necessary qualification and relevant experience in the pertinent disciplines. | |
| • Consultation with clients and identification of stakeholders | Identify roles and responsibilities of various parties. Establish collaborative relationships with clients, designers and stakeholders. | |

## Checklist 2 – Options/concept design stage

**Designer:**_____ **Date:** _____

| Item | Description | State Yes or NA, and provide details or describe actions (if required) |
|---|---|---|
| • Siting of the plant or structure | Location, formation level | |
| • Physical environment | Adjacent properties, roads, land use, topographical features, underground and overhead services. | |
| • Access | Ease of permanent access, and temporary construction access | |
| • Traffic | Exposure to related hazards | |
| • Site condition | Ground features, geology, proximity to water, known or suspected contamination | |
| • Public safety | Exposure of public, unauthorised access, security. | |
| • High consequence hazards | Dangerous goods, hazardous substances, hazardous building materials, health hazards, confined space. | |
| • Systems of work | Materials, construction technique, pedestrian and vehicle segregation, manual tasks, working at height, over water, noise. | |
| • Environmental conditions | Floods, earthquakes, high winds, thunderstorms, noise, ventilation, lighting. | |
| • Incident mitigation | Adequate emergency egress, sabotage, vandalism, crime prevention and terrorism . | |

## Checklist 3 – Concept/Detailed design stage

**Designer:**_____ **Date:** _____

| Item | Description | State Yes or NA, and provide details or describe actions (if required) |
|---|---|---|
| • Asset Isolation | Consider flow isolation and flow management requirements, LOTO, proof of isolation. | |
| • Electrical safety | Electrical earthing, location of underground and overhead power cables, protection of cables. | |
| • Fire and emergencies | Fire risks, detection, fighting, emergency routes and exits, emergency facilities | |
| • Movement of people and materials | Safe access and egress, disability access, traffic, security, lifting access | |
| • Working environment | Ventilation, air quality, sanitary facilities, lighting, dust. | |
| • Acoustics and vibration | Noise from plant or surrounding areas, noise pollution, vibration from machinery | |
| • Plant and Machinery | Location, access for maintenance, lifting provision, crane location, guards. | |
| • Amenities and facilities | Storage, first aid, rest rooms, accommodation requirements. | |
| • Earthworks | Excavation, geology, ground water, underground services. | |
| • Structural safety | Stability and integrity of existing, temporary and new structure, load bearing and deflection requirements, construction procedures, demolition, dismantling. | |
| • Manual tasks | Methods of material handling, accessibility of material handling, storage facilities, space and layout, use of mechanical aids. | |
| • Substances | Exposure to materials, liquids and gases, trade waste, storage of chemicals, hazardous building materials (asbestos). | |
| • Fall Prevention | Guard rails, anchorage points, safety grills, access for maintenance, temporary work platforms, scaffolding, slips, trips and falls, | |
| • Confined Space | Prevent creation of confined space if possible, reduce the need to enter into confined space, access, egress, atmospheric testing, ventilation. | |

# Attachment 4 – Safe Design Report Template

***The report should be brief and concise to ensure hazards and risks are clearly communicated. The level of detail in the report must be appropriate for the client, the nature of hazards and degree of risk. Do not produce undue lengthy documents.***

## 1. Introduction

Provide context and background to the design. Briefly describe:

- Purpose of the report

  ***This report focuses on critical or unusual hazards relating to the construction, use, operation, maintenance and demolition/disposal of the plant or structure. It is not intended to address typical or common hazards that would be expected to be managed by the client, the Principal Contractor, constructor or users of the plant or structure.***

  ***The information in this report is not to dictate the way the plant or structure is to be constructed or operated. It does not tell the contractors or operators what to do but inform them about the safety issues and the control measures incorporated in the design.***

- Project team (client, project manager, designers, etc)
- Scope of designer's work covered by this report

## 2. Description of the Plant or Structure

Provide a brief general overview of the plant or structure. (e.g. size, shape, materials, capacity or other general features). Clearly describe the intended purpose of the plant or structure and why the plant or structure is required (e.g. new infrastructure to service development, rehabilitation of deteriorated infrastructure, amplification etc.)

## 3. Design Intent & Limitations

Outline critical safety related design criteria and assumptions adopted in the design, and any limitations of use. Highlight any critical or unusual elements of the design (e.g. critical dimensions, special materials, areas where highly specialised or experience constructors are required etc.)

