UNSUITABLE OUTCOMES TOP 10…AND STILL COUNTING

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ABSTRACT

There appears to be a new mentality of cut and paste design occurring in our current service reservoir/tank constructions. Old mistakes, unsuitable materials and poor building methods seem to be reappearing again, after a period of relatively good outcomes.

This can be put down to several issues:
1. Designers and engineers having no effective field experience
2. Clients who do not understand or visit their existing tanks
3. A lack of 'fit for purpose' guidelines on tank design and operational issues

Tanks are often being treated like commercial buildings, using similar materials and construction techniques which are not suitable for their specialized application. Cost cutting, short term duty of care and outcomes based on modelling instead of real time experience, all contribute to the current problems facing our water industry today.

1.0 INTRODUCTION

A drinking water storage tank is not like a normal industrial building, housing machinery, materials and people. It has many unique operational issues that impact on its ability to function effectively and to reach its expected design life. Stored water creates changing pressures on walls, floors and expansion joints. It accelerates corrosion to anything it contacts and also creates a humid and gaseous (chlorine) environment to materials and structures situated around and above it. This now leads to a listing of 'The 10 most unsuitable things seen to date'. It was difficult to settle on that amount, but time does not allow for everything to be presented in this document!

2.0 DISCUSSION

The following examples of these poor designs and associated unfortunate outcomes are listed below.

1. Roofing that allows rain water and associated contamination to enter into the tank. Platform and hatch areas are commonly unsealed and allow debris to accumulate on the upstream edges, causing ponding and roof sheet deterioration. It is often assumed that a bit of extra water will be a bonus in these dry times, but would tanks storing wine or grain allow water to flow in or would a house holder or factory owner accept rain water entering into their building?

2. Placing safety mesh under the roof sheets to comply with OH&S during construction. This material is usually the cheapest available and corrodes quickly, causing the roof sheets to fail and then dropping the debris down into the tank and making regular cleaning of the floor difficult.

Figure 1: ***Entry hatch design allowing roof drainage to enter the tank***

3. Using roof framing materials that are not suitable for hot, moist and gaseous conditions. Zincalume coated purlins and rafters have a short life span in these situations and they also deteriorate quickly when roof screws puncture the surface coating.

Figure 2: ***Zinc purlin corrosion due to a moist, chlorinated environment***

4. Roof screws that are not rated for marine or extreme conditions. The roofing contractor often uses the cheapest type of screw to reduce costs, but corrosion failures are now occurring under five years in some environments.

5. Platform and entry hatch designs that limit working space and safe access into and out of the tank. What may be suitable for a factory environment is different to an elevated, confined space application, where diving and rescue equipment is commonly used. Platforms mounted high over the entry hatch area, instead of being level with the roof. Entry hatches mounted too far off the wall, so that ladder supports have to be extended to accommodate the gap.

Figure 3: ***Platform design that restricts the safe working area and access into and out of the tank***

6. Aluminum roof framing that is not securely fixed. While Aluminum is a good corrosion resistant material, it has a lot of flexing movement and will loosen off the fixing bolts unless nylock type nuts are used. Being a softer material to steel, extra thickness is also required for edge flashings, as fixing screws are prone to pulling out in windy conditions.

Figure 4: ***Aluminium roof framing bolts missing***

7. Internal pipework and other fixture materials that are not suitable for constant

immersion. Concrete tanks often have ductile iron pipework that is uncoated and this leads to accelerated corrosion. Fixing bolts and supporting brackets are often not insulated or are made from dissimilar metals, which will also contribute to corrosion issues.

8. Not thinking about how internal pipework will affect the stored water quality. Inlets placed next to outlets lead to short circuiting issues. Outlets close to the floor allow sediments to be drawn into the downstream reticulation system. Scours not being fitted in the lowest area of the wall or floor will not allow for effective draining of the tank.

Figure 5: ***Outlet pipework flush with the floor and drawing in sediments***

9. Building a tank whose walls are designed to move in and out under pressure and then the client back-filling directly against those walls, to save money on a retaining wall. This leads to significant structural damage and a complete failure of the tank in some circumstances.

Figure 6: ***Using the tank walls to retain the embankment area***

10. Having no understanding of short and longer-term maintenance requirements. Just because a tank is new, does not mean it will not require maintenance. Good external

access for elevated work platforms, cranes, service vehicles and larger trucks is often necessary for roof repairs after storm events. Steel tanks will need to be recoated after 30 years of service, so a good-sized flat area for parking the necessary heavy equipment should be factored in. Also, after events, such as fitting Telco aerials that encourage bird roosting and do not permit regular or emergency maintenance to be carried out safely.

Figure 7: ***Telecommunication equipment restricts access to tank for maintenance***

3.0 CONCLUSION

At the risk of upsetting some people, there is a relevant quote from George Orwell: "*Some ideas are so stupid that only intellectuals believe them.*"
If we are to improve the construction and design outcomes in our future water storage assets, then the people making decisions need to get out of the office, visit existing structures, climb up onto the roof areas and engage in discussions with the people who are affected by the poor outcomes made to date. Only then will we learn to update and move towards a better and safer future.