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- This document is current at the date of downloading. Hunter Water Corporation may update this document at any time.

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Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
1 Purpose

This Standard Technical Specification – Chemical Storage and Delivery Systems (STS 670) details the minimum requirements of Hunter Water Corporation (Hunter Water) for chemical storage and delivery systems. This specification applies to chemical storage and delivery systems from the supplier’s transfer point to the point where the chemical is either injected into the water or wastewater network or added to the treatment process at a water or wastewater treatment plant.

This STS 670 does not include consideration for the chemical beyond the dosing or injection point or the application or use of the chemical.

In addition to the requirements of this standard, the following non-exhaustive list of requirements are applicable to all Hunter Water chemical storage and delivery systems:

- compliance requirements
- general design requirements
- site specific requirements
- component specific requirements
- associated requirements.

1.1 Initial release

This version of Chemical Storage and Delivery Systems STS 670 is an initial release to provide guidance to suppliers and internal stakeholders until a more comprehensive document becomes developed and published by Hunter Water.

It is expected that updated versions will be released over the next several years, so users of this document should consider this version as a guideline.
2 Interpretation

For the purposes of interpretation of this STS 670, except where the context requires otherwise:

- ‘drawings’ means the drawings detailing the work involved in a particular project
- ‘include’ means including but not limited to, and is used to provide clarification or examples of the type and nature of items intended
- ‘specification’ means a specification detailing the work involved in a particular project
- ‘standard drawings’ means Hunter Water drawings
- ‘standard technical specification’ (STS) references any of Hunter Water’s standard technical specifications, as implied by the text.

Headings are for the convenience of the reader and shall not be used in the interpretation of this standard technical specification.

Unless stated otherwise, any expression such as ‘give notice’, ‘submit’, ‘approval’, or ‘directed’ means give notice to, submit to, approval by, or directed by the person nominated by Hunter Water.

Approval does not imply acceptance of responsibility by Hunter Water for compliance with this technical specification, STS 670. Unless an approval has been issued in writing, approval has not been granted.

2.1 Order of precedence

The order of precedence for managing hazardous chemicals is:

1. Legislative requirements
   a. current Codes of Practice
2. Australian Standards
3. Hunter Water policies, procedures and standards.

The order of precedence of mechanical standard technical specifications is:

1. STS 670 – Chemical Storage and Delivery Systems
2. STS 600 – General Mechanical Requirements.

Any deviation from this standard technical specification shall be approved in writing on a case by cases basis by the STS 670 Document Owner.

These standard technical specifications are available on the Hunter Water website http://www.hunterwater.com.au
3 Roles and responsibilities

3.1 Document Owner

The Document Owner of this Hunter Water standard technical specification for chemical storage and delivery systems is Hunter Water’s Manager Strategic Asset Planning.

3.2 Responsibilities

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Asset Planning</td>
<td>Maintain standard technical specification document</td>
</tr>
<tr>
<td></td>
<td>Oversee implementation of standard technical specification</td>
</tr>
<tr>
<td>Internal Stakeholders</td>
<td>Review standard technical specification to ensure it supports business requirements</td>
</tr>
<tr>
<td>Asset Standards Committee</td>
<td>Approve standard technical specification and any major amendments</td>
</tr>
<tr>
<td>Investment Committee</td>
<td>Approve standard technical specification and any major amendments</td>
</tr>
</tbody>
</table>

Any request for a variation to STS 670 shall be made in accordance with the change management process in the Hunter Water Asset Standards Management Plan.
4 Definitions

Where the following term, abbreviation or expression occurs in this STS 670, it is defined as follows, unless the context implies otherwise:-

<table>
<thead>
<tr>
<th>Term / Abbreviation / Expression</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCA</td>
<td>Building Code of Australia</td>
</tr>
<tr>
<td>CDU</td>
<td>Chemical dosing unit</td>
</tr>
<tr>
<td>CHAIR</td>
<td>Construction Hazard Assessment Implication Review</td>
</tr>
<tr>
<td>Chemical</td>
<td>Any chemical compound, including the chemical compound in solution, either:</td>
</tr>
<tr>
<td></td>
<td>• introduced into the water or wastewater network</td>
</tr>
<tr>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>• added to a process at a water or wastewater treatment plant</td>
</tr>
<tr>
<td>Chemical installation</td>
<td>A chemical storage and delivery system for one chemical at a Hunter Water location</td>
</tr>
<tr>
<td>Chemical site</td>
<td>A Hunter Water location with more than one chemical Installation</td>
</tr>
<tr>
<td>Codes</td>
<td>A general term referring to more than one authorised or model Code of Practice</td>
</tr>
<tr>
<td>Consequence</td>
<td>The outcome of an event affecting objectives, expressed qualitatively, quantitatively or semi-qualitatively.</td>
</tr>
<tr>
<td></td>
<td>Can be assessed against criteria for injury, ill health or fatality, financial loss, damage to property, environment or reputation, or regulatory / legal compliance</td>
</tr>
<tr>
<td>Control</td>
<td>Measure that is modifying risk; An existing process, policy, device, practice or other action that acts to minimise negative risk or enhance positive opportunities</td>
</tr>
<tr>
<td>Enterprise-wide risk management</td>
<td>A structured and disciplined approach to aligning strategy, people, processes, technology and knowledge for the purpose of evaluating and managing the uncertainties Hunter Water faces as it creates value. It applies to all business risks (not just financial) and encompasses the entire organisation</td>
</tr>
<tr>
<td>ERM</td>
<td>Enterprise risk management</td>
</tr>
<tr>
<td>Hazard</td>
<td>A source, situation or act with a potential for harm in terms of human injury or ill health, damage to a property, damage to the environment or a combination of any of these</td>
</tr>
<tr>
<td>Hazardous chemical</td>
<td>A substance, mixture or article that satisfies the criteria for a hazard class in the GHS (Globally Harmonised System of Classification and Labelling of Chemicals, published by the United Nations) with some of the GHS tables replaced with the noted tables in Work Health and Safety (WHS) Regulation, Schedule 6, Classification of Mixtures</td>
</tr>
<tr>
<td>HAZOP</td>
<td>Hazard and Operability Study</td>
</tr>
<tr>
<td>Hunter Water</td>
<td>Hunter Water Corporation</td>
</tr>
<tr>
<td>Inherent risk</td>
<td>Assessed risk prior to any controls being implemented</td>
</tr>
<tr>
<td>Likelihood</td>
<td>Chance of something happening</td>
</tr>
<tr>
<td>OEM</td>
<td>Original equipment manufacturer</td>
</tr>
<tr>
<td>Residual risk</td>
<td>The resulting level of risk once all agreed controls have been implemented</td>
</tr>
<tr>
<td>Risk assessment</td>
<td>The overall process of risk identification, risk analysis and risk evaluation</td>
</tr>
<tr>
<td>Term / Abbreviation / Expression</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Risk identification</td>
<td>The process of identifying foreseeable hazards and, recognising and describing any potential risks that may result in injury, ill health or fatality, financial loss, damage to property, environment or reputation, or regulatory / legal compliance, or any combination of these.</td>
</tr>
<tr>
<td>Risk management</td>
<td>Coordinated activities to direct and control an organisation with regard to risk</td>
</tr>
<tr>
<td>Risk rating</td>
<td>The risk ranking as determined by the risk matrix by combining the consequence and likelihood. Hunter Water have four categories of risk rating, namely low, moderate, high and extreme</td>
</tr>
<tr>
<td>SDS</td>
<td>Safety data sheet (formerly material safety data sheet – MSDS) which must be provided by a hazardous chemical supplier. It is a standard reference document for chemical information and it provides working people and emergency service personnel essential information about:</td>
</tr>
<tr>
<td></td>
<td>• basic physical and chemical properties of the chemical</td>
</tr>
<tr>
<td></td>
<td>• correct safety procedures when storing, handling, transporting and disposing of the product</td>
</tr>
<tr>
<td></td>
<td>• health hazards and impacts on the environment</td>
</tr>
<tr>
<td></td>
<td>• what to do in accidents and emergencies</td>
</tr>
<tr>
<td>Standards</td>
<td>Any applicable industry standards including Australian Standards (AS), Australian / New Zealand Standards (AS / NZS), American National Standards Institute (ANSI) and ISO Standards (ISO) referenced in Appendix A</td>
</tr>
<tr>
<td>STS</td>
<td>Standard technical specification</td>
</tr>
<tr>
<td>WHS</td>
<td>Work, health and safety</td>
</tr>
</tbody>
</table>
5 Compliance requirements

All chemical storage and delivery systems supplied to Hunter Water shall comply with the relevant Commonwealth and New South Wales (NSW) legislation requirements at the time of commissioning. Legislation relevant to chemical storage and delivery systems at Hunter Water includes:

- Work Health and Safety Act 2011 (WHS Act)
- Work Health and Safety Regulation 2011 (WHS Regulation)
- Protection of the Environment Operations Act 1997 (POEO Act)
- Protection of the Environment Operations (General) Regulation 2009
- Protection of the Environment Operations (Clean Air) Regulation 2010
- Fluoridation of Public Water Supplies Act 1957 – Fluoride dosing systems only

While compliance with all the relevant legislation is essential, Hunter Water will require evidence of how any chemical storage and delivery system meets the requirements identified in this document.

5.1 Legislative requirements

5.1.1 WHS compliance

The WHS Act and WHS Regulation requirements, including, but not limited to:

- Requirements to identify foreseeable hazards and either eliminate the hazard or minimise the risks through a hierarchy of controls, so far as is reasonably practical. – see WHS Regulation, Chapter 3, Part 3.1.

- Requirements associated with airborne contaminants, hazardous atmospheres and storage of flammable and combustible substances. - see WHS Regulation, Chapter 3, Part 3.2, Divisions 7, 8 and 9, respectively.

- Requirements in relation to the design, manufacture, import, supply, installation, construction and / or commissioning of equipment. Whether these are directly applicable to the contractor, OEM or indirectly to Hunter Water, these provisions shall be met and a contractor shall provide all equipment, services and documentation within its scope of supply to meet these requirements. – See WHS Regulation, Chapter 5.Plant and Structures.

- Requirements in relation to the use, handling and storage of hazardous chemicals, generation of hazardous substances and pipelines used to convey hazardous chemicals. – See WHS Regulation Chapter 7, Part 7.1.

- The application of the relevant SafeWork NSW (formerly WorkCover NSW) Codes of Practice.

