Chemical storage tank systems – checklists (CIRIA publication W003)

Chemical storage poses a potential threat to the environment and health and safety, and careful management of the design, manufacture, installation, operation and maintenance of such facilities is required. CIRIA publication (C598), *Chemical storage tank systems – good practice* (RP658) provides detailed guidance on good practice in the design, manufacture, installation, operation, inspection and maintenance of tank systems.

This document provides checklists of good practice points to consider and is based on the full guidance document. Due to the breadth of the subject, and as individual systems are likely to have individual requirements, specific solutions are generally not covered within the scope of the checklists. The checklists provided are not exhaustive. They are intended to give an indication only of the questions that should be asked and should not be used in isolation. Further reference to the full guidance document (CIRIA publication C598) is advised.

This checklists document is one of three complementary documents produced by CIRIA:

- *Chemical storage tank systems – good practice guidance* (CIRIA C598) Guidance on design, manufacture, installation, inspection, operation and maintenance a comprehensive and detailed report, providing full guidance and reference for all of the target audience. Available in printed form from CIRIA. Note: The complete guidance is also provided on a CD-ROM in the back cover of the document. The CD version includes an advanced search function to enable easy reference of topics within the document.
- *Chemical storage tank systems – good practice – summary guidance document*: a summary of the full report available on the internet at www.ciria.org
- *Chemical Storage Tank Systems – good practice – checklists*: a series of checklists of good practice points to consider, based on the full guidance document, available on the internet at www.ciria.org

  The checklists are also included as an appendix within the full guidance document (CIRIA C598).

Aims

This document aims to provide checklists to assist construction contractors and operatives on-site in the adoption of good practice. Due to the breadth of the subject and, as individual systems are likely to have individual requirements, specific solutions are not covered within the scope of this guidance document.

As the checklists provided in this document are not exhaustive, they do not cover all concerns for all tank storage systems. They are intended to give an indication of the questions that should be asked and should not be used in isolation. Further reference to CIRIA publication C598: *Chemical storage tank systems – a guide to good practice* is advised.

Scope

Checklists are given for key areas as follows:

1. Legislation and guidance.
2. General.
3. Selection and design.
4. Manufacture.
5. Installation.
6. Operation inspection & maintenance.

The types of system covered by this report are above-ground permanent chemical storage systems incorporating tanks and/or facilities for storing containers of 200 litres and above. For the purposes of this document 'chemical' is deemed to be a liquid substance hazardous to health or to the environment which is included in the Approved Substances List under The Chemicals (Hazard Information and Packaging for Supply) Regulations. Types of system not covered within the scope of this document include:

- lagoons
- high pressure and vacuum systems
- high and low temperature systems (such as cryogenic)
- underground storage tanks.

Scope limitations:

- These checklists do not constitute a health and safety manual.
- Use of these checklists should not replace contact with regulators.
- Detailed guidance should be sought from the user's environmental representative (or external specialists) or legal advisor.
- Guidance is given on good practice which is desirable for technical and operational reasons; however it may be in conflict with roles and responsibilities of parties to some contracts or have financial implications (particularly in retrofit) which need to be included. Legislative requirements must always be met.
- In all instances when using these checklists the reader should not take action beyond their expertise without specialist advice.

How to use these good practice checklists

This document comprises a series of checklists for use on-site. The checklists are made up of key points that should be considered in the design, manufacture, installation, operation and maintenance of chemical storage systems.

When working on a certain aspect of a chemical storage system the appropriate checklist should be worked through to help ensure that all of the points have been considered. Throughout the document, where any answers are given as ‘no’, specialist advice should be sought to verify the appropriateness of the system.

Further, more detailed, information can be found in *Chemical storage tank systems – good practice* (CIRIA C598), design, manufacture, installation, inspection, operation and maintenance good practice (full guidance document).

Acknowledgements

These checklists of good practice considerations were produced through CIRIA Research Project RP658 *Chemical storage tanks – guidance on design, manufacture, installation, inspection, operation and maintenance*. It was developed under contract to CIRIA by Posford Haskoning Limited. The document was written by Stuart Cassie and Lyall Seale. The research was guided by a Steering Group that comprised:

Mr S Saunders (Chairman)	Arup
Mr N Berentzen	Chemical Industries Association
Mrs T Brown	Environment Agency
Mr N Hirst	Institution of Chemical Engineers
Mr A Holt	Health & Safety Executive
Mr G Reeves	United Storage
Mr A Rix	Fertiliser Manufacturers Association
Mr C Robertson	MWH
Mr R Walker	Thames Water Utilities Limited

CIRIA's research managers for the project were Craig Elliott and Marianne Scott.

