Issue 60 · November 2022

Connection

The official magazine of Composites Australia

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FRP WORKHORSES ENABLING SOVEREIGN CAPABILITY

Envirotank

Newell Composites

RPC Technologies

GRP Tank Solutions

Corrosion Technology Australia

COMPOSITE SOLUTIONS FOR TANK AND PIPE MANUFACTURE

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President's Letter

The concept of sovereign manufacturing capability has become a hot topic in Australia, and rightfully so, as the double hit of the pandemic and geopolitical issues has exposed significant gaps in Australian manufacturing capability and capacity. The concept extends to enabling and servicing a wide range of crucial industries that Australia depends on, including the resources, defence, utilities (water and sewage treatment and energy) and food processing. Fibreglass reinforced plastic (FRP) tanks and pipes have long been the workhorses that serve these sectors providing safe, lightweight, non-combustible, non-corrosive storage and passage, often for decades in harsh and unforgiving conditions.

Our story on Envirotanks (page 5), demonstrates that establishing on-shore capability and production takes time, collaboration and innovation. It chronicles the 30 year journey of substituting steel with fibreglass. Now, a heartening 96 per cent of underground fuel tanks in Australasia are made from fibreglass, much of the success for which can be attributed to resin system innovations developed in Australia. The technology was also introduced to the American market and is still in use today.

The article on Corrosion Technology Australia (page 18) demonstrates the essential role of FRP tanks in the 'process manufacturing' sector, now supporting the sovereign capability of producing vaccines. Equally, the article on GRP Tank Solutions (page 16) demonstrates how FRP tanks are enabling the clean energy revolution. Our article on Newell Composites (page 8) is a reminder that mining equipment is expected to operate with ongoing integrity and reliability for many decades in a desert climate that often sees winter temperatures drop below zero, rising to close to 50 degrees in the summer months.

Our feature article on RPC Technologies (page 10) and the 'Central Interceptor' project - the waste and waste water infrastructure project running underground from near Auckland's city centre, under its harbour through to the city's wastewater treatment plant –is also a powerful piece that illustrates the versatility of GRP/FRP in critical infrastructure applications. The project requires over 1,000 tonnes of glass reinforced composites, seminal engineering and manufacturing solutions for a myriad of challenges, not least of which is that the underground structure is required to withstand a one in 2,500 year seismic event.

Auckland is abuzz with civil infrastructure projects. Kerryn and I recently spent a week there at the invitation of the Composites Association of New Zealand (CANZ), attending its annual conference at the University of Auckland. Kerryn gave a presentation on the state of the Australian composites industry and the activities that Composites Australia undertakes. We then spent a few days with the CANZ President Glenn Campbell, visiting composites manufacturing sites around Auckland. It was wonderful to meet with so many in the New Zealand composites industry, comparing the challenges and opportunities we all face in our businesses, and we look forward to our two organisations working together for the benefit of the industry.

Leona Reif
President

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FRP Tanks protecting groundwater
Envirotank Pty Ltd

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

For industrial sites including vehicle refuelling facilities, bulk liquid storage tanks are buried for a reason. Stable ambient underground temperatures are a safer option for flammable and combustible liquids and there is less risk of damage from inclement weather, vehicle strike or vandalism.

Today we know that composites have high impact resistance, thermal stability, and damage tolerance, which are properties that enable storage tanks constructed with composites to fare better in accidents. We also know that composites are better at resisting fatigue and corrosion than traditional metals and are also lightweight and thus easier to transport and install. But it wasn't always thus.

Before modern materials, oil was once piped into, and transported in, wooden barrels. These were eventually replaced with steel which according to Dale Timms, General Manager and Director at Envirotank Pty Ltd, was the material of choice until the 90s.

'When we entered the market in 1990, steel tanks were used exclusively for bulk liquid storage. Despite the demonstrated lifetime cost benefits over steel which tended to corrode, introducing fibreglass reinforced plastic as an alternative material was viewed with uncertainty - as a gamble, ' remembered Dale.

At the time, fibreglass tanks were more expensive than steel and asset owners were concerned with the initial costs. There was little concern and no penalties for environmental damage and in the event of corrosion and ultimately leakage, concern was for the cost of a loss of contents.Tanks were buried and out of sight.