5.1.1.1 SafeWork NSW Codes of Practice

SafeWork NSW approved Codes of Practice and Guidelines are practical guides to achieving the standards of health, safety and welfare under the WHS Act and WHS Regulations. They may recommend suitable risk control measures for an identified foreseeable hazard. The application of any such control measures means that determination of the resultant residual risk rating is not required.
The following SafeWork NSW approved Codes of Practice have specific relevance to hazardous chemicals systems:

- Managing risks of hazardous chemicals in the workplace (July 2014).
- Labelling of workplace hazardous chemicals (December 2011).
- Preparation of Safety Data Sheets for hazardous chemicals (December 2011).

The following SafeWork NSW Guideline is relevant to hazardous chemicals systems:

- Placarding for storage of hazardous chemicals
- Factsheets and Guides 27/11/2014 (from SafeWork NSW site)
  - Class 9 dangerous goods are no longer included in Schedule 11 table for placarding. That is, GHS pictograms are not used for placarding of tanks and storage areas.

5.1.2 Environmental compliance

The laws in NSW define a ‘pollution incident’ as including situations that are likely to result in pollution, not just situations in which pollution is occurring or has occurred. All chemical storage and delivery systems shall be designed such that their operation and maintenance is not likely to result in pollution.

The Protection of the Environment Operations (POEO) Act and related regulations have requirements in relation to not contaminating the environment, which may impact upon the design, manufacture, import, supply, installation, construction and / or commissioning of equipment. The contractor shall provide all equipment, services and documentation within its scope of supply to meet these requirements.

Chemical Storage and Delivery Systems shall be designed, supplied, installed, commissioned and be capable of being operated and maintained such that they are not likely to create any pollution incidents. Potential sources of pollution to be considered include:

- disposal of waste in a manner that harms or is likely to harm the environment
- allowing any substance to leak, spill or otherwise escape (whether or not from a container) in a manner that harms or is likely to harm the environment
- emission of ozone depleting substances
- pollution of waters, other than within the terms of a NSW Environment Protection Authority (EPA) Environment Protection Licence for the location
- causing air pollution.

Hunter Water has (as at 1 December 2015) 17 Environment Protection Licences relating to the operation of Hunter Water infrastructure. The design and provision of new or modified chemical storage and delivery systems must comply with the POEO legislation including any relevant site specific EPA Environmental Protection Licence conditions. A copy of the relevant site specific Environmental Protection Licence is available from Hunter Water.

The EPA requires compliance with the following NSW WorkCover Code of Practice:

- Storage and handling of dangerous goods (2005).
The following is a guide to managing environmental risks associated with the storage and handling of liquid substances, including chemicals. The guide outlines the principles for preventing pollution when storing and handling liquid substances:

- Storing and Handling Liquids: Environmental Protection – Participant’s manual, published by the Department of Environment and Climate Change NSW.

5.1.3 Health Act fluoride requirements

The NSW Code of Practice for Fluoridation of Public Water Supplies – March 2011 is a NSW Health Department approved Code of Practice under the Fluoridation of Public Water Supplies Act 1957. Sections of this Code of Practice include requirements for fluoridation facilities, such as:

- Section 5 – Design controls for fluoridation facilities
- Section 7 – Environmental safety
- Section 8.2 – Storage of fluoridating agent
- Section 9.1 – Sample requirements.

5.1.3.1 Code of Practice for Fluoridation of Public Water Supplies

The NSW Department of Health Code of Practice for Fluoridation of Public Water Supplies is used to minimise any risks associated with excessive exposure to fluoride. Its aim is to achieve best practice in the establishment and operation of fluoridation plants, in order to meet the technical, occupational health and safety and environmental requirements of the relevant legislation. All new and existing fluoridation facilities shall comply with this code:

- NSW Code of Practice Fluoridation of Public Water Supplies.

5.1.4 Alternative methods for compliance

Compliance with the legislation referenced in this Section 5, Compliance requirements may be achieved by following another method other than a Code of Practice and / or Australian Standards, such as a technical or industry standard, if it provides the equivalent or higher standard of WHS and environmental compliance than required by the legislation.

Where an alternative method for compliance is applied, the supplier shall demonstrate to Hunter Water how this alternative method meets the legislative level of compliance.

5.1.5 Risk assessment

Section 34 of the WHS Regulation, requires identification of reasonably foreseeable hazards that could give rise to risks to health and safety. Section 35 of the WHS Regulation requires that these risks to health and safety must be managed by eliminating the risks, so far as is reasonable practicable, or if elimination is not reasonable practicable, minimising the risks, so far as is reasonable practicable. Section 47 of the WHS Act advises that consultation must be undertaken with workers who are likely to be affected (e.g. plant operator and maintenance personnel). Chapter 3 of SafeWork NSW Managing Risks of Hazardous Chemicals in the Workplace Code of Practice advises when a risk assessment is appropriate and provides three options (basic, generic, or detailed). Refer to the Code of Practice for guidance.
Therefore, the design of any new or modified chemical storage and delivery systems on Hunter Water sites shall require a risk assessment to be undertaken for any risks to health, safety or the environment that cannot be eliminated. The risk ranking of each risk shall be determined using the Risk Ranking Matrix in Appendix C: Risk Ranking Matrix.

These risk assessments shall occur at the following stages in any project:

- preliminary design review
- design
- commissioning.

At each stage, these risk assessments shall include operation and maintenance risks, as well as the construction, installation and commissioning risks usually considered during the Construction Hazard Assessment Implication Review (CHAIR) for a project.

The risk assessments shall meet the requirements of the relevant SafeWork NSW Codes of Practice, including:

- How to manage work, health and safety risks
- Managing risks of hazardous chemicals in the workplace
- Managing the risks of plant in the workplace
- Work, health and safety consultation, coordination and cooperation
- Managing the work environment and facilities.

Considerations in these risk assessments should include:

- hazardous properties of the chemical, particularly hazardous chemicals
- possible hazardous reactions
- nature of work
- plant or system used in handling, generation or storage of the chemical, or plant / system that could interact with the chemical.

The outcomes from each risk assessment, including the recommended risk control measures, shall be provided in a written report to Hunter Water. Where alternative risk control measures for the same hazard are proposed, Hunter Water shall confirm in writing the risk control measures to be implemented in the project.

5.1.6 Compliance review

Ensure that new or upgrade projects are designed to meet these Compliance Requirements by having an accredited consultant participate in each phase of design review for the project and complete a final audit prior to commissioning.

5.2 Australian Standards

The legislation and Codes of Practice mentioned above provide the high level requirements to meet compliance.

The Australian Standards are a technical guide that must be followed unless alternative methods for compliance are provided, and have been endorsed by Hunter Water.

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Hence, Australian Standards are to be used as technical guides in accordance with the relevant Code of Practice. It should be noted that compliance with the relevant Australian Standard does not necessarily mean compliance with the legislation or Code of Practice. Guidelines on their use is provided in the Codes of Practice.

If there is conflict or omission between the legislative requirements and Australian Standards, then the issue is to be risk assessed and managed as per the relevant Code of Practice and documentation shall be provided with the project information. Examples of common NSW Codes of Practice are Managing the Risks of Plant in the Workplace and/or Managing Risks Chemicals in the Workplace.

A list of relevant codes and standards are provided in Appendix A.

5.3 Hunter Water technical standards

All installations shall comply with relevant Hunter Water STSs (see Hunter Water STS web page), including:

- STS 500 – General Requirements for Electrical Installations
- STS 550 – General Requirements for SCADA and Automation Systems
- STS 600 – General Mechanical Requirements
- STS 904 – Preparation of Electrical Engineer Drawings specified
- STS 906 – Operation and Maintenance Manual Requirements
- STS 911 – Preparation of Civil Structural and Mechanical Drawings.
6 Design principles

The design, supply and commissioning processes shall comply with the statutory requirements and apply the statutory guidance throughout these processes to eliminate or mitigate risk, typically including:

- reference to the WHS and POEO Acts when defining the objectives and desired outcomes of the project
- any relevant, current Hunter Water Licence conditions, the WHS and environmental regulations and industry standards when defining the project scope
- the incorporation of the specific regulatory requirements, Codes of Practice, standards and Hunter Water requirements during the design, commissioning and operational readiness aspects of the project.

6.1 General design requirements

The following general design requirements shall apply to all new chemical storage and delivery systems and any upgrades to existing chemical storage and delivery systems.

6.1.1 Infrastructure

A fully functioning chemical storage and delivery system shall be provided. It shall:

- include infrastructure for safe, non-polluting:
  - delivery of the chemical
  - receipt and storage of the chemical
  - transfer and dosing of the chemical
  - removal of the chemical from the bulk storage
- include, but is not limited to, pipework, fittings, valves, storage tanks, drains and overflows, pumps, instruments and controls, from the chemical delivery point to the dosing or injection point or the application or use of the chemical
- utilise compatible materials where the materials are either in contact with the chemical or likely to encounter the chemical as stipulated by the manufacturer of the equipment or component (See Appendix B: Material compatibility for general information).

6.1.2 Spill containment systems

A chemical storage and delivery system shall include sufficient spill containment measures – a secondary containment system – for the bulk storage, truck unloading point, any chemical transfer systems and dosing systems, including the dosing point.

A secondary containment system includes any one or any combination of the following:

- chemical bulk storage tank bund(s)
- chemical delivery truck bund designed to be of sufficient capacity to safely contain spills from the chemical delivery truck
• dosing pits, provided they have either sufficient holding capacity or drain through a pipe-in-pipe into an approved point in the Hunter Water network. Allowance shall be made for the level switch indication within the bottom of the pit (see telemetry section).

All transfer and dosing pipes outside chemical bunds shall have secondary containment (e.g. pipe-in-pipe design).

The bunds, sumps, dosing pits and associated pipe-in-pipe containment systems will not allow any mixing or contamination with non-compatible chemicals.

Chemical delivery bunds shall have a readily cleanable surface area and allow for easy removal of chemical spills and cleaning liquids.

Where there is a risk of spray from any tank, equipment or pipe work not being captured in a secondary containment system, shielding, shrouding, deflection screens or another alternative shall ensure that all sprays are captured in a secondary containment system for the same chemical.

6.1.3 Design life

A chemical storage and delivery system shall:

• have a design life of:
  o 50 years – concrete bunds and pits
  o 30 years – structural, tanks and pipe work
  o 15 years – mechanical and electrical equipment
  o 10 years – control systems and telemetry

• be designed for economic operation and maintenance throughout its design life in its operating environment

• use equipment and materials that provide economic whole-of-life costs in its operating environment.

