Condition Assessment Manual

Corrosion

Corrosion is the deterioration or destruction of a material due to reaction with its environment. Whilst a wide range of materials such as concrete, plastics and wood suffer from corrosion, we are mainly concerned with the chemical reaction of metals due to environmental contact.

In a corrosion cell, the **Anode** is consumed, and the **Cathode** is **not** consumed, but serves to shed electrons caused by the corroding anode. Connecting two metals together provides the **Internal Circuit** and the **Electrolyte** is the solution to conduct the electrons from Anode to Cathode. The electrolyte can be soil, concrete, or a thin layer of condensation, as current can travel through such environments.

When two dissimilar metals on the galvanic scale are connected in the presence of an electrolyte, the anodic (or active material) will corrode to protect the cathodic (or noble material) ie. Zinc will corrode to protect stainless steel and aluminium will corrode to protect carbon.

Steel is not a **uniform material**. It consists of crystals of different compositions, some anodic and some cathodic, hence lots of tiny corrosion cells can form on the surface. Also, as steel is worked in the form of welding, cutting, drilling or bending, the worked areas become anodic to the unworked areas.

Areas of lower oxygen concentration become anodes to areas of higher oxygen concentration.
If parts of steel are obscured behind bolts, crevices, dirt and rust, the lower oxygen concentration accelerates corrosion, while the well-ventilated areas remain cathodic.
Stainless steels are also affected, as oxygen is required to maintain the protective **oxide film**.
This can become self-aggravating as the accumulation of rust further restricts access to air and promotes more corrosion.
This results in **Pitting or Crevice Corrosion**, which is much more dangerous than **Uniform Corrosion**.

Corrosion can be minimised by
- **Material Selection** Avoid dissimilar metals
- **Design Considerations** Minimise crevices, sharp edges, areas that collect moisture
- **Cathodic Protection** Sacrificial or Impressed current systems.
- **Coatings** These represent about 70% of corrosion mitigation measures in terms of expenditure. Coatings generally operate by excluding the metal from the environment.

Protective Coatings

Coatings have three main categories;

- **Metallic** Galvanizing, metal spraying or electroplating
- **Inorganic** Chemical or conversion coatings, which provide a protective film that can be primed and painted.
- **Organic** Powder coating, wrapping tapes and paints.

COATING	DESCRIPTION
Acrylic	Domestic Type coating, water based. Will ‘chalk’ due to UV contact. External only.
Alkyd	Oil based enamel, uses turps as a thinner. Will ‘chalk’. External only.
Bitumen	Older internal coating designed to be fully immersed but difficult to apply due to required heating and no longer used - suspected of being carcinogenic. Cracks easily if allowed to dry out and can hide corrosion defects.
Epoxy	Is organic in type (oil based). Two-pack (a chemical reaction to cure). Can be solvent less or use a solvent to thin it out for easy application. Epoxy is a very hard surface finish and tolerant to apply. It is designed to be fully immersed.
Vinyl	Solvent based organic. The vinyl compound is dissolved in a solvent. Types VR3/VR6 relate to the number of coats applied. Vinyl is difficult to apply – requires long curing times and can be affected by adverse weather conditions. Can trap solvent during curing and this can lead to osmotic blistering. Designed to be fully immersed.
Chlorinated Rubber	Solvent based organic. The rubber compound is dissolved in a solvent. Is easy to re-coat, as a new coat applied will dissolve into the old one. External only.
Alumastic	Has an asbestos and aluminium particle present. Is bitumen based. Generally a cheap coating for surface repairs. External only.
Galvanised	Hot dipped in molten zinc. It forms a very hard surface due to chemical layers created in the heat process. Not suitable for constant immersion as the exposed zinc acts as an anode to protect the underlying metal and soon disappears. Can be epoxy coated for full immersion protection.
Micaceous Iron Oxide	Is a pigment type of mica particles. Can be added to acrylic, alkyd

(MIO)	and epoxy resins. Generally used as an exterior coating. Will not tolerate constant immersion.
Red Lead	Primer-undercoat, which contains lead and creates OHS&R issues. Is not used anymore but removal is expensive.
Zinc Phosphate	Primer undercoat
Zinc Silicate (inorganic)	The silicate is inorganic and acts as a binder to the zinc. A common undercoat used under epoxy topcoats.
Zinc Epoxy	Organic type due to the addition of epoxy. Would be used instead of galvanizing, but not as effective.