## 4. Stakeholder Consultation

Outline key aspects of client consultation with the designer. List all stakeholders consulted during design development, and state key safety related issues.

## 5. Critical Hazards and Control Measures

List all critical hazards and risks associated with the construction (including site preliminary and establishment works), use, maintenance, modification and demolition of the structure. Briefly describe the associated risk control measures built into the design.

## 6. Supporting Documents and Standards

List or attach relevant supporting documentation including, but not limited to:

- Design drawings, specifications and any other relevant design documentation
- Risk assessments (e.g. HAZOP, CHAZOP, CHAIR, etc.)
- Operations and maintenance manual
- Investigation reports (e.g. geotechnical, contamination, survey)

Reference any applicable standards including:

- Regulations, standards, codes of practice
- Sydney Water policies, procedures, guides, process etc.

# Attachment 5 – CHAIR Guidewords (Contextual Prompts)

## CHAIR 1 GENERIC WORDS

| CHAIR 1 GENERIC WORDS | | | Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations | Treatment Facilities | Pipelines |
|---|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | | | | |
| SIZE | -Too large<br>-Too long<br>-Too narrow | -Too short<br>-Too small<br>-Too wide | -Pump Laydown Space<br>-Pump Lifting Clearance<br>-Lifting Injured Persons Out<br>-Pump Cable Lengths<br>-Bypass connection size for construction (full SPS flow)<br>-Detention time/Capacity | -Clearances for Maintenance / Ops.<br>-Switchboard Minimum Clearances<br>-Switchboard install/Removal<br>-Electrical Conductor Sizing | - Downsize / upsize<br>- Connections<br>- Services<br>- Horizontal/vertical clearances<br>- Cover<br>- Shallow pipeline protections<br>- Minimum grades |
| HEIGHTS/DEPTHS | -Access / egress<br>-Confined space<br>-Falls / struck by falling objects | -Scaffolding (shape, space to fit)<br>-Working at heights | -Confined Space<br>-Edge Protection<br>-Manoeuvring equipment (Switchboards etc)<br>-Access to both sides of equipment. | - Confined space<br>- Excavations that exceeds 1.5 metres in depth<br>- access/ ladders / temporary work platforms<br>- Physical barriers<br>-Switchroom Requirements (AS3000) | - Confined space<br>- Excavations that exceeds 1.5 metres in depth<br>- Trench protection<br>- Access/ ladders / temporary work platforms<br>- Physical barriers<br>- Aerial/bridge crossings |
| POSITION/LOCATION | -Misaligned<br>-Too far<br>-Too high | -Too low<br>-Wrong position | -Pump Lifting<br>-Valve Handwheel Access.<br>-Flood Levels<br>-Dismantling of flanges<br>-NRV installation (Vertical/Horizontal - Cleaning access)<br>-instrument locations (e.g. Mechanical equipment removal, beam angles on level instruments etc,).<br>-Guarding (NRVs etc)<br>-Float switch cable tangles (Stilling Tubes) | -Access to valves/fittings /instruments / components for maintenance<br>-Isolation locations<br>-Lifting clearances | - Fittings to be accessible for future maintenance<br>- Hydrant spacing<br>- Isolation and valve locations<br>- Scour valves<br>- Working adjacent to roadways<br>- Laydown areas and storage |