6.1.4 Inspection and approval

A chemical storage and delivery system shall incorporate any requirement for inspection and approval for use by:

• all relevant statutory bodies or local authorities (e.g. pressure vessel registration for SafeWork NSW, EPA requirements for high risk installations, etc)

• specialist providers (to ensure compliance with equipment suppliers’ and / or chemical suppliers’ use or delivery requirements).

6.1.5 Mountings and attachments

All tanks, equipment, associated pipework and attachments in a chemical storage and delivery system shall:

• have stable foundations and supports
be adequately secured to prevent any movement between tanks, equipment and the associated pipe work or attachments to prevent damage to the tanks, equipment, the associated pipe work or attachments
not penetrate through the bund wall
be suitably sealed with compatible materials to prevent any damage to the substrate
provide for the operability, maintenance and cleaning of the facility.

Where practicable, all mounting brackets and electrical cables / equipment shall be located above the bund’s flood containment level.

6.1.6 Safety and security

Consideration to minimise vandalism shall be given to all safety facilities, such as potable water supply and hose points, safety showers, eyewash, hose reels, fire extinguishers etc. If these safety facilities are not protected by a security fence or located within a secure building then the facilities shall be made vandal-resistant.

A chemical storage and delivery system shall:

- be designed such that areas of plant and equipment that require operation, maintenance or leak testing can be accessed safely. This includes the provision of stairs, ladders, gantries and walkways which must also be constructed of corrosion resistant materials. Pipe runs shall avoid personnel access ways and shall not cause trip hazards
- include security barrier to the chemical site to prevent unauthorised access
- be designed for safe removal and decommissioning at the end of its operating life.

6.1.7 Lighting and power

A chemical storage and delivery system shall:

- have adequate lighting for operation and maintenance, including during emergency work, night time or inclement weather
- include a 240V and, where required, a 415V outlet, for the delivery of bulk liquid chemicals that require pumping from the delivery truck into the chemical storage tank. The socket should be located close to the tank but electrical cabling for these outlets is not permitted inside the tank bund.

6.1.8 Temperature

The chemical storage tanks and delivery system shall be compatible with:

- the maximum and minimum temperature of the chemical being delivered from the truck. The chemical delivery temperature varies between suppliers, so it is the responsibility of the plant designer to confirm the maximum and minimum chemical delivery temperature from each potential chemical supplier and choose the most extreme temperature range
- the maximum and minimum temperature experienced by the surrounding environment.

Consideration shall be given for the freezing point of chemicals. Where necessary, insulated tanks and electrical heat traced pipes and valves shall be installed.
6.1.9 Separation distances

Consideration shall be given for separation distances between the chemical installation and the property boundary. Separation distances are typically dependant on the type and volume of chemical being stored. Refer to Appendix A for relevant applicable standards for minimum distances.

6.2 Site specific requirements

Factors to be addressed in assessing the impact of the operating environment on the design, operation and the maintenance of a chemical storage and delivery system and when selecting the equipment and materials shall include:

- local weather conditions (average and extreme temperatures, humidity, winds, rainfall, etc.)
- an extreme weather event (i.e. 1 in 100 year rainfall, 1 in 100 year flood level and maximum wind conditions experienced by the site).
- external environmental influences such as:
  - risk of flood
  - bushfire risk
  - saline atmosphere near to marine environments
  - higher humidity in shoreline (e.g. lake, river and creek) environments
  - higher humidity around other systems at a chemical site
  - corrosive environment due to other systems at a treatment or chemical site
  - explosive risks due to other systems at a treatment or chemical site
- safety data sheet (SDS) holder / location
- emergency plan holder / location.

Consideration shall be given for existing underground works. For example, concrete bunds shall not be located above sewage rising mains or any other underground electrical or pipe work.

A plume modelling study shall be conducted when designing or modifying any installations storing hazardous gases. For example, water treatment reservoirs are usually located on a hill and use chlorine to treat the water. Chlorine gas is heavier than air, so the plume modelling study will assess the proximity to any public or protected place, including dwellings, picnic areas, public walkways or any open area where people are accustomed to gather.

A plume modelling study shall also be conducted for any installations that could intentionally or inadvertently manufacture hazardous gases.

6.3 Component specific requirements

6.3.1 Chemical storage tanks and accessories

Tanks shall be designed to meet the specific requirements of their intended contents. The following standards, for example, provide guidance with the design for specific chemical types:

- AS 1692 Steel tanks for flammable and combustible liquids
- AS 1894 The storage and handling of non-flammable cryogenic and refrigerated liquids
- AS 2927 The storage and handling of liquefied chlorine gas
• AS 3780 Storage and handling of corrosive substances
• AS 3833 The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
• AS 4332 The storage and handling of gases in cylinders
• AS 4766 Polyethylene storage tanks for water and chemicals
• ASTM D1998 Standard specification for polyethylene upright storage tanks.

In addition to the specific applicable standards and codes, new bulk chemical storage tanks shall, as a minimum:

• include a nameplate, clearly legible from outside the secondary containment system, indicating:
  o manufacturer
  o manufacturer’s details (name, address etc.)
  o date of manufacture
  o serial number
  o Hunter Water plant number, if known, or space for it to be added
  o materials of construction
  o product
  o design volume
  o overflow volume
  o safe fill level volume – the maximum operating volume, which shall not be greater than 95% of the overflow volume
  o either:
    ▪ maximum specific gravity of chemical or density of chemical
    or
    ▪ maximum mass in kilograms of stored chemical when storage tank is filled to its overflow volume
  o design pressure (if relevant)
  o test pressure (if relevant)
  o design maximum and minimum operating temperature (if relevant)
  o test maximum and minimum temperature (if relevant)

• include level indication which is external and visible from tanker transfer point and protected from damage

• include venting in accordance with the relevant standard. If the chemical’s vapour is hazardous, the venting system shall pass through a vapour capture system. The vapour capture system shall allow the safe, spill-free removal and replacement of the capture medium

• include vermin proof mesh fitted on all vents and breathers

• include a tank inlet pipe located a minimum distance of two times the inlet pipe diameter above the top of the overflow pipe

• not use sight glasses for level indication if the tank capacity exceeds 10,000 litres

• include a lockable isolation valve to permit maintenance / replacement of the sight glass where the tank capacity is less than 10,000 litres and a sight glass system is used

• provide tank overflow lines as per the relevant standard
• be self-draining to the lowest point in the tank with a drain valve
• include accessible entry points. Where tank internal access is required for maintenance through the top of the tank (tank roof), the roof shall be capable of supporting the weight of maintenance personnel
• have tanks fixed to prevent movement, including buoyancy should the bund become filled with water.

6.3.2 Tank containment bunds

The following shall apply to the secondary containment system for a chemical storage tank:

• The secondary containment system shall include a bund with construction joints kept to a minimum. Any joints shall be fully sealed using compatible sealants to guarantee integrity of the containment system.
• For new bunds, if practicable it is preferred that bunds are manufactured from concrete with the sump, floor and walls to be poured as one piece of concrete. There will be no expansion joints, contraction joints, isolation joints or penetrations in the concrete apart from the sump drain.
• The installation contractor of new tank bunds shall conduct hydrostatic testing by filling the bund with potable water for a minimum period of 48 hours. This leak test shall be witnessed by a Hunter Water authorised representative, and can be done before or after tank installation.
• The bund shall feature suitable grading without pooling to a drainage sump accessible for placement of a suction pipe from outside the bund wall.
• Any sump grating shall be compatible with the chemical stored.
• The sump drain valve will drain into the sewage network. Under no circumstances will the sump be allowed to drain to stormwater. For bunds that cannot drain by gravity into the sewage system then a suitably rated pump shall be installed to pump spilled chemical into the sewage system. Where no local sewage system exists, a blind sump shall be used.
• Access to the sump drain valve shall be located outside the bund area. The valve shall be clearly marked with appropriate signage to indicate that the valve will be normally closed, with the open and closed position clearly marked.
• The sump drain valve shall have provision for a padlock to lock it in the closed position.
• Where tanks are not inside buildings, containment bunds shall have roofs to prevent rainwater entering the bund. The roofing should overhang the outer wall of the secondary containment area by at least 12º from the vertical plane of the outer wall.
• Roofs above chemical tank bunds shall be a lightweight structure. The sections of roof directly above the chemical storage tank shall have easily detachable sheeting, purlins, beams and pipes to facilitate tank replacement.
• The capacity of the bund shall be 110% of the volume of the tank (this is to ensure containment of fire hydrant water). If two or more tanks are interconnected, then the bund capacity will be 110% of the combined volume of those interconnected tanks.
6.3.3 Chemical unloading system

The following shall apply to a chemical unloading system to transfer concentrated liquid chemicals or solids from road transport vehicles:

- Chemical delivery systems shall be installed in accordance with the appropriate Australian Standard.
- The chemical unloading bund shall have a capacity of 9000 L with no further allowance for rainwater, and minimum dimensions of 12 m x 4.5 m, unless otherwise specified by Hunter Water. Surrounding rainwater runoff shall be diverted away from the unloading bund.
- The maximum depth of the bund area shall be 250 mm. Any driver over humps will allow underbody clearance for passenger vehicles.
- Unloading bunds shall have a sump and drain measuring 600 mm x 600 mm x 600 mm with galvanised steel grating that is rated to withstand the weight of a fully laden chemical delivery truck. The unloading area shall have suitable grading to the sump without pooling.
- Construction joints shall be kept to a minimum. Any joints shall be fully sealed using compatible sealants to guarantee integrity of the containment system. New delivery bunds shall be manufactured from concrete with the sump, floor and walls to be poured as one piece of concrete. There shall be no expansion joints, contraction joints, isolation joints or penetrations in the concrete apart from the sump drain.
- The installation contractor of new unloading bunds shall conduct hydrostatic testing by filling the bund with potable water for a minimum period of 48 hours. A Hunter Water nominated representative shall witness this leak test, and allowance shall be given for environmental influences (e.g. rain, evaporation, etc).
- The delivery bund sump shall drain into the sewerage network unless otherwise specified by Hunter Water. For delivery bunds that cannot drain by gravity into the sewerage system, a suitably rated pump shall be installed with a float and / or conductivity switch to automatically pump spilled chemical and / or rain water up and into the sewerage system. If no sewer exists, a roof over the bund area is required and a controlled method to remove stormwater via tanker will be provided.
- Access to the sump drain valve shall be located outside the delivery bund in a valve pit with a lightweight lockable lid. The valve shall be clearly marked with appropriate signage to indicate what the valve is used for, where it drains to, and the open and closed position.
Delivery bunds shall be located so as the delivery truck hose shall not exceed 6 m. If the site layout does not allow this distance to be achieved then remote filling points shall be installed. The delivery truck driver must clearly see both the tank level and all hose connections points during chemical delivery.