According to Dale, product and material acceptance of fibreglass composite technology took close to 30 years. Having graduated from Monash University majoring in Industrial Chemistry, and almost a decade working on resins early with the industrial agrochemical giant, Monsanto, Dale recognized that chemistry could solve the environmental hazard.

The catalyst for change and materials acceptance was the steady introduction of environmental regulations and Australian and international standards that stipulated that buried tanks must be monitored 24 hours per day. Envirotank also introduced a 30 year warranty against corrosion, in line with its licensor's warranty in the USA. Its double wall fibreglass tanks offer a full 360-degree secondary containment with a variety of monitoring devices, which can be installed in the interstitial space between the two walls. Due to the unique integral rib design, double wall fibreglass tanks are the strongest, most robust

Dale Timms, General Manager and Director at Envirotank points to the testing standard - UL 1316 underground tanks available. They are rust-proof, maintenance free and formulated to be compatible with all petroleum alcohols and alcohol-gasoline mixtures.

Another catalyst for change has been the steady changes to fuel types; particularly ethanol-blended and oxygenated fuels, biodiesel fuels and ultra-low sulphur diesel. 'Newer biofuels and the increased use of chemical additives are creating increasing incidents of aggressive microbiological-induced corrosion including the metal components in fuelling systems. Internal corrosion is now just as important as external corrosion.

Left. Dale Timms, General Manager and Director at Envirotank with Kerryn Caulfield and Don Craig, Managing Director of Envirotank.

One challenge was to try and predict where future fuels may go and what impact that would have on the long-term performance of the tank laminates. Consideration had to be given to the types of glass utilized but more importantly what resin would be compatible with both current fuels and potential future fuels. Future fuels were expected to have chemical oxygenates added to them to make them burn cleaner and these could come in a variety of formulations. There was also a push to introduce renewable additives such as ethanol and methanol as examples (these can be made by using agricultural products as the starting point, fermenting then distilling the alcohols for fuel use).

Oxygenates and alcohols are very aggressive to both steel and fibreglass. In partnership with FGI – now allnex – a terephthalic resin was formulated and underwent long-term testing to assess its suitability. Once it had passed these tests the resin was adopted by Envirotank for all fuel storage tanks.

Equally, these systems were developed to be suitable for Australian soil conditions including acidic sulphate soils which when exposed to air tend to be corrosive. These resin system innovations; as Dale explains were also introduced to the American market and are still in use today.

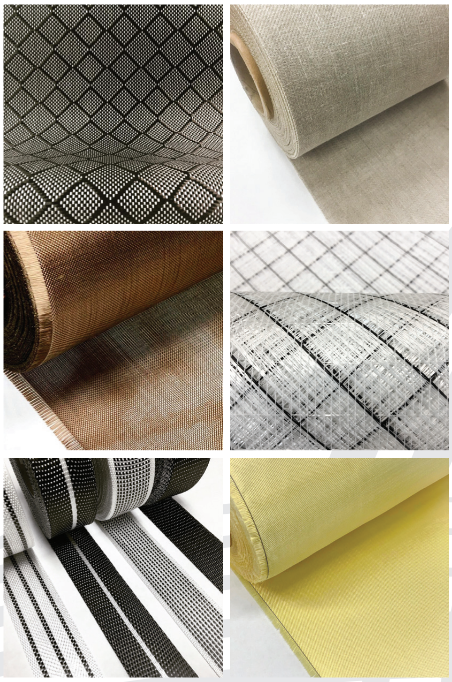
Below. This massive bulk liquid storage tank was made by Envirotanks at its Coolaroo site in Victoria.

Now, over 30 years later, a heartening 96 per cent of underground fuel tanks in Australia are made from fibreglass of which 100 per cent are double walled including a structural inner and outer wall. To date, Envirotank has produced over 30,000 compartmented tanks. With up to four compartments separated by bulkheads and containing 4 different products, the use of fibreglass for underground fuel storage is not only an environmental win for the country and its taxpayers, it is also a financial win with lower up-front costs for the fibreglass tank versus the equivalent steel tank.