Anti-Corrosive Pigments

- **Inhibitive** pigments protect by moisture passing through the coating and dissolving a small amount of the pigment to form a protective film on the metal surface. These are prone to osmotic blistering in very damp conditions.
- **Barrier** pigments provide a dense barrier to the environment. Micaceous Iron Oxide leafing pigments have outstanding durability and resistance to acids, alkalis and chemicals. The tiny flakes float to the surface of the film to form a shingle effect, which reduces moisture vapour transfer rate through the coating. They can be used in alkyd, acrylic and epoxy binders, but have limited availability of colours.

Coating Failures

- Poor surface preparation – not grinding out crevices and weld slag, poor quality abrasive blasting
- Wrong coating selection
- Moisture
- Wrong solvent
- Poor application of coating
- Bad design features
- Faulty formulation of product

Seventy percent of coating failures are caused by inadequate surface preparation. This percentage increases when lack of care in application of the coating is considered.

- A structure with sharp edges, crevices and other poor design features lends itself to premature coating failure

- Cleaning fluids used that are incompatible with the coating

- Contamination of the prepared surface by **salts** is usually the result of exposure to a coastal environment, but can be due to the presence of sulphates or other chemicals

Such contaminants are often hygroscopic and absorb moisture from the air, which can allow rusting to occur under relatively dry environments. It can also lead to **Osmotic Blistering**. No matter how good the coating, vapour will penetrate the coating and dissolve any residual surface salt. This forms a very concentrated solution under the coating in contrast to water on the outside. Osmosis results by the concentrated solution drawing more water through the coating to form a blister, attempting to equalise the salt concentration. The blister will usually break at some stage, resulting in pitting corrosion.

Coating overlap can lead to defects such as **holidays** and **blisters**. A common application technique is to blast and coat the tank walls first to within a metre of the floor. The floor and lower wall section are then blasted and coated. Several things can go wrong with this technique. Blasting the lower wall section can cause damage to the new coating higher up in the form of over blast. The coating overlap results in a condition known as **poor intercoat adhesion**. This problem can relate to patch repairs of defects after **spark testing**, if the re-coat times have been exceeded. Also the small amounts of coating required for patch repairs are generally mixed from industrial sized containers leading to inconsistencies in the mix.

Solvents have many grades of purity with turpentine being the lowest grade. They are used to thin the coating for easier application and sometimes act as a curing agent. Pockets of solvent can be trapped during curing if application thickness or timing is exceeded. This will lead to osmotic blisters.

Cold weather or high humidity will affect coating curing. Most tanks are re-coated during cold weather due to availability of the tank (water usage is lowest). High temperatures cause the coating to cure prematurely. The coating does not 'wet the surface' sufficiently.

Inspection Methods

Video Images

- Treat the video camera as a still unit.
- Only move in or out and pan in one direction only. **Never** move back onto what you have already filmed. If you require more detail, stop the shot; adjust the distance and change angles to give a fresh perspective of the same object.
- When visibility is limited, move up close and film around the edge of the subject until it has been covered.
- When filming vertical objects such as posts or pipes, move upwards in a twisting manoeuvre to take in more than one plane of the vertical surface.
- Pause where detail is necessary or when a feature might warrant discussion by the viewer and move steadily across a feature that has no interest other than its general condition.
- Try and include a silt shot and diver vacuum shot for general interest.
- Don't disturb the silt or create the impression of stirring it up unnecessarily. We need to maintain water clarity.
- Move around the tank in a logical order, either clockwise or anticlockwise and take in all the features encountered.
- If in a bland area of wall, move towards the tank's centre and do the floor, support posts and silt shots.
- Inspect floor joints to determine what is typical.
- The walls are one of the main structural features, so try and cover the whole area. Pay close attention to the wall/floor joint area and also 1 to 2 metres off the floor as most coating defects are in this area. Give some wall footage as a background when filming the overflow pipe and any other higher fittings.
- Finish off with the ladder and landings (if they are present).
- When starting a shot, hold your breath - the need to breathe is generally 8 to 10 seconds, the ideal length of film required for each feature. In good visibility, keep the camera running if it helps tie the story together.
- Always replace the lens cover when not in use or lifting the camera in and out of the water.
- Check that the camera and light are turned off, as the dive tender will be busy with other matters and will generally put the camera into a safe area as soon as practical without checking the operating condition.