The area between the unloading bund and the chemical transfer connection point shall be concreted and drain to the unloading bund. For remote filling applications, the area between the transfer connection point and the tank bund does not necessarily require concrete surfacing.

Impact barriers shall be installed to protect operating plant from vehicle movements.

The chemical delivery points shall be located within the tank bund, whereby any drips or spills shall fall into the tank bund. Access to the delivery point couplings should be from outside of the tank bund. The chemical delivery truck driver shall not enter the tank bund. The chemical delivery point will have a hose support with restraint in place to prevent chemical spray if pipes or couplings fail during filling. Alternatively, the connection will be installed in a downward 45 degree angle to minimise load on the coupling and pipework.

The chemical delivery points shall be suitably supported with robust mounting brackets positioned close to the couplings.

Compatible unloading couplings to match chemical supplier’s requirements shall be used.

Delivery connection point(s) shall be clearly labelled.

Lifting equipment shall be designed in accordance with AS 1418 and operated and maintained in accordance with AS 2550, where lifting equipment is required for delivery / unloading.

Solid systems shall include equipment to contain any dust or fume emissions and to eliminate dust and fume discharge to the environment.

Solid systems shall provide necessary systems and protection to prevent moisture ingress during unloading and storage.

Consideration shall be made for future plant modifications. For example, piping for dosing pit drainage, power and potable water could be required beneath the new delivery bund. This requirement will largely depend on the current configuration of the plant.

Appropriate ‘no parking’ signage shall be installed in a clearly visible location close to the delivery bund.

Bund wall and floor coatings shall be in accordance with WSA 201-2017 Manual for Selection and Application of Protective Coatings Version 2.1. Surfaces will be non-slippery. Colour will be light grey unless otherwise specified by Hunter Water. There shall be no penetrations of the impervious coating after installation / application of the coating.

Transfer pipework will fully drain to bulk tank or tank bund (i.e. elevated pipework drains to top of tank, vertical pipework to drain to the bund). Truck unloading pipework should rise vertically from the transfer connection point to above the top level of the tank then slope towards the tank. A system shall be incorporated to confirm that the transfer pipework is completely drained before uncoupling the delivery hose.
6.3.4 Chemical mixing systems

Chemical mixing systems for the dilution of concentrated liquids, or dissolving of solids within a batching tank shall:

- have secondary containment
- have smooth-walled tank internals to prevent accumulation of material
- be constructed of materials capable of withstanding contact with concentrated chemical, any heat of reaction, gases or abrasiveness during dilution or dissolving
- allow any mixer to be easily removed for maintenance
- feature guarding of all rotating parts in accordance with the relevant Codes of Practice and standards
- feature backflow prevention on potable water supplies to chemical storage, mixing areas and their adjacent hose points. Backflow prevention devices shall be a reduced pressure zone (RPZ) type installed by a licenced and accredited plumber. It is the installation contractor’s responsibility to supply RPZ installation, commissioning and test reports to Hunter Water
- allow ergonomic transfer of solid powders and liquids with elimination of or minimal manual handling
- have solid powder mixing systems contained to prevent powders or dust being dispersed into the atmosphere or onto operating personnel
- have solid powder mixers and handling systems that include necessary grates or measures to prevent blocking due to clumping or debris
- allow safe access to any dosing areas that may incur dust or liquid spillage for spillage removal using vacuum or necessary safe means of removal
- allow safe access for the clearance of powder blockages
- consider the hydroscopic nature of the chemical – dehumidification may be required if humidity could contribute to clumping and blockage.

6.3.5 Delivery systems

Chemical delivery systems, including chemical supply, pumping and discharge equipment, shall:

- designed to be fail-safe. That is, any failure in any of the dosing equipment, fittings or pipe work shall immediately stop the operation of the chemical delivery system and raise a local alarm and telemetry alarm. This requirement is designed to halt dosing when a failure is detected, it does not necessarily need to stop the whole water or wastewater system.
- have metering pumps with variable discharge to Hunter Water specifications
- have suction filters at the dosing pump inlet for corrosive chemicals, odour control chemicals and fluoride (e.g. ferrous chloride, ferric sulphate, hydrofluorosilicic acid, sodium hydroxide, etc.) to prevent contamination from entering the delivery system (e.g crystals, solids, etc). The filter aperture size will be based on the chemical supplier’s recommendation. The filters shall be easy to remove for maintenance and cleaning.
- have all equipment and pipework mounted so that there shall be no penetrations through the secondary containment system. All other fixings shall be suitably sealed with compatible materials to prevent any damage to the substrate. All mounting brackets and electrical cables / equipment shall be located above the bund’s flood containment level

- have dosing equipment positioned for efficient and safe maintenance. The dosing pump, isolation valves, suction filters etc. shall all be located within an impervious transparent cabinet designed to channel a pressurised chemical leak into the tank bund. Access to this cabinet should be from outside the tank bund

- have the dosing equipment cabinet located at the opposite side of the building to where the chemical fill point is located, at an ergonomically compliant height above the bund so operators and maintainers can easily access the components

- have the dosing equipment cabinet installed with sufficient space to enable a person to leave the vicinity under emergency conditions. The minimum clearance between the end of an open cabinet door and any fixed structure shall be 600 mm

- ensure that all dosing equipment cabinets are lockable

- include an anti-siphon device (e.g. spring loaded check valve or actuated shut off valve) to prevent siphoning of the storage tank to the injection point when the delivery system is not in service. This valve shall have the ability to be tested in-situ to check its functionality

- include a back flow prevention device to prevent chemical or processed liquid from flowing back through the pump and into the storage tank

- include provision for operators and maintainers to safely connect a potable water supply to the suction side of the pump for flushing and priming. This would typically be a fixed tee-coupling and valves. Note: this may also require installation of backflow prevention devices on the potable water supply

- include the installation of an air bleed on the pump discharge, which discharges to safe containment without the risk of splashing or an uncontained spill

- consider purging pipework containing gas. The gas could be hazardous (e.g. chlorine gas created from sodium hypochlorite), therefore may require venting to atmosphere and not venting inside the building

- have the dosing injection point located to prevent any risk of leakage to environment. For example, using a sealed pit that has telemetered float and / or conductivity switches

- have a dosing injection point with a removable quill

- ensure that chemical dosing can only occur when water or wastewater is flowing past the dosing injection point, when injecting corrosive chemicals (e.g. ferrous chloride) directly into the mains pipe. This is to prevent corrosive chemical attack on the internal surface of the pipe

- have dosing pits that are completely sealed to prevent chemicals escaping or ground / rain water entering the pit. Consideration shall be given for groundwater effecting the buoyancy of the sealed pit

- consider the impact of vehicle movements on top of the dosing pit lid

- include a vandal-proof dosing pit lid. Where necessary, Hunter Water will supply padlocks.
• have a delivery system that automatically controls dosing of the chemical, as required, and have appropriate mechanism(s) to prevent dosing in periods of no flow or according to the control parameters required for safe operation.

6.3.6 Pipework and connections

The chemical storage and delivery system pipework and connections shall:

• be designed with reference to Hunter Water STS 600, section on Services Routing, to select appropriate pipe runs
• be coloured or marked in accordance with AS 1345-1995 Identification of the contents of pipes, conduits and ducts
• feature a pipe-in-pipe design or secondary containment ducts for all transfer and dosing pipes outside chemical bunds, where the outer containment drains to the associated chemical bulk storage tank bund or into an approved point in the Hunter Water network. The following design requirements apply:
  o The outer pipe and all joints will be of chemically compatible material for the product being transferred.
  o All joints will be fully sealed, or of a single unjoined length.
  o The outer pipe will be installed in a manner that will allow low-pressure hydrostatic testing to be easily carried out on an annual or frequent basis.
• ensure that overhead pipe work shall be shielded to prevent spray from reaching outside the bunded area or onto an operator
• be installed according to relevant standards and manufacturer’s instructions, including for:
  o carbon steel: AS 1074, AS 1579 and AS 4041
  o polythene pipe: AS 4130 with a minimum pressure rating of PN16
  o schedule 80 PVC pipe: ASTM D1785 and ASTM D2467-04e1
  o polyvinylchloride (PVC) pipe: AS 1477:
    ▪ a minimum of class 18
    ▪ only used in applications less than 60°C
    ▪ painted for ultraviolet (UV) protection when exposed to sunlight
    ▪ jointed using an approved bonding solvent: AS 3879
  o stainless steel pipe: AS 5200.053
    ▪ grade 316L
    ▪ spiral wound tube to have minimum thickness of 3mm
    ▪ any welds to be cleaned, pickled and passivated to Hunter Water’s STS 100
• be self-draining where possible, otherwise it shall:
  o have air vent valves installed at any high points of liquid lines that shall incorporate splash guarding to prevent spraying of chemical when bleeding
6.3.6 Pipework

- have bleed points piped to lower safe locations, to the sump if necessary
- have drains at low points to allow full pipe drainage to a secondary containment system or closed capture system for flushing and maintenance

- consider avoiding springing of joints or induced stress
- be protected from impacts (vehicles or other activities such as maintenance or lifting equipment)
- have either flanged joints with gaskets or union joints to allow easy removal of pipework connections to serviceable items (pumps, flow meters, dosing points etc.), and also at regular pipe length intervals
- have gaskets, seals and O-rings that are compatible with the chemical being contained
- have the joint covered with a spray guard where pressurised connections could leak and spray onto areas either outside the chemical’s secondary containment system, or where operating personnel are frequently present. Any leakage shall be directed to a safe containment location, or a suitable sheet of splash guard material shall be installed to direct leakage to a secondary containment system. If sheeting is used it shall:
  - be chemically resistant transparent sheeting, where plant operations and plant condition is to remain visible
  - direct leakage to inside a secondary containment system where external walls of a building are used for chemical spray containment
- be installed with a trace wire along the complete buried length to allow for future detection, for buried non-metallic pipes.