The project was funded by the Environment Agency and the Health & Safety Executive.

A2.1 Legislation and guidance

A wide range of legislation relating to the use of chemical storage tank systems exists. The relevant legislation may differ between England and Wales, Scotland and Northern Ireland.

		Yes	No
1	Have all legislative requirements been considered, and adhered to, for the tank system?		
2	Environmental legislation?		
3	Health and safety legislation?		
4	Have British Standards and regulatory guidance been followed where appropriate?		
5	Have codes of practice been followed?		
6	Have EU and International guidance documents been referred to where appropriate?		

A2.2 General

A2.2.1 Stakeholder consultation and contractors

		Yes	No
1	Have all relevant parties involved been consulted (eg designer, installer, operator) at all stages of system development from design through to commissioning and operation?		

Note: Where possible, use of a single reputable (appropriately qualified and experienced) contractor for the detailed design, manufacture, installation and commissioning of a storage system can avoid problems of conflicting responsibilities.

A2.2.2 Risk assessment and health and safety

'Think safety' and carry out risk assessments throughout the lifetime of a chemical storage system.

CIRIA SP154 *A simple guide to controlling risk* and HSE's leaflet *5 Steps to risk assessment* provide general advice on risk assessment theory and methodology that can be applied to most situations.

		Yes	No
1	Has risk assessment been used throughout selection, design, manufacture, installation, operation and maintenance to ensure careful consideration of all potential issues?		
2	Have the Construction (Design and Management) Regulations 1994 (CDM Regulations) been considered for all stages of the system lifecycle?		
3	Has a health and safety plan been developed to control the safety of construction?		
4	Has a health and safety file been developed to record information on the completed work (tells those responsible for the maintenance, repair or renovation of the facility during its lifetime of the risks that have to be managed)?		

A2.3 System selection and design

Have the Storage system selection and design criteria accommodated the following aspects:

		Yes	No
1	Have the storage system selection and design criteria accommodated the following aspects:		
	• Economic concerns?		
	• Technical and practical aspects?		
	• Manufacture requirements?		
	• Installation requirements?		
	• Future operation, maintenance and inspection activities?		
2	Have risk assessments been carried out?		
3	Has the impact on surrounding activities and the environment been assessed?		
4	Has the system been designed to be as simple as possible?		
4	Have the needs of the manufacturer, installer and end user been considered?		
6	Has the system been designed in accordance with relevant codes of practice and guidance?		
7	Have specialist designers been used for system components outside the scope of your experience?		
8	Have manufacturers / designers been consulted where there is any doubt?		
9	Have reused and recycled components and materials been incorporated where possible (if so, has caution been taken to ensure their condition and suitability)?		
10	Are you confident that the design is right first time?		

A2.3.1 Materials

		Yes	No
1	Are the materials from which the storage system is to be constructed compatible with the chemicals which can be expected to be stored?		
2	Multiple material system components and their compatibility?		
3	Coatings and linings?		
4	Cathodic protection systems?		

A2.3.2 Type, dimensions, location and detail

Types and dimensions

		Yes	No
1	Have the specifications for the storage system been checked for correctness?		
2	Has advice been obtained from a reputable designer/contractor?		
3	If an 'off the shelf' system is to be used, is this appropriate for your needs?		
4	Have the following aspects been considered:		
	• Nature of the chemical stored, the process requirements and the intended use?		
	• The volume of chemical to be stored?		
	• Layout of the system, number of tanks, their dimensions, shape and orientation?		
	• Available space (plan area, height and minimum separation distances)?		
	• Adequacy of ground conditions for supporting the system and the level of groundwater if excavation is required?		
5	Planning issues, such as environmental and visual impact and light restriction?		

Location

		Yes	No
1	Have the following locations for chemical storage systems within a site been avoided:		
	• Roofs (prone to environmental attack, difficult to access, etc.)?		
	• Adjacent to watercourses and other environmentally sensitive areas (including where potential connections exist via surface water drainage systems)?		
	• Adjacent to drainage systems, particularly if these lead to watercourses?		
	• Within potential floodplains?		
	• In areas where wind loading may be high?		
	• Adjacent to external roads, main site thoroughfares?		
	• High risk delivery routes that may be tortuous or pass through sensitive areas?		
	• Close to non process or public access stairs and walkways?		
	• Flammable liquids in proximity to ignition sources?		
	• Proximity to other chemicals?		
	• Proximity to the site boundary?		
	• Adjacent to residential areas or to other areas, such as leisure facilities, where the public may gather in significant numbers and thereby be put at risk?		
	• In places where the available area is limited such that bunding or secondary containment may not feasible?		
2	Where any of the above locations are unavoidable, have additional precautions been taken?		