Envirotank has two plants, one based in Auckland and serving the entire country of New Zealand and another in Melbourne, Australia. Both plants have also supplied underground fuel tanks to the Asia Pacific Rim. For fuel storage, tanks range between 2,000 and 120,000 litres. Non-fuel tanks that don't require a double wall are built to hold up to 450,000 litres.

The manufacturing facility is fully automated 'chop and drop' technology over a rotating mandrel and moving carriage delivering the resin. Internally programmed PLC controls to ensure glass and resin content, which in turn controls costs and delivers consistent products. Every tank is internally tested on site. The University of Queensland is used for tensile, flexural and modulus testing.

This mighty FRP tank - made by Maskell Productions, Envirotanks sister company in NZ - is designed and engineered to last 50 years and hold 150,000 litres of dairy effluent, milk and/or whey.



FRP industrial equipment for mineral processing

Newell Composites S.A.

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

Covering some of the most arid parts of Australia, South Australia has a diverse commodity base beneath its many geological terrains. The engine room of the South Australian economy, the mining industry plays a crucial role in driving economic development, investment, and exploration and export opportunities for the state.

Main Pic. The snail-shaped Evolute™ Feed Well, designed to improve flow distribution, has a hollow centre and is 8.1m in diameter.

BHP's colossal Olympic Dam, located 560km north of Adelaide, boasts the world's fourth largest copper resource as well as the largest single deposit of uranium. These ore deposits - which also contain gold and silver - are mined through a labyrinth of above and below-ground operations, including more than 450km of underground roads and tunnels.

The hydrometallurgical technique of extracting and separating valuable minerals from ore requires a series of expertly designed processing ponds. 'Heap leaching' is a process using sulfuric acid and cyanide salts to trigger a set of chemical reactions that dissolve copper from pulverised ores; the liquid result holding the valuable dissolved metals is called the 'pregnant leach solution'. These are harsh and

The Feed Tank, Feed Launder, Drop Well and Feed Well are designed to operate for many decades with ongoing integrity, reliability and productivity in the region's desert climate that can drop to below zero while rising to close to 50 degrees in the summer months.

unforgiving conditions for the best of materials.

Newell Composites has operated for 55 years from its Murray Bridge site, 78 kilometres east-southeast of Adelaide. The company's mainstream products are industrial chemical storage tanks, pressure vessels and custom built items such as large fire retardant tanks for water cartage. Its reputation for niche and large-scale project manufacturing, particularly filament wound corrosion resistant fibreglass reinforced plastic (FRP) industrial products, is well earned.

One recent project, destined for BHP's Olympic Dam site, is a 3m diameter x 5m high Feed Tank, 1.1m wide x 0.7m deep Feed Launder, 1.5m diameter x 2.9m high Drop Well and 8.1m diameter x 1.315m high Feed Well. These four pieces of vital industrial equipment form part of the mineral refining for extracting precious metals, copper and other compounds from ore.

According to Robert August, Managing Director of Newell Composites, "Mining equipment is expected to operate for many decades with ongoing integrity, reliability and productivity in the region's desert climate that often sees winter temperatures drop below zero, rising to close to 50 degrees in the summer months. FRP suits this environment. It requires minimal maintenance, is long-lasting and cost-effective for mineral processing."

All made from C Glass, ECR and E Glass fibreglass, the equipment was designed externally and verified by Mike Leggett of Oceania Engineering Composites to the stringent BS EN 13121-3:2016 requirements. The Feed Tank was filament wound using the company's 'Hoop-Chop' method, with its complex parts hand laminated. Connecting the Feed Tank to the Feed Well is a 24.65 metre long 'Feed Launder' which is built to move crushed ore or sediment. The 1.1m wide by 0.7m high rectangular shaped 'Feed Launder' was made in four sections, each with edge flanges that are covered and joined by ribs. The last and shortest 2.4 metre section runs into the Drop Well. The snail-shaped Evolute™ Feed Well, designed to improve flow distribution, has a hollow centre and is 8.1 metres in diameter.

The 24.65 metre long 'Feed Launder' - which is built to move crushed ore or sediment - connects the Feed Tank to the Feed Well.

"Given the science we know about the corrosive mineral processing environment, we used Hetron 922 Vinyl Ester resin system with a double synthetic corrosion barrier. All products are post-cured to ensure total quality and strength. A highly durable UV stabiliser was added to the resin system to protect the chemical bonds from the likely effects of degradation," advised Robert.