6.3.7 Valves

All valves shall:

- be installed to allow easy access and ergonomic operation of manual valves
- be located whereby they are accessible for maintenance and replacement
- include an adjacent nameplate to identify the valve with the process and instrumentation diagram (P&ID) tag number in accordance with Hunter Water naming conventions
- have provision for a Hunter Water padlock to ensure they are vandal proof and can be isolated, locked out and tagged during maintenance
- be located with consideration of people and vehicle movements
- be suitable for the application in accordance with manufacturers’ specifications.

Isolation valves should be ball valve style. Flow control valves should be needle or diaphragm valves. Automatic valves shall be designed to fail-to-safety, whereby, if the valve malfunctions then it will either automatically open or close depending on the fail-safe orientation.

6.3.8 Electrical equipment

All work shall comply with the guidelines in STS 500.
All electrical equipment and wiring shall be installed above the bund flood containment level of any secondary containment system or shall be designed to operate safely in chemically submerged conditions.

All electrical equipment shall continue to operate or shut down safely if the secondary containment system is full.

6.3.9 Instrumentation

Instrumentation and electrical safety equipment for chemical dosing units shall be installed in accordance with the following requirements:

- Include telemetry in accordance with STS 550 and this specification to Hunter Water’s Operations Centre for monitoring and actioning the state of the following non-exhaustive list of the chemical storage and delivery system:
  - security alarms on building doors
  - security alarms on perimeter fences for high risk chemical installations
  - pump operation
  - safety shower and / or safety eyewash operation
  - tank level
  - valve state for automatically controlled valves, and valve state for high risk manually operated valves where incorrect condition or a failure could result in an uncontained discharge.

- Include a pressure switch on dosing line to disable the chemical delivery pump and raise a local alarm and via telemetry if a high or low-pressure event occurs. The purpose of this system is to detect if the dosing line is either blocked or broken.

- Ensure remote adjustment of the chemical dosing rate.

- The system shall have the capability to raise a local alarm and via telemetry, if the pump experiences a power failure and / or flow rate fluctuations.

- Tank level sensor system is to provide for:
  - local and remote monitoring of the tank level for re-ordering purposes.
  - local and telemetry alarm if the tank level unexpectedly drops when the pump is not running.
  - local warning device (e.g. siren or flashing light) if the chemical delivery driver exceeds the high level of the tank.

- Include a float switch or conductivity switch inside the tank bund to disable the chemical delivery pump and raise a telemetry alarm if chemical or water enters the bund.

- Where a dosing pit is installed, provide float switch or conductivity switch inside dosing pit to disable the chemical delivery pump and raise a telemetry alarm if chemical or water enters the pit.

- The chemical delivery driver typically connects the truck’s chemical pump to a power outlet on the chemical dosing facility. A float switch or conductivity switch shall be positioned inside the
tank to automatically cut power to this power outlet if the delivery driver accidently overfills the tank.

- Include at least one emergency stop located in an accessible location to cut power to the power outlet connected to the unloading trucks’ chemical delivery pump. This emergency stop should be adjacent to the power outlet and clearly labelled ‘Delivery pump emergency stop’. Activating this emergency stop will also trigger a local alarm and raise a telemetry alarm.

- Include telemetry on showers and eyewash facilities to raise a telemetry alarm if the shower and / or eyewash is activated continuously for more than 60 seconds. This safety feature will inform head office that someone may have encountered the chemical and requires emergency assistance.

### 6.3.10 Buildings

Buildings associated with chemical storage and delivery systems shall:

- have the Hunter Water plant number, installation name and emergency telephone number clearly attached to the outside of the building and legible from outside any boundary or security fence

- where the building type is covered by the Building Code of Australia (BCA), meet the relevant sections of the BCA

- where a building is located in a designated bushfire prone area, utilise the recommended bushfire mitigation measures into the design, including the relevant sections of AS 3959. The designer shall liaise with Hunter Water to determine if the area is bushfire prone. A bushfire study should be conducted if no previous studies exist

- be located at least 5 m away from vegetation to mitigate the risk of fire and prevent trees or branches falling onto the building. This area should be within the boundary of the installation and requires access for ground maintenance

- have separation distances to boundaries and protected places, etc., which shall be in accordance with the relevant legislation, Codes of Practice and / or standards

- be in accordance with the relevant legislation, Codes of Practice and / or standards in regards to the fire-resistance level (FRL) of the walls, roof and doors.

- where appropriate, have security fencing with barbed wire installed around the tank bund to prevent unauthorised access. The fence shall not impede the delivery of chemical, maintenance or operation.

If the building design does not allow the tank to be removed through the roof then the design should allow for tank replacement through a sidewall, but the building must be tall enough to allow access for a portable crane to lift the tank over the bund wall.

The distance between the top of the tank and the ceiling shall be 1 m minimum, and the height of the ceiling above ground level 2.2 m minimum. This distance is required for personnel to access the tank hatch and for level measurement instrumentation to be maintained.

Consideration shall be given for emergency egress and maintenance access when designing the chemical storage installation. Adequate floor space is required between the tank bund wall and the entrance area / shed wall. For network chemical dosing units (CDUs), this distance shall be 1 m minimum (see Appendix H for typical shed layouts).
Consideration shall be given for the location of the emergency shower relative to the entrance door. The shower shall be located as close to the entrance door as possible. Areas under safety showers and eyewashes shall drain to the unloading bund, tank bund or other system that drains to sewer.

6.3.11 Ventilation

A chemical storage and delivery system within a building shall include a suitable natural or forced ventilation system to:

- prevent accumulation of chemical fumes or dust
- prevent condensation build up
- ensure that the operating atmosphere within the building meets the relevant safe exposure standards outlined in relevant codes and regulations.

If exhaust fans are to be used for gaseous chemical systems (e.g. chlorine) within buildings, the ventilation system shall be in accordance with the requirements of AS 2927.

If a ventilation system is installed it shall collect any chemicals which cannot be safely or legally emitted into the environment, such that emissions are within the necessary regulations, codes and licence conditions.

Ventilation systems shall be designed to permit safe access for cleaning and disposal of wastes.

6.3.12 Security and fencing

Where specified by Hunter Water, or alternatively, by the BCA, buildings will be supplied with emergency alarm systems and emergency lighting to meet the BCA requirements.

Chemical storage facilities will be secured by barriers or fencing appropriate to meet the regulations, relevant codes and standard requirements for the hazard classification of chemical being handled.

If specified by Hunter Water an intruder alarm system will be installed in accordance with AS/NZS 2201.1:2007 Intruder alarm systems.

Sites, compounds and buildings will be installed with a lock system to prevent unauthorised access. Hunter Water will supply all padlocks.

6.3.13 Safety / environmental equipment

Chemical storage and delivery systems shall include the installation of:

- a safety shower to comply with AS 4775 in a location which is compliant with the requirements of the standard relevant to the particular chemical or chemical type, e.g. AS3780 for corrosive substances
- an independent backflow prevention device (RPZ) on potable water supply to the safety shower (i.e. separate to any backflow prevention to chemical process areas)
- a wash-down hose complete with hose reel (with auto-shut-off nozzle) capable of reaching all areas where the chemical is used. Backflow prevention is to be installed on potable water supplies to these hose points
- storage for any specific safety equipment (e.g. masks) that may need to be kept in the area
- any manual handling equipment required (e.g. pallet lifts)
• storage / space for emergency response kits
• appropriate firefighting systems for the chemicals in use.

Access to / on sites will ensure adequate separation of personnel and moving equipment including safe parking for employees and visitors.

If subject to a fire risk, the building shall be installed in accordance with AS 1905.1-2005 Components for the protection of openings in fire-resistant walls – fire-resistant door sets, and will have a rating determined by a risk assessment of the equipment, chemicals and process proposed.

A HAZMAT document holder for the SDS and emergency plan shall be provided in a location safe from potential spills and spray, for example, on the inside of the door or in a lockable HAZMAT enclosure on the outside of the building.

### 6.3.14 Labelling

All chemical sites and chemical storage and delivery systems shall be labelled to identify the presence of a chemical and warn of the hazards associated with that chemical.

All labelling at any chemical storage and delivery system for a hazardous chemical shall be in accordance with the hazardous chemical labelling requirements in the WHS Regulation, including placard and HAZCHEM signage.

The following documents provide guidance on hazardous chemical labelling requirements:

- SafeWork NSW Code of Practice, Labelling of workplace hazardous chemicals
- SafeWork NSW Guideline, Placarding for storage of hazardous chemicals
- Safety signage, including placards and HAZCHEM signage, fitted to any chemical storage and delivery system compliant with the requirements of:
  - The WHS Regulation
  - The SafeWork NSW Code of Practice, Labelling of workplace hazardous chemicals
  - The SafeWork NSW Guideline, Placarding for storage of hazardous chemicals
  - The relevant standard for the chemical stored, such as AS 1319, AS 1345, AS 1596, AS 1894, AS 1940, AS 2927 or AS 3780

- Safety signage shall be durable for the design life of the labelled item and be clear, legible and securely attached.

### 6.3.15 Painting

Pipe work containing any chemical shall be identified in accordance with the SafeWork NSW Code of Practice, Labelling of workplace hazardous chemicals.

Equipment and buildings will be painted with a coating system in accordance with the appropriate Australian Standard for the particular chemical exposure. Where an appropriate Australian Standard does not exist, the designer may specify an appropriate equivalent international standard to be approved by Hunter Water.

Designs interfacing with existing painted equipment shall ensure that the relevant Australian Standards for the removal of lead based paint are specified and followed.
6.3.16 Specific requirements for individual chemicals

Reference shall be made to the relevant legislation, Code of Practice or standard for the specific requirements of individual chemicals.

Where established good industry practice exists for particular chemicals or chemical applications, that supplements standards, codes and guidelines, designers should utilise such information.

When choosing hazardous chemicals for treatment processes, consideration shall be given for Hunter Water manufacturing hazardous chemicals, gases and substances. A Hunter Water SDS is required for every hazardous chemical, gas or substance intentionally or unintentionally manufactured by Hunter Water.

6.3.17 Relevant codes and standards

A list of relevant codes and standards is provided in Appendix A.
7 Associated requirements

7.1 Modification of an existing chemical storage and delivery system

All modifications shall follow the Hunter Water change management process.