Note: Secondary containment of some form is essential for chemical storage systems. If the proposed location dictates that it will not be feasible, the proposed location must be altered.

System Details

Baseplates:

The most likely location for a tank to fail

		Yes	No
1	Has the baseplate been designed to conform to good practice for preventing corrosion?		
2	Has corrosion protection been specified for use on the underside of tank baseplates?		
3	Has the design ensured that no voids are created (as these may cause a corrosion problem)?		

Foundations and supports:

Key area for tank base corrosion and structural failure

		Yes	No
1	Are the ground conditions suitable for good foundation design?		
2	Has the foundation material included concrete or bitumen sand ('bit sand')?		
3	Have tanks been founded on reinforced concrete bases?		
4	Has the system had a chemically resistant membrane barrier placed below the tank?		
5	Has secondary containment been built around the tank?		

Fixings, brackets and connections:

Can cause potential corrosion or weakness 'hotspots'

		Yes	No
1	Have the correct design codes been followed?		
2	Have the number of fixings and brackets been minimised (whilst ensuring adequate strength)?		
3	Have long strip connections been avoided (for items such as tank access stairs)?		
4	Have connections been reinforced (particularly where components may exert force on the tank or fitting such as on plastic tanks)?		
5	Have fixings and brackets been oriented to avoid formation of conditions which may promote corrosion?		
6	Has corrosion protection been provided whenever aluminium surfaces are joined to steel?		

Insulation:

Can create potential corrosion areas if badly designed or fitted

		Yes	No
1	Is insulation absolutely necessary?		
2	Has tank wall insulation been stopped before it meets the baseplate, roof curb or pipe and associated connections?		

A2.3.3 Bunding and containment

		Yes	No
1	Does size and layout take account of all reasonably foreseeable modes of failure of primary containment, and compatibility of chemicals stored?		
2	Do systems containing flammable liquids incorporate firebreaks into containment design?		
3	Is the capacity volume the sum of all of the following:		
	• At least 100% of primary storage capacity?		
	• Allowance for rainfall (pre- and post-incident)?		
	• Allowance for cooling water?		
	• Freeboard for fire fighting water and foam and dynamic effects?		
	• Volume of pipes, equipment, supports, etc. within bund?		
4	Is the containment capable of retaining maximum design volume of prescribed chemical for not less than 8 days?		
5	Is containment impermeable and resistant to degradation by the chemical stored?		
6	Is the containment capable of withstanding the static and dynamic loads associated with:		
	• Release of liquid from primary storage tanks?		
	• Release of water from hoses during fire fighting operations?		
	• Wind (50-year design life)?		
	• Potential impact by site vehicles (if not protected by barriers)?		
7	Is the containment capable of resisting the effects of weather, aggressive ground conditions and abrasion, fire and corrosive chemicals?		
8	Are bund walls structurally independent from the primary containment?		
9	Are walls and, where practicable, floors sufficiently accessible to permit inspection and for maintenance to be carried out?		
10	Are bund wall heights less than 1.5 m, unless circumstances are exceptional?		
11	Where access to parts of the bund floor is not practicable is provision made to detect any leakage through the base of the primary containment?		
12	Has bund volume and wall height and tank accessibility been checked for adequacy?		
13	Have emergency shut off valves been located between the tank and the bund wall?		
14	Are bunds capable of being emptied, preferably by a pump located in a sump?		
15	Are pumps capable of removing the volume of liquid required within the time required to avoid overspilling of bund, and able to withstand attack from the chemicals stored?		

A2.3.4 Pipes, fittings and connections

		Yes	No
1	Is the chemical being transferred and its source and destination clearly defined?		
2	Where gravity feed is proposed, is the fall between source and destination sufficient?		
3	Have connections with other systems, supplies and processes been specified?		
4	Have any other special requirements such as pressure or temperature control been specified?		
5	Has a competent pipework designer been used?		
6	Is the design in line with appropriate pipe design codes and guidance such as BS8010: Code of practice for pipelines?		
7	If flexible hoses have been specified are they absolutely necessary?		
8	Have frost protection requirements been considered?		
9	Have secondary containment requirements been considered?		
10	Have the maintenance and inspection requirements been accommodated?		
11	Has the pipework been designed to minimise its length?		
12	Does the design avoid (or include protection against) potential physical or environmental impacts?		
13	If the pipeline is below ground, is it in an impermeable duct with provision for access?		
14	Has provision for isolation in emergency situations been included?		