| CHAIR 1 GENERIC WORDS | | | Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations | Treatment Facilities | Pipelines |
|---|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | | | | |
| POOR ERGONOMICS | -Effect on PPE<br>-Posture / manual handling<br>-RSI / discomfort / fatigue / stress | -Slips, trips, falls<br>-Visibility (lighting sightlines) | -Pump Lifting<br>-Access Stair compliance to AS<br>-Exit Signage<br>-Access to both sides of equipment<br>-Access for NRV Cleanout<br>-Handwheel heights and orientation (Vert vs Horizontal). | -Lighting rating and Locations<br>-Emergency Exit signage<br>-Access around equipment (multiple sides)<br>-Heights/Orientation/Location of operating and maintenance points on equipment.<br>-Equipment weights (including VSDs etc.) | -Heavy or awkward loads<br>-Repetitive actions and movements<br>-Poor working posture |
| MOVEMENT/DIRECTION | -Compression<br>-Downwards<br>-Expansion / Tension<br>-Friction / slip<br>-Physical damage<br>-Reverse | -Rollover<br>-Rotation<br>-Stability<br>-Upwards<br>-Vibration | -Pump Vibration<br>-Pump Mounting<br>-Spindle Supports. | -Pipework/Pump Vibration & Isolation<br>-Vehicle movements and exposed equipment.<br>-Trafficable ratings<br>-Thermal Effects | |
| LOAD/FORCE | -Additional loads (construction)<br>-Dynamics<br>-High/Excess | -Low/insufficient<br>-Temporary Weakness | -Crane positioning relating to buried services and ground conditions.<br>-Pump motor capacity allowance (15% extra)<br>-Motor Torque vs Pump Requirements<br>-Bypass Pumping Power Supply.<br>-Crane ratings and certifications (for construction loads).<br>-Pipework and Flange pressure ratings.<br>-Flood loads on structures. | -Crane positioning relating to buried services and ground conditions.<br>-Temporary Operating arrangements and loading (e.g. uneven hydraulic loads on tank walls).<br>-Crane ratings and certifications (for construction loads).<br>-Pipework and Flange pressure ratings.<br>-Electrical Fault levels | - Loads or buildings near the edge of excavations<br>- Loads to existing pipework, utilities and ground<br>- Shallow pipeline protection<br>- Pressure ratings<br>- Anchorage and thrust block requirements<br>- Critical pumped or high pressure zones<br>- Enclosed air valves |
| ENERGY | -Inertia / moment.<br>-Low / high energy. | -Potential / kinetic<br>-Tension / compression | -Hammer effects<br>-Transformer Capacity, Switchgear Capacity, Cabling Capacity (upstream), protection grading.<br>-Thrust block locations, thrust loads general when isolating.<br>-Pump anchoring.<br>-Inundation/FIFM | -Hammer effects<br>-Transformer Capacity, Switchgear Capacity, Cabling Capacity (upstream), protection grading.<br>-Thrust block locations, thrust loads general when isolating.<br>-Inundation/FIFM | -Thrust block locations<br>- Thrust loads general when isolating<br>- Anchorage details<br>- Dead ends<br>- Surge relief devices |

| CHAIR 1 GENERIC WORDS | | | Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations | Treatment Facilities | Pipelines |
|---|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | | | | |
| TIMING | -Extended delays<br>-Incorrect sequence | -Too late, too early<br>-Too short, too long | -Flow profile (diurnal)<br>-Station location (public/hidden/sensitive)<br>-Council/other events?<br>-Bypass capacity for storm events | -Equipment availability (Min. Operational Requirements).<br>- Extended shutdown<br>- Night works/ connections<br>- Overlap of Trades<br>-Impractical schedule expectations | - Extended shutdown<br>- Site location (public/hidden/sensitive)<br>- Night works/ connections<br>- Council/other works or events |
| EGRESS/ACCESS | -Emergency egress,<br>-Entry / exit points (location/arrangement)<br>-External Impacts<br>-Lighting<br>-Maintenance | -No. of exit points.<br>-Obstructions.<br>-People and Equipment Movements<br>-Size (width, height, length). | -Station classification (confined space).<br>-Anchor points<br>-Hatch sizes for equipment etc.-Segregation of lighting & power circuits (dry well flood).<br>-Access for emergency power/genset/Pumping. | - Access size and location<br>- Vehicle access/off-street parking.<br>- Access platforms- movement of people, material and vehicles<br>- Impact on existing roads and/or traffic<br>- Reduced access<br>- Emergency lighting<br>- Multiple exit/entry points.<br>- Anchor points | - Fitting and pit locations- Access lid size and location<br>- Vehicle access/off-street parking.<br>- Access platforms<br>- Movement of people, material and vehicles<br>- Impact on existing roads and/or traffic<br>- Reduced access |
| MAINTENANCE/REPAIR | -Access / Egress / Heights<br>-Discomfort / Stress / PPE<br>-Dropped Objects<br>-Posture / Manual Handling | -Rotating Equipment<br>-Size / Width<br>-Visibility / Slips / Trips<br>-Weight | -Vertical mounted NRVs & access for cleanout.<br>-Access to all equipment<br>-Valve actuation/operation forces | - Access to asset, fittings and pits in accessible locations<br>- Vehicle access/off-street parking.<br>- Access platforms<br>- Signage<br>- Scouring points<br>- Safe Isolation | - Access to asset, fittings and pits in accessible locations<br>- Vehicle access/off-street parking.<br>- Access platforms<br>- Signage<br>- Scouring points<br>- Impact on existing roads and/or traffic |