Any proposed modification of any existing chemical storage and delivery system shall include a condition assessment of all retained elements of the existing chemical storage and delivery system, to ensure that the retained elements will continue to operate within their design capabilities, following the proposed modification. Any proposed chemical storage and delivery system modification shall demonstrate its:

- integration with current Hunter Water operational and maintenance strategies
- compliance with Hunter Water’s standard technical specifications.

A formal risk assessment shall be completed on the impact of the proposed modification, including details of any controls necessary to reduce the risks to as low as reasonably practicable.

When any chemical storage and delivery system is modified, all relevant / affected drawings and documentation shall be submitted to Hunter Water for review prior to being issued for construction. All documentation of the modification, including the risk assessment, shall be provided to Hunter Water.

7.2 Training

The installer shall identify the specific skills and / or training required to install, operate, maintain or decommission the chemical storage and delivery system, and provide a list of skills, licences and certificates for the identified tasks.

Where the training is specific to the equipment supplied, training manuals shall be supplied for the equipment prior to commissioning.

7.3 Decommissioning / disposal

The design of a chemical storage and delivery system and its installation shall include provision for:

- practical decommissioning and removal
- disposal of unsafe or environmentally hazardous materials in addition to the chemical
- potential replacement with alternative equipment or re-use of the chemical storage and delivery system’s location.

The contractor shall:

- identify any specialised skills required to safely plan and conduct decommissioning activities
- provide identification of all hazardous material prior to dismantling / disposal
- provide a method for disposal of all hazardous material for decommissioning / disposal.
8 Documentation

Documentation will be provided in accordance with Hunter Water STS 906 Operation and Maintenance Manual Requirements.

As a minimum, the following documentation shall be provided to Hunter Water progressively through any chemical storage and delivery systems project:

- operation and maintenance manuals, associated drawings or other necessary documentation to allow safe and reliable operation and maintenance of the chemical storage and delivery system. Draft documents should be submitted during the project and final documents should be submitted during commissioning
- the training and instruction manuals for operators and maintainers to allow safe and reliable operation and maintenance
- written reports from each HAZOP, CHAIR and each risk assessment and selected control measures, conducted at the preliminary design, completion of design and commissioning stages of the project
- a Compliance Assessment report (see Appendix D) completed following commissioning and prior to hand-over of the new or updated chemical storage and delivery system
- an efficient procedure for periodic leak testing of the tank bund. If leak testing is to be done by filling the bund with water, consideration shall be given to ensuring the tank and/or pipe work does not become buoyant and potentially rupture.

8.1 Equipment list

As a minimum, the contractor shall supply lists for the following (see Appendix I):

- backflow prevention devices (RPZ) and their location on site
- compressed gases
- cooling towers
- cranes and all lifting equipment
- engines, generators and compressors
- eyewash and safety showers
- fall protection equipment
- fire safety and suppression equipment
- flammable and combustible liquids and gases
- flow meters
- gas reticulation systems
- gas sensors (fixed)
- hazardous chemical and substances including all SDS documentation
- lanyard and harness attachment points
- non-hazardous substances (e.g. polymers and alum)
- nameplate data
- pressure vessels
- residual current devices (RCDs)
- registerable plant
- safety and relief valves
- spill kits.

### 8.2 Manifest, SDS and emergency plan requirements

An up-to-date SDS and emergency plan shall be stored within a HAZMAT emergency information enclosure that is easily accessible.

If the entrance door to the installation is a standard doorway then the HAZMAT enclosure should be connected to the inside face of the door, so personnel can access the emergency information when the door is open. This does not apply to installations that only have roller doors.

Where necessary, a site manifest shall also be stored inside the HAZMAT enclosure.

All emergency documentation shall be laminated or similar.

### 8.3 Label documentation

A site-specific hazardous chemical label manifest shall be supplied to Hunter Water during the commissioning phase of the project.

All signs and labels shall be photographed and documented in the manifest so Hunter Water personnel can revisit the site in the future to assess signage condition.

### 8.4 Critical spares

A list of critical spare parts shall be supplied with new installations. The critical spares list should itemise both cost and availability for all items.

If a critical spare has a long lead time from the date of order then Hunter Water must be informed about this lead time.
9 Related documents

In addition to this Standard – STS 670 Chemical Storage and Delivery Systems, all work shall comply with relevant current standards and regulations inclusive of all amendments. In particular:

- NSW Work Health and Safety Act 2011 and the related NSW Work Health and Safety Regulation 2011
- SafeWork NSW Codes of Practice
- Safe Work Australia Model Codes of Practice
- Protection of the Environment Operations Act 1997 (POEO Act)
- Protection of the Environment Operations (General) Regulation 2009
- Protection of the Environment Operations (Clean Air) Regulation 2010
- Fluoridation of Public Water Supplies Act 1957 – Fluoride dosing systems only
- NSW Code of Practice Fluoridation of Public Water Supplies
- Building Code of Australia
- Hunter Water design manuals
- Hunter Water standard technical specifications
- Hunter Water standard drawings.

Appendix A: Codes of Practice and Standards is a list of standards referenced in this specification and other standards relevant to the scope of this STS 670.
10 Document control

Document Owner: Manager Capability Engineering

Document Author: Team Leader Mechanical Engineering

Document Controller: Senior Engineer Standards & Strategy

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<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Details of Change</th>
<th>Approval Date</th>
<th>Approved By</th>
<th>Next Scheduled Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>18/12/17</td>
<td>G. Baker</td>
<td>Initial release</td>
<td>06/02/18</td>
<td>D. Cleary</td>
<td>06/02/20</td>
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<tr>
<td>2.0</td>
<td>15/15/19</td>
<td>G. Baker</td>
<td>Update to 6.3.2 and 6.3.6</td>
<td>30/05/19</td>
<td>L. Backhausen</td>
<td>30/05/21</td>
</tr>
</tbody>
</table>
Appendix A: Codes of Practice and Standards

The following SafeWork NSW approved Codes of Practice have specific relevance to hazardous chemicals systems:

- Managing risks of hazardous chemicals in the workplace (July 2014)
- Labelling of workplace hazardous chemicals (December 2011)
- Preparation of Safety Data Sheets for hazardous chemicals (December 2011).

The following SafeWork NSW Guideline is relevant to hazardous chemicals systems:

- Placarding for storage of hazardous chemicals.

Other relevant Codes of Practice include:

- NSW Code of Practice for Fluoridation of Public Water Supplies.

For clarity, where a standard has several parts and / or amendments and / or supplements, the reference number is for the leading part of the standard.

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1074-1989</td>
<td>Steel tubes and tubulars for ordinary service</td>
</tr>
<tr>
<td>AS 316-2006</td>
<td>Class Labels for Dangerous Goods</td>
</tr>
<tr>
<td>AS 1319-1994</td>
<td>Safety signs for the occupational environment</td>
</tr>
<tr>
<td>AS 1345-1995</td>
<td>Identification of the contents of pipes, conduits and ducts</td>
</tr>
<tr>
<td>AS 1428.1-2009</td>
<td>Design for access and mobility – General requirements for access – New building work</td>
</tr>
<tr>
<td>AS/NZS 1477-2006</td>
<td>PVC pipes and fittings for pressure applications</td>
</tr>
<tr>
<td>AS 1579-2001</td>
<td>Arc-welded steel pipes and fittings for water and wastewater</td>
</tr>
<tr>
<td>AS/NZS 1596-2014</td>
<td>The storage and handling of LP gas</td>
</tr>
<tr>
<td>AS 1692-2006</td>
<td>Steel tanks for flammable and combustible liquids</td>
</tr>
<tr>
<td>AS 1894-1997</td>
<td>The storage and handling of non-flammable cryogenic and refrigerated liquids</td>
</tr>
<tr>
<td>AS 1905.1-2005</td>
<td>Components for the protection of openings in fire-resistant walls – fire-resistant doorsets</td>
</tr>
<tr>
<td>AS 1940-2004</td>
<td>The storage and handling of flammable and combustible liquids</td>
</tr>
<tr>
<td>AS/NZS 2201.1:2007</td>
<td>Intruder alarm systems</td>
</tr>
<tr>
<td>AS 2243 series</td>
<td>Safety in laboratories, Parts 1-10:</td>
</tr>
<tr>
<td>AS 2508 series</td>
<td>Safe Storage and handling information for hazardous chemicals</td>
</tr>
<tr>
<td>AS 2550-2011</td>
<td>Cranes, hoists and winches – Safe use set</td>
</tr>
<tr>
<td>AS 2594-1983</td>
<td>AS 2594-1983: Hose and hose assemblies for liquid chemicals</td>
</tr>
<tr>
<td>AS 2927-2001</td>
<td>The storage and handling of liquefied chlorine gas</td>
</tr>
<tr>
<td>AS 3559</td>
<td>Construction of buildings in bushfire prone areas</td>
</tr>
<tr>
<td>AS 3735-2001</td>
<td>Concrete structures for retaining liquids</td>
</tr>
<tr>
<td>Reference Number</td>
<td>Title</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>AS 3745</td>
<td>Planning for emergencies in facilities</td>
</tr>
<tr>
<td>AS 3780-2008</td>
<td>Storage and handling of corrosive substances</td>
</tr>
<tr>
<td>AS.NZS 3833-2007</td>
<td>The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers</td>
</tr>
<tr>
<td>AS/NZS 3879 - 1995</td>
<td>Solvent cements and priming fluids for use with unplasticized PVC (uPVC) pipes and fittings</td>
</tr>
<tr>
<td>AS 4041-2006</td>
<td>Pressure piping</td>
</tr>
<tr>
<td>AS 4130-2009</td>
<td>Polyethylene (PE) pipes for pressure applications</td>
</tr>
<tr>
<td>AS 4145.1-2008</td>
<td>Locksets and hardware for doors and windows – Glossary of terms and rating systems</td>
</tr>
<tr>
<td>AS 4326-2008</td>
<td>The storage and handling of oxidising agents</td>
</tr>
<tr>
<td>AS 4332-2004</td>
<td>The storage and handling of gases in cylinders</td>
</tr>
<tr>
<td>AS 4452-1997</td>
<td>The storage and handling of toxic substances</td>
</tr>
<tr>
<td>AS 4681-2000</td>
<td>The storage and handling of Class 9 (miscellaneous) dangerous goods and articles</td>
</tr>
<tr>
<td>AS 4775-2007</td>
<td>Emergency eyewash and shower equipment</td>
</tr>
<tr>
<td>AS 5026-2012</td>
<td>The storage and handling of Class 4 dangerous goods</td>
</tr>
<tr>
<td>AS 5200.053-2008</td>
<td>Plumbing and drainage products – Stainless steel pipes and tubes for pressure applications</td>
</tr>
<tr>
<td></td>
<td>Industry guidelines from chemical suppliers e.g. Orica, IXOM, etc</td>
</tr>
</tbody>
</table>
Appendix B: Material compatibility

Hunter Water utilises multiple different types of chemical for various applications and the following non-exhaustive table is provided for general advice only. The plant designer must confirm material compatibility for each application.