A2.3.5 Control and monitoring systems

		Yes	No
1	Has a risk assessment been carried out?		
2	Has the system been designed to fail to safe and trigger alarm on failure?		
3	Have the alarms been backed up by another system that operates on a different basis?		
4	Have electric, electronic or programmable electronic systems (E/E/PES) been designed in accordance with BS IEC 61508: 2000?		
5	Will flow into the tank impinge on the device?		
6	Have sampling points been located at ground level wherever possible?		
7	Have self-closing valves been specified?		
8	Have high level alarms and cut-offs been specified to allow generous safety factors between alarm and cut-off?		
9	Have alarms and cut-offs been set independent to primary control and monitoring equipment?		
10	Have high and low level alarms been fitted on bunds?		
11	Have high and low level alarms for temperature and pressure been specified, that are suitable to operate within the system specifications?		
12	Has the need for intrinsically safe alarms been considered?		
13	Has specialist advice on fire alarms been sought from a suitably qualified and experienced fire engineer or specialist, and local fire authority?		
14	Is the level of sensitivity appropriate to individual storage systems?		
15	Has the need for strain gauges been considered?		
16	Are emergency stop buttons easily accessible?		

A2.3.6 Tank venting, pressure and explosion relief systems

		Yes	No
1	Has the potential for the stored chemical to crystallise in vent systems, potentially blocking them, been considered?		
2	Has the potential release of odours been considered?		
3	Are systems in line with latest regulatory requirements?		
4	Have pressure drops in long vent lines been considered and addressed if appropriate?		
5	Have vermin proof and weatherproof cowls been fitted?		
6	Have provision for pressure relief and vacuum breaking both been taken into account in system design?		
7	Have vents been adequately sized to take account of the maximum filling and emptying rates?		
8	Has the scrubber back pressure and gas flow rate been set to an adequate level for the pressure rating of the tank?		
9	If a floating roof is to be installed are the seal materials and arrangement fit for purpose?		

A2.3.7 Security

		Yes	No
1	Have the systems been designed to fail to safe?		
2	Have road barriers been designed to withstand impact from the heaviest vehicle expected on site?		
3	Have road barriers been located a suitable distance away from system components?		
4	Have road barriers been located at strategic points for most likely vehicle movement damage?		

Road barriers are a last line of defence therefore system components should always be located away from traffic routes wherever possible.

A2.3.8 Designing for installation and future use

Installation requirements

		Yes	No
1	Have system components been positioned so that they are far enough apart to permit ease of access and for dismantling?		
2	Have valves and connections been located where they can be easily accessed?		
3	Has the construction/installation process been considered?		
4	Have integrity testing and commissioning requirements been considered?		
5	Have construction/installation professionals, and end user/operators, been consulted to assess buildability and operability?		
6	Has earthing and electrical continuity of the storage system been provided to protect against lightning and sparking from electrostatic discharges?		

Access

		Yes	No
1	Has provision been made in the design for safe access to and egress from key areas of the storage system, particularly areas where regular maintenance, inspection or cleaning may be required, including under emergency conditions?		
2	Has provision been made for:		
	• Sufficient space around high structures (such as tanks) for scaffold construction?		
	• Hard standing to facilitate use of powered access equipment (if required)?		
	• Anchorage points for rope access equipment?		
	• Adequate lighting which may have to have explosion protection?		
3	Have confined spaces been avoided?		
4	Has the main tank access hatch been installed at the base of the tank rather than in the roof wherever possible?		
5	Have sampling points been located such that they are accessible at ground level?		

Egress

		Yes	No
1	Have systems been designed to allow quick and safe escape in the event of an emergency?		
2	Have systems been designed in accordance with appropriate best practice standards?		
3	Have emergency stop buttons and alarms been located on escape routes?		
4	Has adequate signage been provided to avoid confusion between systems?		

Stairs, walkways and handrails

		Yes	No
1	Are stairs, walkways and handrails in line with current best practice standards?		
2	Have handrails, knee rails and kicking boards been provided?		
3	For metallic components have brackets rather than strip welds been incorporated?		
4	Are walkways independent of system components?		
5	Are walkways over pipework independently supported?		
6	Has handrail detail been incorporated into the design of the system?		