## CHAIR 1 OVERVIEW WORDS

| CHAIR 1 OVERVIEW WORDS | | | Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations | Treatment Facilities | Pipelines |
|---|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | | | | |
| ENVIRONMENTAL | -Extreme Weather (Wind, Rain, Hail, Light)<br>-Ground<br>-Noise | -Temperature (Hot, Cold, Heat, Fire)<br>-Water | - Noise Mitigation (Gensets etc.)<br>- Overflow levels (temporary weirs etc).<br>- Groundwater<br>- Surface water/ Stormwater<br>- Contaminated land<br>- ASS soils<br>- Rock in the area<br>- Settlement<br>- Potentially unstable grounds<br>- Bushfire zone / bushfire prone land | - Groundwater<br>- Surface water/ Stormwater<br>- Contaminated land<br>- ASS soils<br>- Rock in the area<br>- Settlement<br>- Potentially unstable grounds<br>- Bushfire zone / bushfire prone land<br>- Re use opportunities | -Groundwater<br>- Surface water/ Stormwater<br>- Contaminated land<br>- ASS soils<br>- Rock in the area<br>- Settlement<br>- Potentially unstable grounds<br>- Bushfire zone / bushfire prone land |
| EXTERNAL SAFETY | -Adjacent Property / Buildings<br>-Day / night / weekend<br>-External fire / Emergency Plans | -Members of the public<br>-Power / services<br>-Traffic | -Contingency plan for emergency maintenance (construction)<br>-Lighting<br>-Security/Fencing<br>-Vehicle access/off-street parking.<br>-Protection grading | -Security/Fencing<br>-Vehicle access/off-street parking<br>-Pedestrian pathways and traffic management<br>-Protection grading | -Security/Fencing<br>-Vehicle access/off-street parking<br>-Pedestrian pathways and traffic management<br>-Area prone to antisocial activities/people |
| TOXICITY | -Handling<br>-Lead / Asbestos | -Precautions<br>-Ventilation | -Mechanical Ventilation Suitability<br>-Trade Waste (safety shower?)<br>-Site registers.<br>-Hazardous Areas | - Asbestos management plan<br>- ASS management plan<br>- Hazard markers<br>- site registers<br>-Ventilation<br>-Hazardous Areas<br>-Atmospheric Monitoring | - Asbestos management plan<br>- ASS management plan<br>- Hazard markers<br>- Site registers |
| FIRE/EXPLOSION | -Detection<br>-Emergency isolation systems<br>-Emergency procedures | -Fire protection<br>-Inert Atmosphere<br>-Prevention | -Trade waste.<br>-Electrical Protection Settings | -Trade waste.<br>-Electrical Protection Settings<br>-Hazardous Areas<br>-Fire Detection | - Explosive atmospheres<br>- Ventilation through pits<br>- Hot works |