Guideline Material Compatibility

<table>
<thead>
<tr>
<th>KEY</th>
<th>Ferrous chloride</th>
<th>Sodium hypochlorite &lt;20%</th>
<th>Chlorine gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incompatible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not recommended</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Compatible</th>
<th>Incompatible</th>
<th>Not recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS plastic</td>
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<td></td>
</tr>
<tr>
<td>Acetal (Delrin®)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brass</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buna N (Nitrile )</td>
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<td></td>
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<tr>
<td>Carbon graphite</td>
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<tr>
<td>Carbon steel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpenter 20</td>
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<td></td>
</tr>
<tr>
<td>Cast iron</td>
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<td></td>
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</tr>
<tr>
<td>Ceramic Al2O3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ceramic magnet</td>
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<tr>
<td>ChemRaz (FFKM)</td>
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<td></td>
<td></td>
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<tr>
<td>Copper</td>
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<td>CPVC</td>
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<td>EPDM</td>
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<td>Fluorocarbon (FKM)</td>
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<td>Hastelloy-C®</td>
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<td>HDPE</td>
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<td>Hypalon®</td>
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<td>Hytrel®</td>
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<td>Kalrez®</td>
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<td>Kel-F®</td>
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<tr>
<td>LDPE</td>
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</tr>
<tr>
<td>Material</td>
<td>Ferrous chloride</td>
<td>Sodium hypochlorite &lt;20%</td>
<td>Chlorine gas</td>
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<tr>
<td>Natural rubber</td>
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<td>Neoprene</td>
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<td>Noryl®</td>
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<td>PCTFE</td>
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<tr>
<td>Polycarbonate</td>
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<td>Polyurethane</td>
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<td>PPS (Ryton®)</td>
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<tr>
<td>PTFE</td>
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</tr>
<tr>
<td>PVC</td>
<td></td>
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<tr>
<td>PVDF (Kynar®)</td>
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<tr>
<td>Santoprene®</td>
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<tr>
<td>Silicone</td>
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<td>Stainless Steel - 304</td>
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<td>Stainless Steel - 316</td>
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<td>Titanium</td>
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<tr>
<td>Tygon®</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tygon® (E-3603)</td>
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<td></td>
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</tr>
<tr>
<td>Viton®</td>
<td></td>
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## Appendix C: Risk Ranking Matrix

The table below shows the resultant risk rating from assessed consequence and likelihood of an identified risk.

The following table provides explanatory notes on the determination of the likelihood and consequence scales.

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Safety</th>
<th>Environment</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insignificant or No Injury</td>
<td>Temporary or Immediately restored with no discernible change</td>
<td>Medical Treatment Required and/or LTI &lt; 1 week</td>
</tr>
<tr>
<td></td>
<td>Minor Injury requiring First Aid Treatment</td>
<td>Short Term Impact / Contained On Site (recovery 1 week to several months)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Treatment Required and/or LTI &lt; 1 week</td>
<td>Medium Term Impact (recovery over several months to 1 year)</td>
<td>Long Term Serious Injury (LTI &gt; 1 week)</td>
</tr>
<tr>
<td></td>
<td>Fatality or Permanent Disability / Ill Health</td>
<td>Long Term Impact (recovery over several years)</td>
<td>Species Destruction or Permanent / Irreversible Impact</td>
</tr>
</tbody>
</table>

### HWC Corporate Likelihood Scale

<table>
<thead>
<tr>
<th>From Above</th>
<th>Indicative frequency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Extremely Likely</td>
<td>Multiple times in a year</td>
</tr>
<tr>
<td>B</td>
<td>Very Likely</td>
<td>1 in a year or so</td>
</tr>
<tr>
<td>C</td>
<td>Likely</td>
<td>1 in 5 years or multiple times over 10 years</td>
</tr>
<tr>
<td>D</td>
<td>Unlikely</td>
<td>1 in 10 years or multiple times in 20 years</td>
</tr>
<tr>
<td>E</td>
<td>Very Unlikely</td>
<td>1 in 50 years or less frequent</td>
</tr>
</tbody>
</table>

Source: Hunter Water Procedure - Performing Task Based Risk Assessments (TRIM:HW2013-421/11.004)
### Appendix D: WHS Checklist

**WHS Checklist**

<table>
<thead>
<tr>
<th>Location Description:</th>
<th>Station ID</th>
<th>Plant Item / Operational Area:</th>
<th>Area / Tank ID:</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area / Activity</td>
<td>Task Details: Compliance Assessment of Hazardous Chemical Storage and Handling rev [insert revision number]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Personnel Present:

Prepared By: __________________________ Site Assessment Date: ________________

Reviewed By: __________________________ Next Review Due: ________________

<table>
<thead>
<tr>
<th>WHS Reg Clause</th>
<th>CONTROL MEASURE</th>
<th>ACTIVITY / CIRCUMSTANCE</th>
<th>GUIDANCE FOR POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT</th>
<th>IDENTIFIED FORESEEABLE HAZARD</th>
<th>HAZARD RISK RATING</th>
<th>CONTROL APPLIED</th>
<th>RESIDUAL RISK RATING</th>
<th>ASSESSMENT NOTES</th>
<th>SUGGESTED ADDITIONAL CONTROL OR ACTION</th>
<th>RESULTANT RESIDUAL RISK RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Elimination</td>
<td>Inventory control - can the hazardous chemical be eliminated, inventory minimised or replaced by a lower risk alternative?</td>
<td>Can hazardous chemicals be eliminated?</td>
<td>L</td>
<td>C</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Partial elimination</td>
<td>Is inventory of hazardous chemical minimised?</td>
<td>Can risk be minimised by less inventory?</td>
<td>L</td>
<td>C</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Substitution</td>
<td>Can hazardous chemical be substituted with a less dangerous alternative?</td>
<td>Can non-hazardous alternative be substituted?</td>
<td>L</td>
<td>C</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Green = appears to be compliant
<table>
<thead>
<tr>
<th>WHS Reg Clause</th>
<th>CONTROL MEASURE HEIRARCHY LEVEL</th>
<th>ACTIVITY / CIRCUMSTANCE</th>
<th>GUIDANCE FOR POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT</th>
<th>IDENTIFIED FORESEEABLE HAZARD</th>
<th>HAZARD RISK RATING</th>
<th>CONTROL APPLIED</th>
<th>RESIDUAL RISK RATING</th>
<th>ASSESSMENT NOTES</th>
<th>SUGGESTED ADDITIONAL CONTROL OR ACTION</th>
<th>RESULTANT RESIDUAL RISK RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 &amp; 41</td>
<td>Isolation</td>
<td>Provide and maintain adequate facilities</td>
<td>Are hazardous chemicals secured from unauthorised access? Is site in a secure/locked enclosure?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Green = appears to be compliant</td>
</tr>
<tr>
<td>51</td>
<td>Admin</td>
<td>Managing risks to health and safety</td>
<td>Does a hazardous atmosphere exist?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>52</td>
<td>Admin</td>
<td>Ignition Sources</td>
<td>Do risks to health and safety associated with an ignition source in a hazardous atmosphere exist?</td>
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<td></td>
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<tr>
<td>330</td>
<td>Admin</td>
<td>Manufacturer to provide SDS</td>
<td>Does HWC generate hazardous chemicals?</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>341 to 346 &amp; others</td>
<td>Admin</td>
<td>Provision of information</td>
<td>Risks arising from personnel being unaware of the hazards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>341 to 346 &amp; others</td>
<td>Admin</td>
<td>Hazardous characteristics - communication</td>
<td>Risks to personnel due to ignorance of the hazards of the material</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>341</td>
<td>Admin</td>
<td>Labelling hazardous chemicals - general</td>
<td>Haz chemicals that are used, handled and stored, are they labelled?</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>342</td>
<td>Admin</td>
<td>Labelling hazardous chemicals - containers</td>
<td>Are containers including decant containers labelled?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>343</td>
<td>Admin</td>
<td>Labelling hazardous chemicals - pipework</td>
<td>Are pipe runs sufficiently labelled at visible intervals?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>344</td>
<td>Admin</td>
<td>Access to SDS</td>
<td>Is a current SDS available and accessible?</td>
<td></td>
<td></td>
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<tr>
<td>345</td>
<td>Admin</td>
<td>Changes to SDS</td>
<td>Does HWC generate hazardous chemicals requiring modification to an SDS</td>
<td></td>
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<tr>
<td>346</td>
<td>Admin</td>
<td>Hazardous Chemicals Register</td>
<td>Is the hazardous chemical listed on the register and is the register accessible?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>347</td>
<td>Admin</td>
<td>Manifest of Hazardous Chemicals</td>
<td>Is a manifest required for this site, and if so is this material listed? Is the manifest available for emergency services?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>348</td>
<td>Admin</td>
<td>Notification to Regulator (WorkCover)</td>
<td>If a manifest quantity exists on site, has the site been notified to WorkCover?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>WHS Reg Clause</td>
<td>CONTROL MEASURE HIERARCHY LEVEL</td>
<td>ACTIVITY / CIRCUMSTANCE</td>
<td>GUIDANCE FOR POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT</td>
<td>IDENTIFIED FORESEEABLE HAZARD</td>
<td>HAZARD RISK RATING</td>
<td>CONTROL APPLIED</td>
<td>RESIDUAL RISK RATING</td>
<td>ASSESSMENT NOTES</td>
<td>SUGGESTED ADDITIONAL CONTROL OR ACTION</td>
<td>RESULTANT RESIDUAL RISK RATING</td>
</tr>
<tr>
<td>----------------</td>
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<td>---------------------------------------------------------------</td>
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<td>-----------------------------</td>
</tr>
<tr>
<td>349 Admin</td>
<td>Outer warning placard - requirement to display</td>
<td>Is an outer warning placard (HAZCHEM) required? Note: Placard is required if any storage exceeds placarding quantity.</td>
<td></td>
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<tr>
<td>350 Admin</td>
<td>Placard - requirement to display</td>
<td>Is the correct placard displayed on the tank?</td>
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<tr>
<td>351 (1) Admin</td>
<td>Management of risks to Health and Safety</td>
<td>Are hazards identified and managed?</td>
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<tr>
<td>351 (2) (a) Admin</td>
<td>Hazardous properties of the chemical</td>
<td>Have the hazardous properties identified from the SDS been controlled?</td>
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<tr>
<td>351 (2) (b) Isolation / Engineering / Admin</td>
<td>Hazardous chemical or physical reaction</td>
<td>Are controls in place to ensure that hazardous reactions with other substances cannot occur?</td>
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<tr>
<td>351 (2) (c) Admin</td>
<td>Nature of the work</td>
<td>Do the operating procedures deal with the risks associated with the chemical?</td>
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<tr>
<td>351 (2) (d) Engineering</td>
<td>Structures, plant and system of work</td>
<td>Are the structures and plant suitable for the material?</td>
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<tr>
<td>352 Isolation / Engineering / Admin</td>
<td>Review of control measures</td>
<td>Refer Clause 352 of WHS Regulation. Check if there is a policy to review control measures after a change in (a) SDS, (b) health monitoring requirements, (c) air quality monitoring or (d) every 5 years</td>
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<tr>
<td>353 Admin</td>
<td>Safety signs</td>
<td>Are safety signs, required to control an identified risks, located next to the hazard, and clearly visible</td>
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<tr>
<td>354 Isolation / Engineering / Admin</td>
<td>Identification of risk of physical or chemical reaction</td>
<td>Similar to 351 (2) (b)</td>
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<tr>
<td>354 Isolation</td>
<td>Separation from other haz chem storages</td>
<td>Dangerous reaction, heating, toxic fumes</td>
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<tr>
<td>354 Isolation / Engineering / Admin</td>
<td>Interaction with other hazardous chemicals</td>
<td>Reaction producing toxic reaction products</td>
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<tr>
<td>354 (special instance) Isolation</td>
<td>Introduction of incompatible material</td>
<td>Violent reaction, loss of containment, personnel exposure to fumes, splashing</td>
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<td>WHS Reg Clause</td>
<td>CONTROL MEASURE HIERARCHY LEVEL</td>
<td>ACTIVITY / CIRCUMSTANCE</td>
<td>GUIDANCE FOR POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT</td>
<td>IDENTIFIED FORESEEABLE HAZARD</td>
<td>HAZARD RISK RATING</td>
<td>CONTROL APPLIED</td>
<td>RESIDUAL RISK RATING</td>
<td>ASSESSMENT NOTES</td>
<td>SUGGESTED ADDITIONAL CONTROL OR ACTION</td>
<td>RESULTANT RESIDUAL RISK RATING</td>
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<td>354 (3)</td>
<td>Isolation / Engineering / Admin</td>
<td>Identification of risk of hazardous chemical contaminating food (water product)</td>
<td>Can chemical inadvertently enter domestic water, or in too high a concentration?</td>
<td>L C R</td>
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<tr>
<td>354 (3)</td>
<td>Slightly different from 343</td>
<td>Contamination of food and personal products</td>
<td>Toxic effects to personnel</td>
<td>L C R</td>
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<tr>
<td>355</td>
<td>Isolation / Engineering / Admin</td>
<td>Specific control - fire and explosion</td>
<td>Are ignition sources excluded from areas where there is a possibility of fire or explosion?</td>
<td>L C R</td>
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<tr>
<td>356 (1)</td>
<td>Engineering / Admin</td>
<td>Keeping hazardous chemicals stable - is material stable?</td>
<td>Does storage, handling and shell life cause instability / decomposition to create additional hazard?</td>
<td>L C R</td>
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<tr>
<td>356 (2)</td>
<td>Engineering / Admin</td>
<td>Keeping hazardous chemicals stable - are stabilizing controls maintained?</td>
<td>Is routine maintenance required and undertaken to maintain stability? Is site in a secure / locked enclosure?</td>
<td>L C R</td>
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<tr>
<td>357 (1)</td>
<td>Isolation / Engineering</td>
<td>Containing and managing spills</td>
<td>Is a spill containment system present and of sufficient capacity? Is all plant containing hazardous chemical contained (including pressurised systems)? Does capacity match this volume? Does bund collect rainwater, does this impact on containment volume &amp; is this managed? Are bulk tanks interconnected and does bund capacity match this volume? See &quot;separation from boundaries&quot; for information on for unloading area / containment</td>
<td>L C R</td>
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<td>357 (2)</td>
<td>Isolation / Engineering</td>
<td>Containing and managing spills- Incompatible chemicals mixed</td>
<td>Is common bunding linking incompatible chemicals?</td>
<td>L C R</td>
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<tr>
<td>357 (3)</td>
<td>Engineering / Admin</td>
<td>Containing and managing spills-Contained spills clean up</td>
<td>Procedure for safe clean up of contained spills?</td>
<td>L C R</td>
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<tr>
<td>358</td>
<td>Isolation / Engineering / Admin</td>
<td>Protection of hazardous chemicals from damage</td>
<td>Is protection from impact or excessive loads?</td>
<td>L C R</td>
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<tr>
<td>WHS Reg Clause</td>
<td>CONTROL MEASURE HEIRARCHY LEVEL</td>
<td>ACTIVITY / CIRCUMSTANCE</td>
<td>GUIDANCE FOR POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT</td>
<td>IDENTIFIED FORESEEABLE HAZARD</td>
<td>HAZARD RISK RATING</td>
<td>CONTROL APPLIED</td>
<td>RESIDUAL RISK RATING</td>
<td>ASSESSMENT NOTES</td>
<td>SUGGESTED ADDITIONAL CONTROL OR ACTION</td>
<td>RESULTANT RESIDUAL RISK RATING</td>
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<tr>
<td>359</td>
<td>Engineering</td>
<td>Fire Protection and firefighting equipment</td>
<td>Is a fire protection system present and suitable for hazardous chemical storage?</td>
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<tr>
<td>360</td>
<td>Engineering / Admin</td>
<td>Emergency Equipment</td>
<td>Is emergency equipment installed, maintained, &amp; accessible? (e.g. spills kits, fire control)</td>
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<tr>
<td>361</td>
<td>Admin</td>
<td>Emergency planning</td>
<td>Fire, spill, chemical burn to personnel (Does the emergency plan deal with the correct responses and resources to deal with this particular material?)</td>
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<tr>
<td>361 (and 43)</td>
<td>Admin</td>
<td>Emergency Plans</td>
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<td>362</td>
<td>Engineering / Admin</td>
<td>Safety equipment</td>
<td>Is safety equipment installed, maintained, &amp; accessible? Is safety shower water supply secure from damage / vandalism?</td>
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<tr>
<td>363 (1)</td>
<td>Engineering / Admin</td>
<td>Control of risks from storage and handling systems Design and operation</td>
<td>Is the system being used as per design and is it maintained / tested?</td>
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<tr>
<td>363 (2)</td>
<td>Admin</td>
<td>Control of risks from storage and handling systems Personnel competence</td>
<td>Are staff trained / instructed?</td>
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<tr>
<td>364</td>
<td>Engineering</td>
<td>Containers for hazardous chemicals used, handled or stored in bulk</td>
<td>Foundations stable and tank secured to prevent movement?</td>
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<tr>
<td>365</td>
<td>Admin</td>
<td>Stopping use and disposing of handling systems</td>
<td>Is there a standard for decommissioning?</td>
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<tr>
<td>366</td>
<td>Admin</td>
<td>Stopping use of underground tanks</td>
<td>Is there a standard for decommissioning?</td>
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<tr>
<td>367</td>
<td>Admin</td>
<td>Notification of abandoned tank</td>
<td>Notification to WorkCover</td>
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<tr>
<td>368 - 378</td>
<td>Admin</td>
<td>Health monitoring</td>
<td>Does this material have special characteristics or uses which indicate monitoring is required? Is there a health monitoring policy which is implemented?</td>
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<td>379</td>
<td>Admin</td>
<td>Duty to provide supervision</td>
<td>Is training and supervision appropriate?</td>
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<tr>
<td>WHS Reg Clause</td>
<td>CONTROL MEASURE HEIRARCHY LEVEL</td>
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<tr>
<td>389</td>
<td>Engineering / Admin</td>
<td>Pipelines</td>
<td>Is pipeline protected from adverse effects arising from activities, structure, equipment or substance?</td>
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<td>Green = appears to be compliant</td>
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<tr>
<td>390</td>
<td>Admin</td>
<td>Pipelines builder's duties</td>
<td>If Hazchem pipe is on public property, has Notification to Regulator (WorkCover) ?</td>
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<td>391</td>
<td>Engineering / Admin</td>
<td>Pipeline operator</td>
<td>Is pipeline risk assessed &amp; labelled ? Are pressurised pipe leaks contained from pump discharge through to injection point? Is there any potential for dosing point leakage into an uncontained environment? Does pipe-in-pipe drain to containment? Are sections without pipe-in-pipe outside of containment?</td>
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</table>
Appendix E: Photos of recent installations

Photo 1. Example chemical delivery system

Photo 2. Example chemical delivery system
Photo 3. Example chemical delivery system

Photo 4. Example chemical delivery system
Appendix F: CDU P&ID diagrams
Appendix G: Typical CDU site layouts
Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.

Version 2 authorised by Lutz Backhausen on 30/05/2019
Appendix H: Indicative CDU shed and dosing pit layouts
### Appendix I: Equipment List

<table>
<thead>
<tr>
<th>Equipment Description</th>
<th>Location / Area</th>
<th>Serial No.</th>
<th>Tag No.</th>
<th>Model No.</th>
<th>Capacity</th>
<th>Mfg. Details</th>
<th>Remarks / Comments</th>
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</thead>
<tbody>
<tr>
<td>Backflow prevention devices (RPZ)</td>
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<td>Compressed gases</td>
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<td>Cooling towers</td>
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<td>Cranes and all lifting equipment</td>
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<td>Engines, generators and compressors</td>
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<td>Eyewash and safety shower list</td>
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<td>Fall protection equipment</td>
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<td>Fire safety and suppression equipment</td>
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<td>Flammable liquids and gases</td>
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<td>Gas sensors (fixed)</td>
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<td>RCDs (residual current devices)</td>
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<td>Spill kits</td>
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<td>Other</td>
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