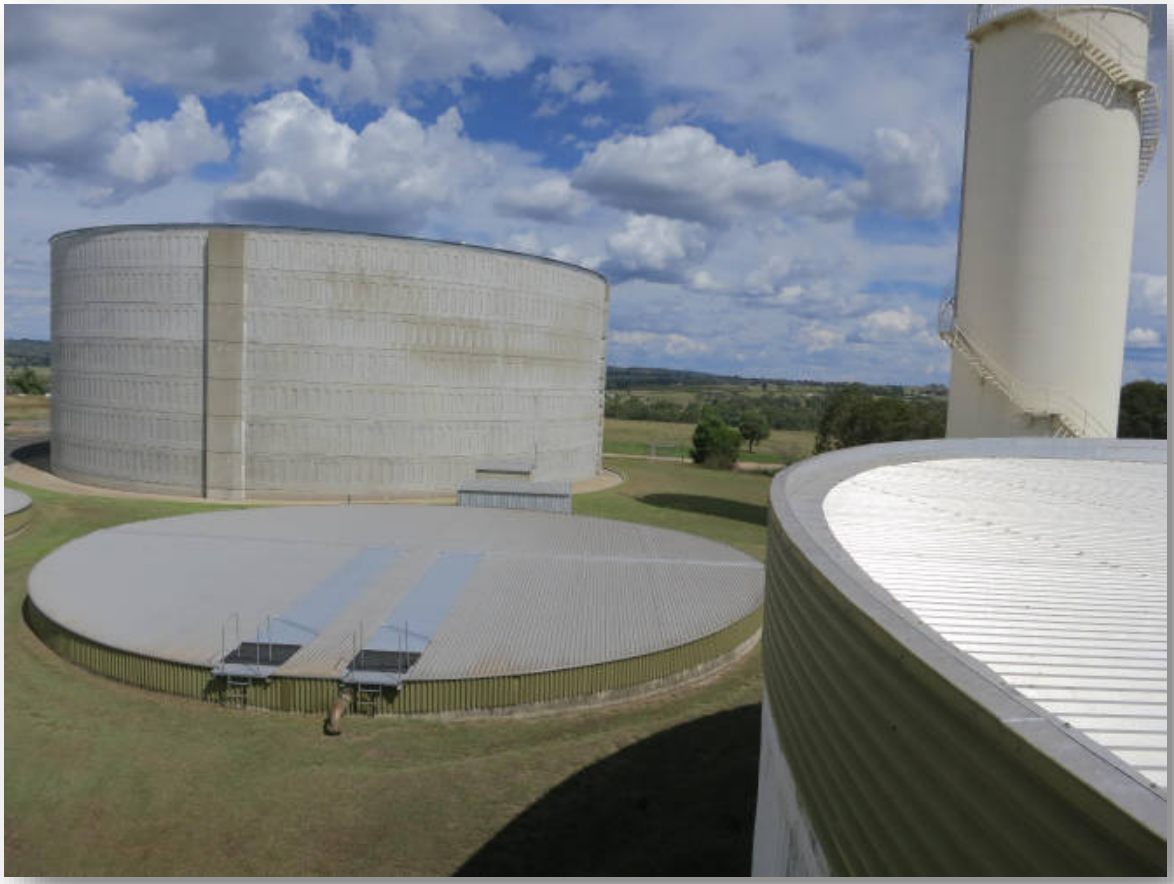
Reservoir Design

HAZOP Checklist 101

Synopsis:

This checklist summaries the key aspects of an effective storage tank design. It can be used when reviewing design plans or developing a scope of work for a tender pack. For more detailed information on each section (including pictures/photos/explanations), refer to the document *Reservoir Design for the Next Generation*.



Section 1 – Location – Plan for future site needs

What future development may occur?

- ☐ Will there be encroaching urban development?
- ☐ Is there an avenue for waste disposal?
- ☐ Will there be additional tanks?
- ☐ Will there be a future need for pumping or chlorination?

Does your access road accommodate for?

- ☐ Tankers for water delivery or waste water removal
- ☐ Trucks for maintenance, repair or cleaning
- ☐ Work vehicles for sampling, maintenance etc.
- ☐ Is there a level parking section below the entry hatch/working area?

Is the landscaping and site layout going to impact?

- ☐ Overgrown trees dropping material on the tank or damaging coatings
- ☐ Root systems disrupting foundations or impacting pipes
- ☐ Avoid steep slopes or provide stairs/walkways to access lifting areas up onto the tank
- ☐ Limit access for scaffolding, cranes, digging or lifting equipment

Section 2 – Naming and Identification

Does the naming convention?

- ☐ Clearly identify the reservoir location through suburb or area
- ☐ Contain a water storage number (WS)

Are tank identifiers used?

- ☐ Is the tank ID clearly visible and durable?
- ☐ Have clock face positioning numbers been stencilled inside and outside?
- ☐ Are all penetrations (eg inlet, outlet, scour, monitoring etc) clearly marked?
- ☐ Are all valve operating directions clearly marked?
- ☐ Do the roof supports carry an ID number (eg, centre post is No.1, No.2 closest to the 6 o'clock position)

Section 3 – Roofing Systems

Roof sheeting

- ☐ Are the fixing screws suitable for long term corrosion resistance?
- ☐ Are ridge flashings minimised for effective sealing?
- ☐ Are the roof sheets full length and only cut around the edges? (eg. avoid centre pitch design)
- ☐ Are the edge fixings stronger to prevent wind damage?
- ☐ Are edge ridges sealed effectively to prevent vermin or dust entry?
- ☐ Are the sheets oriented to prevent build-up of debris or water pooling behind roof fixtures?