Still Images

- Use these to highlight important features or defects. A good sediment profile, close up of a corrosion nodule, a section of missing floor joint, anything that can be described as **typical** to similar features etc.
- These are to compliment the written reports and highlight any defects noted.

- This is a better format to use in meetings to discuss a particular feature or defect than to sit down and play a video.

Visual Inspection

All inspected items are allocated a Priority number from zero to four. This is further expanded to include a Status indicator of Action, Flagged or Deferred.
Clients have varying budgets and maintenance expectations, so the priority and status indicators must be customised for each project. Within that project however, consistency is important. Assets must be benchmarked against each other, to establish a sliding scale of maintenance priorities. **Refer to appendix A**.

Get a feel for overall workmanship of the coating by looking for hard to coat areas ie. sharp edges on personnel entry hatches, flanges, the underside of support brackets and areas where a coating will fail to penetrate, due to poor design.

- If the coating feels slippery and smooth, it generally denotes good **dry film_thickness**. A sandpaper type finish denotes thinner coverage. Look for patch repairs and if they have been successful. Bear in mind **cheesy finish** which denotes bad material mixing and **poor intercoat adhesion**.
- A lot of welded areas contain crevices that should have been ground out to allow full penetration of the coating.
- Areas under entry hatches and inlets can have corroding material on top of the coating that has been dropped in or introduced through the pipework.
- **Osmotic blisters** or coating adhesion problems are common across the floor where bad surface preparation was carried out prior to painting. Also painters have to move across the floor as they apply the paint, so contamination can happen immediately prior to coverage if best practice is not carried out.
- Operating reservoirs are subject to stress and weight variations that can affect their design life.
- Pipe work entering and exiting through walls and floors are subject to **differential settlement** in their foundations that can cause stress cracks and leakage.
- Most leakage occurs in the wall/floor area or around floor penetrations of pipe work.
- Many leaks have been found where buried pipe work leaves the tank and passes under the wall area upstream of the stop valve.
- This is caused by differential settlement of either the tank or the stop valve pit, placing undue pressure on the pipe.
- Stress cracks in concrete walls and floor should be noted, as reinforcing steel can be subjected to increased corrosion due to water penetration.
- Concrete surfaces should be checked for softness or **chalkiness** indicating early deterioration - high chlorine levels within the tank can cause this problem.
- Check floor penetrations for stress cracks around their edges.
- Overflow pipe work has the potential to leak around faulty flanges or through pitting caused by heavy corrosion – the water loss will often go unnoticed as overflow systems generally drain direct into the stormwater system.
- Floor joints come in a variety of materials both hard and mastic.

- Some soften with age and contact with chlorinated water leading to failure.
- Tanks with steel walls and concrete floors are subject to additional expansion and contraction pressures in the wall/floor area as they fill and empty throughout their working cycle. Close attention must be given to the flexible joint sealing these two surfaces.
- Uncoated aluminium support posts and fittings require special attention.
  Heavy pitting corrosion has been noted on aluminium placed into potable water without suitable surface preparation to remove carbon particles left in place during the manufacturing process. Aluminium posts should be electrically isolated from the bolted connection attached to the roof framing. If a continuous connection is present, it will turn the post into an anode to protect the steel re-enforcing fabric within any concrete structure present. This will lead to accelerated corrosion of the post.
  - Roof framing will corrode in warm, humid conditions. Efficient ventilation will avoid condensation forming on the under roof areas. Condensation and evaporation will leave corrosive residues on all areas of internal roof structures, and lightweight galvanized purlins often display the most damage. Some types of Z purlin have a raised lower edge that traps condensation.
  - Many roof gutters drain into overflow riser sections, and these areas need to be checked for alignment, to ensure contamination is not entering the tank during periods of high flow.
  - Internal ladders and platforms can degrade structurally, and cause serious injury if used. The splash zone is the most susceptible area of failure.
  - The presence of bird feathers or faecal matter around the high water line will indicate security and sealing defects in the tank. Ventilation, cable penetrations, roof hatches, gutters and sheeting all need a thorough inspection to avoid contamination.