Maintenance

		Yes	No
1	Has care been taken not to place fittings that require removal or dismantling too close to fixed system elements?		

Cleaning

		Yes	No
1	Does the design cater for the required cleaning procedures?		
2	Has provision been made for safe access/egress?		
3	Has the system been designed to avoid the need to clean any cramped areas such as around pipes, in corners, etc.?		
4	Has discharge of wash water been considered and addressed?		

A2.4 Manufacture

A2.4.1 General

Risk assessment and health and safety are equally important in manufacture as in the other stages of storage system design, installation, inspection, operation and maintenance. Health and safety measures should be in line with current regulation, guidance and best practice.

		Yes	No
1	Have components been used that are compatible with the chemical to be stored and with the other components and are they fit for purpose?		

A2.4.2 System materials

		Yes	No
1	Have materials been purchased from recognised manufacturers/ sources?		
2	Do the materials meet current best practice standards?		
3	Have physical inspections of materials been undertaken before their use in manufacturing of system components?		
4	Has testing of materials and system components been conducted as part of the manufacturing process?		

A2.4.3 Pipes, fittings and connections

		Yes	No
1	Has corrosion protection been provided by one or more of the following methods, particularly where aluminium surfaces are joined to steel:		
	● Galvanising the steel?		
	● Painting the surfaces with a zinc-chromatic compound (steel surface as a minimum)?		
	● Using a joint compound capable of excluding moisture from the joint for extended periods?		
	● Using an appropriate gasket?		

A2.4.4 Control and monitoring systems

		Yes	No
1	Has assembly of the overall system been carried out in accordance with relevant manufacturing codes and guidance?		

A2.4.5 Bunding and containment

		Yes	No
1	Have critical metal parts within the bund (ie those which could be attacked by spilled tank contents and rainwater) been made from materials which are resistant to the chemicals expected to be stored?		

A2.4.6 On-site assembly and installation requirements

		Yes	No
1	Are lifting points adequate to ensure that the unit can be lifted safely?		
2	Have component weights been clearly marked?		
3	As a minimum, are the lifting points capable of taking the weight of the unit, with an additional allowance for safety?		
4	Has a document been prepared that contains guidelines for the handling, installation, operation and maintenance of the system (to accompany the system at time of delivery)?		

A2.5 Installation

Contract letting organisation (client/consultant)

		Yes	No
1	Is the tenderer suitably qualified and experienced?		
2	Does the tenderer fully understand what is required?		
3	Is the proposed contract suitable?		
4	Is the price provided realistic?		
5	Has the tenderer included adequate health and safety provision?		

Tendering organisation (contractor)

		Yes	No
1	Do you have the required expertise?		
2	Do you understand exactly what is required?		
3	Is the contract acceptable?		
4	Have you accounted for everything in your quote?		
5	Is adequate provision made for health and safety?		

A2.5.1 Construction health and safety

Compliance with the CDM Regulations

		Yes	No
1	Has a Health and Safety Plan been developed and implemented?		
2	Have competent and adequately resourced sub-contractors been arranged?		
3	Have risk assessments been carried out and method statements developed for high risk operations?		
4	Have contractors' findings and statements been obtained?		
5	Have all contractors been made aware of all of the risks on site?		
6	Have all workers on site been given adequate training?		
7	Are provisions made to ensure that all contractors and workers comply with site rules?		
8	Has Health and Safety performance been monitored?		
9	Are only authorised persons allowed on site?		
10	Has the HSE been notified of the project (where relevant)?		
11	For a storage system being installed on a "greenfield site" has a pre-construction safety report (PCSR) been submitted to the HSE prior to construction commencing (as per COMAH Regulations)?		

Risk assessments

		Yes	No
1	Has the risk assessment included the following considerations (for steel tanks):		
	• Offloading from delivery vehicles (HGVs)?		
	• Erection of tank steelwork?		
	• Welding operations?		
	• Thermal cutting of apertures and for fittings?		
	• Grinding operations?		
	• Tank erection during high winds?		
	• Painting / coating of system components?		
	• Testing of weld seams?		
	• Water testing of tank?		

A2.5.2 Ground conditions and preparation

General

It is always advisable to seek expert advice from a suitably qualified and experienced engineer when considering ground conditions.

		Yes	No
1	Have ground investigations been undertaken?		
2	Have the expected ground conditions been detailed within the contract specification?		
3	Is aquifer protection required?		