| CHAIR 1 OVERVIEW WORDS | | | Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations | Treatment Facilities | Pipelines |
|---|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | | | | |
| ENVIRONMENTAL IMPACT | -Dust<br>-Effluent<br>-Noise | -Seepage<br>-Vapour<br>-Waste Minimisation | -Temporary Pumping & Site Monitoring Arrangements<br>-Odour impacts & treatment<br>-Stormwater<br>-Overflow locations<br>-Flooding | - Hazardous waste<br>- Odour impact and treatment<br>- Surface runoff<br>- Noise due to rock braking activities<br>- Spills | - Hazardous waste<br>- Odour impact and treatment<br>- Surface runoff<br>- Noise due to rock braking activities<br>- Risk of heave<br>- Spills |
| UTILITIES & SERVICES | -Air<br>-Electricity<br>-Fuel<br>-Lighting | -Oxygen<br>-Water<br>-Water | -Backflow prevention<br>-Segregation of lighting and power circuits.<br>-Mechanical Ventilation<br>-Contingency supplies (pumping, power, etc.)<br>-Electrical earthing<br>-Proximity to MDF | -Backflow prevention<br>-Mechanical Ventilation<br>-Contingency supplies (pumping, power, etc.)<br>-Electrical earthing<br>-Existing Services (Gas) | - Existing utilities assets have been identified and located<br>- Cover and clearance to existing services<br>- NIT testing<br>- Electrical earthing<br>- Substations<br>- Proximity to railway corridors and stray currents |
| COMMISSION/START-UP/ SHUTDOWN | -Requirements<br>-Sequence | | -Test points, bleeding, drain points<br>-Temporary arrangements<br>-Bypass Starters/Control<br>-Isolations for cutover or testing.<br>-FIFM | -Test points, bleeding, drain points<br>-Temporary arrangements<br>-Isolations for cutover or testing.<br>-FIFM<br>-Bypass<br>-Utilities for Testing (Water etc) | - Temporary water supply<br>- Bypass<br>- Location and number of isolation points<br>- Trial Shutdowns<br>- FIFM<br>- Pressure / gravity |
| SAFETY EQUIPMENT | -Barriers / Guards<br>-Personnel Protection<br>-Safety Showers | | -Trade Waste (safety showers)<br>-Anchor Points<br>-Hatches/Safety grills<br>-Handrailing/Access ladders and platforms<br>-IP Ratings of equipment | -Chemical, spray, trade waste risks (safety eyewash & shower)<br>-Anchor Points<br>-Hatches/Safety grills<br>-Handrailing/Access ladders and platforms<br>-IP Ratings of equipment<br>- Physical barriers | - Trench protection<br>- Access/ ladders / Tripod<br>- Physical barriers |
| NATURAL HAZARDS | -Earthquake<br>-Flooding | -High Winds<br>-Thunderstorm (lightning protection) | -Flood Levels (1 in 100 AEP)<br>-Lightning Protection | -Flood Levels (1 in 100 AEP)<br>-Lightning Protection<br>-Appropriate wind ratings | -Surface runoff, erosion<br>-Flood levels |

| CHAIR 1 OVERVIEW WORDS | | Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations | Treatment Facilities | Pipelines |
|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | | | |
| INSPECTION/TESTING | -Access<br>-Eliminating<br>-Isolation | -Test/Bleed points<br>-Anchor Points<br>-Isolation Locations | -Test/Bleed points<br>-Anchor Points<br>-Isolation Locations<br>-Cutover | - Trials<br>- ITP<br>- Disinfection<br>- Isolation locations |
| DEMOLITION | -Documentation<br>-Ease<br>-Issues | -Hazardous materials<br>-Site access/Community/Environment<br>-Noise<br>-Disposal (Retained equipment?) | -Hazardous materials<br>-Site access/Community/Environment<br>-Noise<br>-Disposal (Retained equipment?) | -Hazardous materials<br>-Site access/Community/Environment<br>-Noise<br>-Disposal (Retained equipment?) |
| DOCUMENTATION | -Emergency<br>-Inspection/Testing<br>-Maintenance<br>-Operations<br>-Records / Reports<br>-Sequence | -Contingency plan updates<br>-Abnormal Job Plans or Control Requirements<br>-Signage Compliance (SDIMS0026)<br>-Asset Tagging? | | - Appropriate permits<br>- Inspection and testing plan<br>- Commissioning plan<br>- Change event management<br>- Unusual or particularly hazardous risks |
| QUALITY CONTROL | -Inspection / Testing<br>-Quality Assurance | -FAT Testing/Pre-FAT (Switchboards and Pumps)<br>-Type Testing | | - Technical reviews<br>- Hold points |
| CONSTRUCTION EQUIPMENT | -Sequence<br>-Timing / Access | - Lifting Arrangements (can we eliminate the need for mobile cranage).<br>- Support of pipework during construction.<br>- Access limitations<br>- Community expectations around timing. | | |