Appendix B. sets out commonly identified issues for items inspected under the ASAM format.

Appendix C. sets out standard comments used during ASAM data entry. The corresponding number to each comment relates to an automatic data entry system within the programme.

Appendix A

Asam® Priority & Status System

Priorities are placed on each inspected item. This creates a benchmark and time schedule for planned maintenance.

P0 - immediate attention from date of inspection.
The highest action priority - this is only to be used in cases of;

- Personal safety being compromised when carrying out routine operations on the asset.
- Water quality being affected to a level that places the consumers at risk.
- Structural defects that have the potential for failure or costly reinstatement if left unattended

P1 - one year from date of inspection.
Also urgent, but will not place at risk the day to day operation of the asset.
Dealing with safety, water quality and structural defects likely to cause further damage, if not rectified within twelve months. All new work that has a warranty defects liability.

P2 - two years from date of inspection.
To be used for priority maintenance.
Coating defects both external and internal, entry hatches, safety rails, roofing defects, deteriorating internal ladders, pipe work and supports.

P3 - three years from date of inspection.
General rating for structural and coating maintenance that is required to preserve the effective asset life.
Additions that can be carried out to improve access and safety as finances permit.
Steel tanks and their internal fittings should be inspected at three-yearly intervals to establish a maintenance pattern.

P4 - four years from date of inspection.
Items rated under this priority are those that are likely to remain structurally sound during normal wear and tear for at least 3 to 4 years, based on past experience of the asset.
This includes roofing, external fixtures not requiring coating, ventilation systems, animal proofing and concrete structures with a proven history.
New coatings that have passed the warranty period.

Inspected items are also allocated a Status indicator of Action, Flagged or Deferred. This defines the urgency of items, and is a good criterion when using ASAM search

A - Attention required on date.
F - Item to be reassessed on date.
D - To be deferred until next inspection.

Appendix B

Typical features on External Inspection

AREA	COMMENTS
Entry Gate	1. Not secure, no lock. 2. Top wires loose or damaged. 3. Holes in netting. 4. Able to enter under the wire, or gate.
External Ladder	1. No lock, or not secure. 2. Unsafe to climb, structurally or design wise.
Walls	1. Coating damage through impacts or weathering. 2. Corrosion at base area. 3. Concrete defects, cracking. 4. Leaks.
Entry Hatch	1. Not locked or secure. 2. Raised edge required to seal against contamination. 3. Hatch not sealing effectively. 4. Unsafe to use.
Roof Hatches	As above.
Roof Platforms	1. Contamination entering tank. 2. Water ponding. 3. Unsupported areas of roof. 4. Unsafe to work on.
Ventilation	1. Unsecured or damaged. 2. Bird proofing defects.
Vandalism	1. Rock impacts to walls. 2. Graffiti. 3. Entry to tank. 4. General damage.
Roof	1. Storm damage. 2. Loose sheeting, missing screws. 3. Unsafe to work on. 4. Contamination able to enter tank. 5. Asbestos sheeting.
Handrails	1. Lack of rails on work areas. 2. Damaged. 3. Unsafe to use existing rails. 4. Bad design or construction.
Davit	1. Required for confined space rescue. 2. Existing unit does not function as intended. 3. Is unsafe to operate (risk of falling off tank)
Bird Proofing	1. Entry through hatch covers, roof areas, ventilation. Internal evidence of feathers or bodies. 2. Can be possums & snakes.
Level Indicator	1. Is it operating? 2. Scale difficult to read. 3. Cable broken. 4. Contamination can enter through cable holes.