Groundwater

		Yes	No
1	If groundwater is encountered that is not described within the contract specification, has the designer been consulted to make any necessary allowances?		
2	Are the de-watering systems acceptable for the conditions?		

Surface water

		Yes	No
1	Have adequate means of dealing with, and disposing of, surface water been incorporated?		
2	Has an appropriate drainage regime been put in place?		
3	Have discharges been made in accordance with regulatory requirements?		

Contamination

		Yes	No
1	Have sites with the potential for ground contamination had an environmental assessment carried out on them at (or before) the design stage?		

Ground preparation

		Yes	No
1	Has compaction of materials been included within the specification?		
2	Is there complete support for the tank across the base?		
3	Is the base flat (to +/– 1mm / m), unless a slope is part of the design?		
4	Is the base clean, smooth and free from debris?		
5	Are the foundation coating and the tank material compatible?		
6	Has the laying of bituminous materials, pre-formed protective felt or geotextile been undertaken according to the supplier's recommendations?		

A2.5.3 System materials

		Yes	No
1	Has inspection of materials been carried out when they are delivered (including visual checks, inspection of paperwork, compliance testing and quality checks)?		
2	Have any materials believed to be of an inferior standard been rejected?		
3	Have materials been stored in a suitable location and environment, and with adequate support?		

A2.5.4 Installation procedures

Foundations

		Yes	No
1	Before starting installation, have foundations been inspected and signed off?		
2	Have foundations for steel tanks been coated with a bituminous material prior to placing the base plate?		

Tank baseplates

		Yes	No
1	Have baseplates been laid working from the centre towards the circumference?		
2	Have ridges in the baseplate structure and voids beneath base plates been avoided?		
3	Has an annular ring around the circumference of baseplates been used?		
4	Have seals been used around baseplates to avoid moisture ingress?		

Welding

		Yes	No
1	Has welding been undertaken in accordance with appropriate standards such as BS2654?		

Earthing and electrical continuity

		Yes	No
1	Have appropriate precautions been taken to provide protection against lightning and sparking from electrostatic discharges?		
2	Has earthing and electrical continuity been provided in accordance with BS7430: 1998?		

A2.5.5 Pipes, fittings and connections

		Yes	No
1	Have seals been used on all joints where specified or required?		
2	Has the seal material being used been checked for compatibility with the chemical to be stored?		
3	Have neck and flanges always been used for connection to storage tank walls?		
4	Has there been adequate support for all suspended pipework (including consideration of the potential loads from personnel standing on the pipe and for heavy valves)?		
5	Wherever aluminium surfaces are joined to steel has corrosion protection been provided?		

A2.5.6 Control and monitoring systems

		Yes	No
1	Do all electric, electronic or programmable electronic systems (E/E/PES) comply with the requirements of BS IEC 61508: 2000?		
2	Have high-level cut off-alarms and sensors been positioned sufficiently below the top of the tank to allow for a margin of safety for filling flow rates and expansion?		
3	Have sampling points been located at ground level or where there is easy access?		
4	Have sampling points been fitted with self-closing valves?		

A2.5.7 Bunding and containment

		Yes	No
1	Is adequate curing time allowed and are conditions suitable for formation of an acceptable lining?		
2	Are any secondary containment drains lined using resins or other impermeable materials continuous along the length of the run?		
3	Are all joints sealed to ensure that an impermeable surface is maintained?		
4	Is the sealant used resistant to the chemical types stored?		

A2.5.8 Integrity testing

		Yes	No
1	Has full testing been carried out on-site after the system has been installed?		
2	Has a risk assessment been conducted before each testing activity?		
3	Have all safety alarms, trips, etc. been checked to ensure they are operational before testing commences?		
4	Have base seams been adequately tested on completion of the baseplate welding?		
5	Have tanks and bunds been filled with water to test their integrity after construction?		
6	Have pumps been tested (including those installed within bunds)?		
7	Has the operation of all valves, monitoring devices and alarms been tested?		
8	Has an appropriate certificate been signed off by the installer and the owner and/or main contractor after each inspection or test?		

A2.5.9 Commissioning

		Yes	No
1	Has all integrity testing been carried out, both at the time of manufacture and on-site after installation?		
2	Has a safe system of work been put in place, including health and safety risk assessments and operation and maintenance and emergency procedures?		
3	Have the system and its components been adequately labelled?		

A2.5.10 Handover

		Yes	No
1	Does handover include provision of the Health and Safety File, including all relevant records of the complete system?		
2	Has an installation plate been fixed to each tank displaying all relevant information such as materials of construction, dates etc.		