# CONSTRUCTABILITY REVIEW (CHAIR 2) GUIDEWORDS (For Reference)

| CONSTRUCTABILITY REVIEW (CHAIR 2) GUIDEWORDS (For Reference) | | Contextual Prompts | | |
|---|---|---|---|---|
| GUIDE WORD | PROMPT WORDS | **Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations** | **Treatment Facilities** | **Pipelines** |
| ELIMINATE/SUBSTITUTE | -Falls (of people)<br>-Falling material / objects<br>-Stepping on or striking against<br>-Caught or trapped<br>-Lifting & carrying – over exertion<br>-Asphyxiation / drowning<br>-Machinery/ Electricity<br>-Transport / mobile plant<br>-Toxicity<br>-Fires & explosion | -Bearing capacity of buried pipework and ground.<br>-Ventilation of Wet well/Dry Well<br>-Load capacity and condition of existing lifting equipment.<br>-Existing unterminated cables<br>-Working around operating assets<br>-Trade Waste Classifications<br>-Access for removal and installation of items.<br>-Existing structures (age/reinforcement etc.)<br>-Temporary Power, Starters, Control etc. | | |
| COMBINE | -Construction / lifting<br>-Sequence<br>-Timing<br>-Locations | -Bypass / temporary operating modes.<br>-Sequencing of bypass works around other works.<br>-Other activities (maintenance) that could be performed concurrently. | | |
| AVOID | -Construction / lifting<br>-Sequence<br>-Timing<br>-Locations<br>-Temporary instability<br>-Access / egress<br>-Delays / confined spaces<br>-Erection / dismantling<br>-Heat / cold / noise | -Lifting Arrangements (can we eliminate the need for mobile cranage).<br>-Support of pipework during construction.<br>-Access limitations<br>-Community expectations around timing. | | |
| OTHER ISSUES | -Modification<br>-Isolation / engineering controls<br>-PPE<br>-Alter / rearrange<br>-Increase / reduce<br>-Simplify / improve | -Failing Isolations (assumptions on operability of isolations)<br>-Electrical metering/protection.<br>-Earthing/bonding of metal structures. | | |

## OPERATION & MAINT. REVIEW (CHAIR 3) GUIDEWORDS (For Reference)

| OPERATION & MAINT. REVIEW (CHAIR 3) GUIDEWORDS (For Reference) | Contextual Prompts | |
|---|---|---|
| GUIDE WORD | **Dry Well SPS<br>Wet Well SPS<br>Water Pump Stations** | **Treatment Facilities** |
| POSTURE / MANUAL HANDLING | -Valve Heights/Orientation to spec.<br>-Access to both sides of pumps<br>-Access to NRVs for cleaning.<br>-Lifting/Handling of large cables.<br>-Accessibility of pump lifting points.<br>-Panel heights (particularly if moving an existing panel). | |
| ACCESS / EGRESS | -Access to all pumps from both sides<br>-Anchor point locations<br>-Access for removal of Soft Starters/VSDs<br>-Access/Plan for equipment removal.<br>-Access Hatch opening directions and holding points.<br>-Emergency access (locations, signage etc).<br>-Location of temporary pumping<br>-Access for temporary power equipment and vehicles. | |
| HEIGHTS / DROPPED OBJECTS | -Safety grilles on hatches.<br>-Toe boards on all handrailing as required by AS1657.<br>-Lanyards/Safety chain on critical items over water.<br>-Complying access.<br>-Equipment above flood level as appropriate.<br>-Lighting accessibility. | |
| WEIGHT | -Lay down of equipment during maintenance (platform rating for pump laydown etc).<br>-Lifting of cables, pumps etc.<br>-Replacement of Starters/VSDs.<br>-Ground/Road capacities for temporary equipment (generator, pump etc). | |
| DISCOMFORT / STRESS | -Ventilation suitability | |

| OPERATION & MAINT. REVIEW (CHAIR 3) GUIDEWORDS (For Reference) | Contextual Prompts | |
|---|---|---|
| GUIDE WORD | **Dry Well SPS**<br>**Wet Well SPS**<br>**Water Pump Stations** | **Treatment Facilities** |
| PERSONNEL PROT. EQUIPMENT | -Arc flash ratings | |
| VISIBILITY | -Bollards etc to protect key equipment.<br>-Lighting adequacy for maintenance and night time callouts.<br>-Identifying nominated laydown areas for heavy equipment.<br>-Emergency egress signage.<br>-Site Signage<br>-Exclusion zones or areas. | |
| SLIPS, TRIPS, FALLS | -Identified pathways/pedestrian areas.<br>-Ground material types (use of gravel/ landscaping etc). | |
| ROTATING / MOVING EQUIPMENT | -Guarding for moving components including NRV swingarms.<br>-Vibration (is support sufficient).<br>-Flexibility/protection of cabling. | |
| IS REPAIR DIFFERENT? | -Access for maintenance equipment and vehicles?<br>-Isolation for repair to maintain operation.<br>-Testing/re-commissioning provisions after repair? | |
| OTHERS THAT MAY APPLY (list below) | -Panel door clearances.<br>-Arc Flash ratings | |