Appendix B

Typical features on Internal Inspection

AREA	COMMENTS
Walls	1. Corrosion. 2. Coating damage. 3. Lower leakage. 4. Cracks.
Columns	1. Corrosion. 2. Coating damage. 3. Poor connection to rafters. 4. Damage to base. 5. Structurally unsecured at base or top fixing.
Floor	1. Corrosion. 2. Cracks. 3. Leaks. 4. Defective joints. 5. Coating damage. 6. Impact damage.
Ladder/platform	1. Unsafe to use (cage fitted) 2. Structurally unsound. 3. Corroded. 4. Coating damage. 5. Not confined space compliant.
Inlet	1. Corroded. 2. Causing sediment disturbance. 3. Coating damage. 4. DIN compliant – yes/no?
Outlet	1. No riser fitted. 2. Corroded. 3. Coating damage. 4. No safety screen fitted. 5. Badly positioned and able to draw in sediments (common with scour)
Scour	1. Corroded. 2. Badly positioned for efficient use. 3. Common with outlet.
Overflow	1. Corroded. 2. Leaking on flanges and joins. 3. Coating damage. 4. Structurally unsound.
Mixer	1. Corrosion or coating damage. Defects to motor or fittings. 3. Securing cables damaged or defective.
Supports	1. Unsecured. 2. Cracked. 3. Badly positioned. 4. Causing damage to walls and floor.
Electrical	1. Broken conduits. 2. Exposed wires. 3. Bad design or installation. 4. Safety issues.
Roof Framing	1. Corrosion at connections. 2. Dry rot in timber, termites. 3. Not securely fixed to anchors or adjacent pieces. Centre roof spider corrosion.
Floor Seals	1. Leaks. 2. Material gone soft, or sticky. 3. Subsided. 4. Material protruding. 5. Brittle material.
Leakage	1. Around pipe work penetrations. 2. Ring beam areas. 3. Defective floor wall seals. 4. Lack of sediment cover in isolated areas.

Appendix C

COMMENTS CODE – BENCHMARKS

1	THERE IS NO SECURE COMPOUND AROUND THE TANK
2	THE COMPOUND AREA IS BEING ACCESSED BY UNAUTHORISED PERSONNEL
3	THERE IS SIGNIFICANT GRAFFITI PRESENT ON THE WALL AREAS
4	THE EXTERNAL LADDER SECURITY IS POOR AND UNAUTHORISED PERSONS CAN ACCESS THE UPPER TANK AREAS
5	UNAUTHORISED PERSONS CAN ACCESS THE ROOF AREA AND THE ENTRY HATCH IS NOT SEALED AGAINST DELIBERATE CONTAMINATION EVENTS
6	THE ENTRY HATCH COVER DOES NOT SEAL AROUND THE FRONT EDGE AREA WHERE THE LADDER STILES EXTEND THROUGH
7	THE UNSEALED ENTRY HATCH NEEDS TO BE RENOVATED TO PREVENT A WATER QUALITY EVENT FROM OCCURING
8	THE ENTRY HATCH FRAME DOES NOT HAVE A SEALED FRONT EDGE – NATURAL OR DELIBERATE CONTAMINATION EVENTS CAN OCCUR
9	THE ENTRY HATCH COVER IS NOT LOCKED OR SECURED AGAINST UNAUTHORISED ACCESS
10	BIRDS AND VERMIN CAN ENTER THE TANK
11	THE VENT MESH IS DAMAGED, ALLOWING BIRDS AND VERMIN TO ENTER THE TANK
12	THE ROOF GUTTERS ARE BLOCKED, ALLOWING STORMWATER TO BACK FLOW INTO THE TANK
13	THE ROOF DRAINAGE IS NOT PROPERLY CONNECTED INTO THE OVERFLOW PIPE – CONTAMINATION EVENTS ARE OCCURRING REGULARLY
14	THE PLATFORM AREA IS NOT SEALED AGAINST NATURAL OR DELIBERATE CONTAMINATION DRAINING BACK INTO THE TANK
15	THE PLATFORM AREA IS UNSEALED AND THERE IS A LOT OF DEBRIS COLLECTED, READY TO DRAIN INTO THE TANK
16	THERE ARE SIGNIFICANT CONTAMINATION POINTS PRESENT AROUND THE PLATFORM AREA
17	THE INTERAL LADDER SYSTEM IS HEAVILY CORRODED AND THIS WILL AFFECT THE STORED WATER QUALITY
18	SIGNIFICANT AMOUNTS OF INTERNAL CORROSION ARE AFFECTING THE STORED WATER QUALITY
19	THE INTERNAL LADDER AND CAGE ARE HEAVILY CORRODED – THEY ARE NOT SAFE TO USE WHEN THE TANK IS EMPTY
20	THE ENTRY HATCH IS TOO SMALL FOR A SAFE DIVER ACCESS OR RESCUE SITUATION
21	THE EXISTING INTERNAL LADDER DESIGN MAKES A CONFINED SPEACE ACCESS OR RESCUE SITUATION DIFFICULT
22	THE INTERNAL LADDER IS POORLY POSITIONED AND TAKES UP AVAILABLE ACCESS UNDER THE ENTRY HATCH
23	THE INTERNAL LADDER SYSTEM NEEDS TO BE UPGRADED TO IMPROVE THE SAFETY OF THE PERSONNEL USING IT
24	THERE IS NO SOLID AREA ON THE ROOF TO SET UP A RESCUE SYSTEM – A CONFINED SPACE ACCESS OR RESCUE SITUATION WOULD BE DIFFICULT
25	THERE IS NO INTERNAL LADDER FITTED
26	WATER QUALITY IS COMPROMISED BY POOR HATCH SEALING AND SECURITY
27	THE ROOF AREA IS NOT SEALED AND STORM WATER IS DRAINING BACK INTO THE TANK