A2.6 Operation, inspection and maintenance

A2.6.1 Management systems

Permit to work systems

		Yes	No
1	Do permit to work systems include:		
	• Description of the works to be undertaken?		
	• The individuals who are to undertake the work, and the adequacy of their training?		
	• Identification of the key hazards and risks involved in the work, such as access, hotworks etc.?		
	• Identification of the health and safety regime and any relevant working practices required to comply with it?		
	• Risk assessment of all relevant hazards, health and safety, practical, operational, etc.?		
	• Checks on system components that must be cut-off, drained, etc. prior to works commencing?		
	• Details of any exclusion zones around which the work is to be undertaken?		
	• Details of emergency procedures in place?		
	• Details of date and time of the work, and the limited duration for which the PTW is valid?		

Change control

		Yes	No
1	Will the change enhance performance of the system?		
2	Is the change really necessary?		
3	Have all options for the change been assessed and, if so, is this change the best practical environmental option (BPEO)?		
4	Does the change involve replacement of component parts, and if so are these parts appropriate to the system in terms of performance and compatibility?		
5	Does the change include change of chemicals stored or passing through any part of the system, if so has material compatibility been considered and checked?		
6	Are there any potential health and safety implications relating to the change, or the work required to undertake the change, or following the change?		
7	Has a risk assessment of all relevant hazards been undertaken and appropriate actions included within the change plan and are the risks ALARP?		
8	When considering storing specialist chemicals (such as ones that might generate a hazardous reaction with other chemicals stored on the site) has proper assessment been made of the ability to store the chemical elsewhere in the event of a failure or an emergency arising?		
9	Has the change been recorded in the Health and Safety File		

Health and safety procedures and PPE

PPE is the last form of defence for health and safety hazards. Hazard removal or mitigation should always be implemented wherever possible.

		Yes	No
1	Have the procedures been developed by a health and safety professional, and are they in accordance with current regulations and good practice?		
2	Have all chemical storage tanks been clearly labelled with their contents and all relevant hazard warning labels?		
3	Are COSHH safety data sheets available?		
4	Has appropriate PPE been provided to all employees prior to commencing work on site?		
5	Has a formal risk assessment of the required PPE for normal operation and emergency situations been undertaken?		

Document control

		Yes	No
1	Have suitable procedures for checking, authorising and filing of all documents from delivery notes to purchase orders to PTW and change control forms been put in place?		
2	Does the system allow for multiple checking of documents, so that a minimum of two individuals see and sign off each piece of documentation?		
3	Have all staff been informed of, or trained in, use of the system?		
4	Has authorisation of documents been assigned to the appropriate members of the organisation?		
5	Has a logical filing and archiving system been included within the system?		
6	Has consideration been given to the need for documents to be stored off-site in case of emergency (such as at the site gatehouse or with the emergency services)?		

A2.6.2 Filling and draining

		Yes	No
1	Has risk assessment been carried out to help formulate appropriate risk control measures?		
2	Has the delivery area been clearly demarcated when in use to prevent unauthorised or unintentional access to that area?		
3	Where delivery areas are not contained within a dedicated secondary containment drainage system, have surface water drains been protected by use of impermeable covers such as ‘Hazmat’ drain covers?		
4	Have spill containment kits and health and safety precautions (emergency PPE) been provided in delivery areas?		

Filling and delivery of flammable chemicals

		Yes	No
1	Are protection measures in place against the build up of static charge (such as earthing of plant and inclusion of anti-static or conductive flooring)?		
2	Have operatives been trained in avoiding static build up when working with flammable liquids?		
3	Is a control procedure in place for periodic testing of earthing and anti-static measures?		
4	Have anti-static or conductive footwear, clothing and overalls been used by operatives and not removed in hazardous areas, and have they been tested for efficiency?		

Connection

		Yes	No
1	Has delivery paperwork been checked to ensure the chemical being delivered is what it is supposed to be?		
2	Have deliveries/draining been independently supervised by an appropriately qualified member of site staff?		
3	Has the connection point labelling been checked (including concentration)?		
4	Does the connection point lead to the correct system or part of system?		
5	Has a visual inspection been carried out along the length of the pipeline from connection point to final destination to ensure no signs of potential problems such as open valves and sample points, damage, etc.?		
6	Are connection(s) providing electrical continuity and earthing in place and soundly made when handling liquids of relatively low electrical conductivity (eg aromatic compounds)?		
7	Are high level alarms and cut-offs fully operational?		
8	Have deliveries always been undertaken with all connections located within a bunded or contained area?		
9	Has emergency fire, spill and safety protection been provided at the point of delivery?		