Roof gutters

- ☐ Can roof gutters be eliminated to prevent future issues such as blockages, leak points, ongoing cleaning, damaged down pipes?

Roof Framing

- ☐ Are the materials suitable for use in moist, humid/severe conditions?
- ☐ Are the fixings specified for longevity in severe conditions?
- ☐ Has ‘under roof’ safety mesh been eliminated to avoid corrosion issues?
- ☐ Do aluminium framing systems have fixings that will not loosen off due to flexing?

Ventilation

- ☐ Does the ventilation increase risk of contamination?
- ☐ Are the inlet and exit vent points oriented away from contamination sources?
- ☐ Do the inlet and exit vents encourage airflow?
- ☐ Has a maintenance strategy been developed for turbine vents (ie. easy replacement, checking for internal corrosion)
- ☐ Have fixed type vents been specified for high wind areas?

Section 4 – Access Systems

Platforms

- ☐ Does the platform area “fall” away to the outside edge to prevent ponding?
- ☐ Has drainage into the tank been eliminated?
- ☐ Has expanded mesh been used on top of the adjacent roof sheets to prevent impact damage?
- ☐ Is the available working area adequate for maintenance tasks and rescue situations?

Guard Rails

- ☐ Do they extend at least 6m either side of the access platform?
- ☐ Do kick rails have adequate drainage and debris removal clearance?
- ☐ Are hinged gates latched to prevent accidental opening?
- ☐ Are stanchions or handrails fitted to assist descending the internal ladder?

Entry Hatches

- ☐ Is the hatch a minimum of 900mm x 900mm to allow for easy diver access or robotic equipment?
- ☐ Do they have a continuous raised edge frame to prevent ingress?
- ☐ Are they completed sealed with no internal projections (eg stanchions)?
- ☐ Are they lockable when closed?
- ☐ Are they securable when open?
- ☐ Are they heavy duty to withstand climatic and vandalism events?
- ☐ Are they light enough for a single person lift?

Access Hatches

- ☐ For tanks over 30m diameter, does it have a second hatch @ 180 degrees to the entry hatch?
- ☐ Is there a sidewall hatch for empty tank, confined space access (min 900mm x 900mm)?

Rescue Systems

- ☐ Can the davit be folded away (to prevent birds roosting)?
- ☐ Can the rescue equipment be rigged without the need for a step ladder?
- ☐ Can it sustain sideways loading for complex rescue situations?

Section 5 – Internal Design Features

General

- ☐ Are there sediment entrapment areas (eg, steps around walls or post bases, low penetrations which can't be cleaned under)
- ☐ Do horizontal surfaces (eg. platform landings) have perforated surfaces to prevent sediment build up?

Materials

- ☐ Are all materials (including fixings) cathodically compatible?
- ☐ Do all metals have a protective coating for immersion?
- ☐ Have all stainless-steel items been passivated to prevent localised corrosion?
- ☐ Have aluminium items undergone acid washing to remove carbon particles?

Posts

- ☐ Are aluminium posts cathodically insulated from floor fixings and roof framings?
- ☐ Are the number of posts minimised to assist with water circulation and reduce sediment trapping points?
- ☐ Are post bases squared off to allow for easy cleaning?

Pipe Work

- ☐ Has pipe work within the tank been minimised (eg, only flanged penetrations protruding into the tank)?
- ☐ Are all penetrations (except the scour) flanged to allow for future fitting of nozzles, screen and flow meters?
- ☐ Is the overflow system external to the tank and is the end screened off to prevent vermin entry?
- ☐ Can GRP or HDPE be used for overflow risers and supports to avoid corrosion?

Outlets & Screens

- ☐ Are outlets at least 150mm above the floor to prevent sediment ingress?
- ☐ Does the outlet have a flange?
- ☐ Have concrete plinths been eliminated to prevent adjacent sediment build up?
- ☐ Are close fitting, protective screens installed on outlets to prevent internal sediment build up, which cannot be effectively cleaned away?
- ☐ Is the screen material cathodically compatible?

Inlets

- ☐ Does the inlet provide water circulation to eliminate stale areas, promote efficient disinfectant distribution but avoid disturbing floor sediment?
- ☐ Is excessive circumferential water movement avoided?
- ☐ Is there an additional ‘blank’ inlet (or outlet) for future installations?

Scour System

- ☐ Is the scour penetration a minimum of 150-200mm in diameter and level with the floor to enable a vacuum suction plate to be fitted?
- ☐ Is the scour point located near the entry hatch for quick and easy cleaning set-up?
- ☐ Have scour trenches been avoided if diver or robotic cleaning is to be used?
- ☐ Do the through-wall scour points have a hose or tanker fill coupling?
- ☐ Are external scour exit points within the client property to prevent disputes with local residents?
- ☐ Is an in-ground sump connected to the scour outlet which can be pumped out?

Sediment Disposal

- ☐ Is there a sewer point nearby which can be used for sediment disposal?
- ☐ Can a levee bank or small holding dam be incorporated to allow turbid waste to settle out?