COMMENTS CODE – EXTERNAL & INTERNAL

1	NO COMMENT
2	APPEARS TO BE IN GOOD ORDER
3	THERE IS NO SECURE COMPOUND AROUND THE TANK
4	THE LADDER AREA IS NOT SECURE AGAINST UNAUTHORISED ACCESS
5	THE LADDER SYSTEM IS NOT SAFE AND SHOULD ONLY BE USED BY EXPERIENCED PERSONNEL
6	
7	THERE IS VANDAL ACTIVITY PRESENT SO THE EXTERNAL SECURITY NEEDS TO BE MONITORED AND UPGRADED
8	THE SKETCH PLATE AREA IS CORRODED DUE TO CHLORINE SPILLAGE FROM THE DOSING POINT
9	THERE IS HEAVY STAINING PRESENT ON THE COATING
10	
11	UNSEALED AREAS ARE ALLOWING NATURAL OR DELIBERATE CONTAMINATION TO ENTER THE TANK
12	STORMWATER AND DEBRIS ARE COLLECTING AND DRAINING BACK INTO THE TANK
13	THE ENTRY HATCH SHOULD BE MODIFIED - A SEALED FRONT EDGE NEEDS TO BE FITTED, ALONG WITH A HINGED, OVERLAPPING HATCH COVER TO PREVENT CONTAMINATION FROM ENTERING THE TANK
14	THE HATCH COVER IS NOT SEALED AROUND THE EDGES AND CONTAMINATION CAN ENTER THE TANK
15	THE ENTRY HATCH IS TOO SMALL FOR A SAFE DIVER ENTRY OR RESCUE SITUATION
16	THE ENTRY HATCH COVER IS NOT SEALED AROUND THE FRONT EDGE AREA AND WHERE THE LADDER STILES PASS THROUGH - CONTAMINATION CAN ENTER THE TANK
17	
18	AN IMPROVED GUARD RAIL SYSTEM IS REQUIRED TO UPGRADE PERSONNEL SAFETY AROUND THE PLATFORM AREA
19	
20	THE ROOF SHEETS NEED RE-FIXING AROUND THE EDGES TO PREVENT STORM DAMAGE FROM OCCURING
21	SOME AREAS OF FLASHING ARE LOOSE AND NEED RE-FIXING TO PREVENT FURTHER WIND DAMAGE FROM OCCURING
22	
23	THE VENTILATION MESH IS DAMAGED AND SMALL BIRDS CAN ENTER THE TANK
24	THE MESH UNDER THE EAVES IS DAMAGED AND BIRDS OR POSSUMS CAN ENTER THE TANK
25	THE TANK IS NOT SEALED UNDER THE ROOF AREA AND SMALL BIRDS OR RODENTS CAN ENTER THE TANK
26	
27	A TITAN ARM AND NEXTEP VERTICAL FRP LADDER SYSTEM NEEDS TO BE INSTALLED TO MAKE THE TANK CONFINED SPACE COMPLIANT
28	THE DAVID ARM HAS BEEN WELDED INTO A FIXED POSITION TO PREVENT IT FROM BEING USED EFFECTIVELY
29	THERE ARE CHAINS FITTED INTO THE GUARD RAIL SYSTEM ADJACENT TO THE DAVIT AREA
30	THERE IS A GATE FITTED INTO THE GUARD RAIL SYSTEM ADJACENT TO THE DAVIT AREA
31	
32	THERE IS EXPOSED ELECTRICAL WIRING PRESENT
33	THE CABLE IS BROKEN AND THE LEVEL INDICATOR NO LONGER OPERATES
34	THE DEPTH SCALE IS NO LONGER LEGIBLE
35	
36	THERE IS CORROSION AND DETERIORATION PRESENT