Filling and draining operations

		Yes	No
1	During filling, have operations been monitored by two independent means (ie a gauge at each end) for verification?		
2	Have high level alarms, operating independently of normal volume measuring instrumentation, been used?		
3	Has an integrated failsafe shut-off system that may be linked to the pump, or to trip valves, to shut off liquid movement when the alarm is triggered been incorporated?		

Completion of filling or draining

		Yes	No
1	When finally disconnecting, has the delivery system been checked to ensure that all liquid has drained out prior to breaking connection?		
2	Have vapour recovery systems been flushed with inert gas prior to final disconnection?		

A2.6.3 General operation and maintenance procedures

		Yes	No
1	Is access to potentially hazardous areas such as confined spaces, heights etc. in line with current best practice regulations and standards?		
2	Have repairs been undertaken in line with site operational procedures and do they include health and safety risk assessments?		
3	Has special consideration been given to access, hotworks and where the system has to be dismantled (such as when pipe flanges are cracked)?		
4	Have repairs to parts of systems that are designed for containment (primary or secondary) been followed by integrity testing of that component part and certified before re-commission?		
5	Has full consideration been given to painting requirements, determined according to site-specific requirements?		
6	Are critical parts of the system repainted on a more frequent basis?		
7	Are existing coatings removed prior to painting by water jetting or grit blasting?		
8	Are access platforms used when undertaking painting at heights?		
9	Are bunds and containment always kept empty of rainwater and clear of debris, including leaves and silt?		
10	In times of rainfall are bunds emptied daily?		

A2.6.4 Cleaning

		Yes	No
1	Are cleaning fluids used compatible with the chemicals stored or spilled?		
2	Are cleaned surfaces that may be slip hazards clearly marked whilst drying?		
3	Are vents, meshes, grills, sumps etc. included as part of the cleaning programme?		
4	Has chemical spillage or washing water been disposed into the site effluent treatment system or sewerage system with consent of the sewerage undertaker?		
5	If the above disposal of chemical spillage or washing water is not permitted, is a holding tank available for storage prior to appropriate disposal (storage and disposal in accordance with Duty of Care)?		

A2.6.5 Inspections and integrity testing

		Yes	No
1	Has the frequency of testing been determined as a result of risk assessment?		
2	Are high risk tanks inspected on a more frequent basis than those with lower risk?		
3	Are the following areas adequately considered:		
	• Containment (ie the tank)?		
	• The tank base?		
4	If a dip stick has been used the possible damage to the area below the dipping point?		
5	Has all testing been carried out in accordance with manufacturers' recommendations and by a suitably qualified and experienced engineer?		
6	Has careful attention been paid to acid/air and oil/water interfaces?		
7	Has pipework been subject to a planned inspection regime including visual inspection and non-destructive testing as appropriate?		
8	Has special attention been paid to insulation, particularly at the base of tanks, around pipe connections and the roofs of tanks?		
9	Have vents, valves and gauges been subject to regular testing?		
10	Have large tanks been fitted with low level accessways?		

A2.6.6 Control and monitoring systems

		Yes	No
1	Do electric, electronic or programmable electronic systems (E/E/PES) comply with the requirements of BS IEC 61508: 2000?		
2	Have gauging systems been maintained in line with the manufacturers' guidelines by a suitably qualified engineer?		
3	Have computer systems been backed up by a manual system?		

A2.6.7 Refurbishment, retrofitting and relining

Refurbishment and retrofitting

		Yes	No
1	Has an appropriate permit to work system been set-up to ensure all checks are in place before any work starts?		
2	Has the system component been drained/emptied of any liquid/gas before starting work?		
3	Has adequate containment and emergency equipment been made available to deal with accidental spills and leaks (including emergency equipment for maintenance personnel)?		
4	Are the materials being used for refurbishment or retrofitting compatible with the chemicals that will be stored in the system?		
5	Has allowance been made for differential expansion and preferential corrosion where unlike materials are to be used?		

Relining

		Yes	No
1	Has safe access into the tank for the relining works been created?		
2	Is this access of a diameter such that an incapacitated operative wearing breathing apparatus could be taken through without undue difficulty?		
3	Has adequate time been allowed for curing of resin materials?		
4	Are the work areas clean and free of debris following completion of the work?		
5	Are system components always integrity tested before re-commissioning?		