37	THERE IS HEAVY STAINING ON THE COATING
38	OSMOTIC BLISTERS HAVE FORMED UNDER THE COATING
39	THE COATING LACKS ADHESION AND IS PEELING OFF IN SEVERAL AREAS
40	THERE IS LIGHT CORROSION PRESENT
41	CORROSION IS BLEEDING THROUGH THE COATING ON MOST AREAS
42	THERE ARE SIGNIFICANT CORROSION NODULES PRESENT
43	THERE IS CORROSION PRESENT ON THE FLANGES AND FITTINGS
44	THERE IS CORROSION PRESENT ON THE RAFTERS WHERE CHLORINE HAS BEEN SPILT
45	THE CP DOES NOT APPEAR TO BE CONTROLLING THE CORROSION THAT IS PRESENT
46	THE CP APPEARS TO BE EFFECTIVE IN CONTROLLING CORROSION IN THE COATING DEFECT AREAS
47	THERE IS CORROSION AND DETERIORATION PRESENT AT THE BASE OF THE WALL FLOOR AREA
48	THERE IS SIGNIFICANT CORROSION BLEEDING THROUGH THE BITUMEN COATING
49	THERE ARE SIGNIFICANT CORROSION NODULES PRESENT
50	SIGNIFICANT CORROSION IS PRESENT RIGHT ACROSS THE FLOOR AREA AND STRUCTURAL DAMAGE IS OCCURING - AN IMPRESSED CATHODIC PROTECTION SYSTEM IS REQUIRED IMMEDIATELY TO SLOW DOWN THE RATE OF DETERIORATION UNTIL THE TANK IS RE-COATED. RE-COATING SHOULD BE CLIMATE CONTROLLED TO GUARANTEE AN EFFECTIVE OUTCOME AND GOOD VALUE FOR MONEY EXPENDED
51	
52	THE OVERFLOW BASE AND RISER SECTIONS ARE HEAVILY CORRODED
53	
54	THE ROOF DRAINAGE IS NOT PROPERLY CONNECTED INTO THE OVERFLOW PIPE - CONTAMINATION EVENTS ARE OCCURRING REGULARLY
55	THE OVERFLOW RISER IS DUCTILE IRON AND NOT EPOXY COATED - IT IS BEGINNING TO CORRODE, PARTICULARLY WHERE THE SS SUPPORT BRACKETS ARE FIXED
56	
57	THE OUTLET IS COMMON WITH THE INLET AND IT IS LEVEL WITH THE FLOOR - A TWO WAY NOZZLE SHOULD BE FITTED TO PREVENT SEDIMENT ENTRY INTO THE PENETRATION AND TO BLEND THE STORED WATER
58	SEDIMENTS CAN ENTER THE PIPEWORK BECAUSE THE OUTLET PENETRATION IS LEVEL WITH THE FLOOR
59	
60	THERE ARE NO OUTLET SCREENS PRESENT FOR DIVER SAFETY
61	THERE IS A BRASS SCREEN PRESENT - THE LARGE SURFACE AREA CAUSES SEDIMENTS TO ACCUMULATE AROUND THE OUTLET PENETRATION
62	THERE IS A FIBREGLASS SCREEN PRESENT - THE LARGE SURFACE AREA CAUSES SEDIMENTS TO ACCUMULATE AROUND THE OUTLET PENETRATION
63	
64	THE LADDER CAGE SHOULD BE REMOVED TO IMPROVE DIVER SAFETY AND TO MAKE THE TANK CONFINED SPACE COMPLIANT
65	THE INTERNAL LADDER IS HEAVILY CORRODED AND SHOULD BE REPLACED WITH A NEXTEP VERTICAL FRP SYSTEM MM LONG