As with all Newell Composites products, this suite of FRP industrial equipment will operate for decades with ongoing integrity, reliability and productivity in the region's harsh desert climate.

New Zealand's 'Central Interceptor' project

A massive feat in engineered GRP RPC Technologies

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.
along with assistance and advice from Gavin Engelsman – GM Engineering and Operations – Infrastructure

Tāmaki Makaurau Auckland is Aotearoa New Zealand's largest city, with a population of 1.7 million—roughly a third of the total population. Beneath the city, magic is happening: Watercare, the city's water utility is building a 14.7km underground wastewater tunnel from Māngere Wastewater Treatment Plant, across the Manukau Harbour to the central city. It's the largest and most complex wastewater infrastructure project in New Zealand history.

The NZ $1.2b Central Interceptor consists of one main tunnel (interceptor) and two link sewers. The project is being delivered by Ghella Abergeldie JV.

Work on the first link sewer is almost complete, with the micro-Tunnel Boring Machine (TBM) having just completed her third drive. While, Hiwa-i-te-Rangi—the large TBM is due to complete the undersea crossing of the Manukau Harbour in early December en route to the central city. Designed to replace ageing infrastructure and reduce wet-weather overflows into the central Auckland waterways as well as handling huge volumes of wastewater from Auckland's growing population,

The tunnel includes 18 shafts, eight of which use a GRP Cascade Structure, reaching depths of 72 metres, as well as numerous connecting sewers, chambers, control facilities and air treatment facilities.

it consists of close to 14.7 kilometres of 4.5 diameter tunnels, close to 5 kilometres of pipe-jacked sewers, 18 shafts, a major pump station, new odour control and air treatment facilities and substantial wastewater management and network infrastructure works. The construction phase of the project began in 2019. The due date for completion is now 2026 however consent applications are expected to extend the tunnel to catch combined wastewater and stormwater flows from two more suburbs.

The sheer size of the 'cans' required the installation of a built automated vertical winder.

The landmark project is being constructed to meet a 100-year durability requirement which includes a one pass HDPE lining of the main 4.5metres diameter tunnels and the extensive use of GRP/FRP in the cascade drop shafts, which would otherwise be subjected to significant corrosion due to sewer gases. Nine cascade structures varying from 3.0 metres in diameter up to 7.5 metres in diameter, and up to 72 metres in depth, will be used to dissipate hydraulic energy and link the existing sewer network with the new tunnel.

The selection of GRP/FRP for use in the cascade structures, in lieu of reinforced concrete, which was the original intention, was adopted by Watercare as a superior long-term solution to address the expected significant corrosion problems that currently occur in all sewer networks. The GRP/FRP structures act as a corrosion protection lining by eliminating any direct contact between the sewer gases and the concrete structures, whilst also reducing the site construction time and improving site safety by minimising the amount of work required to be undertaken within the shafts.

In total over 1,000 tonnes of glass reinforced composites will be utilised, with the GRP components manufactured off site and transported as completed modules, for final assembly and placement and concrete encasement by RPC/GAJV (Gella Abergeldie Joint Venture). The project required seminal engineering and manufacturing solutions for a myriad of challenges, not least of which, are that the underground structure is required to be designed to withstand a one in 2,500 year seismic event.

From a material perspective, it is a performance-intensive hydraulic environment in corrosive underground confines that are not easily accessible to repair or undertake routine maintenance. The raw material inputs span the breadth of composite enabling resins and adhesives including polyester, vinyl ester, epoxy prepregs and methyl methacrylate (MMA) adhesive. A variety of different glass and carbon fabrics was used including "C" glass tissue; ECR (acid resistant) chopped strand mat and woven rovings; Bi axial, double bias, and uni-axial fabric and continuous process roving.

To meet the 100-year design life criteria, the material properties of all raw material inputs used were tested and validated over the course of a 12-month comprehensive testing program that included:

- Long term strength properties and validation of the strength/modulus characteristics
- Fatigue characteristics – 1010 cycles (3hz x 100 years)
- Abrasion and erosion performance (compared to reinforced concrete and alternative materials)
- External pressure collapse strength
- Ring bending stiffness

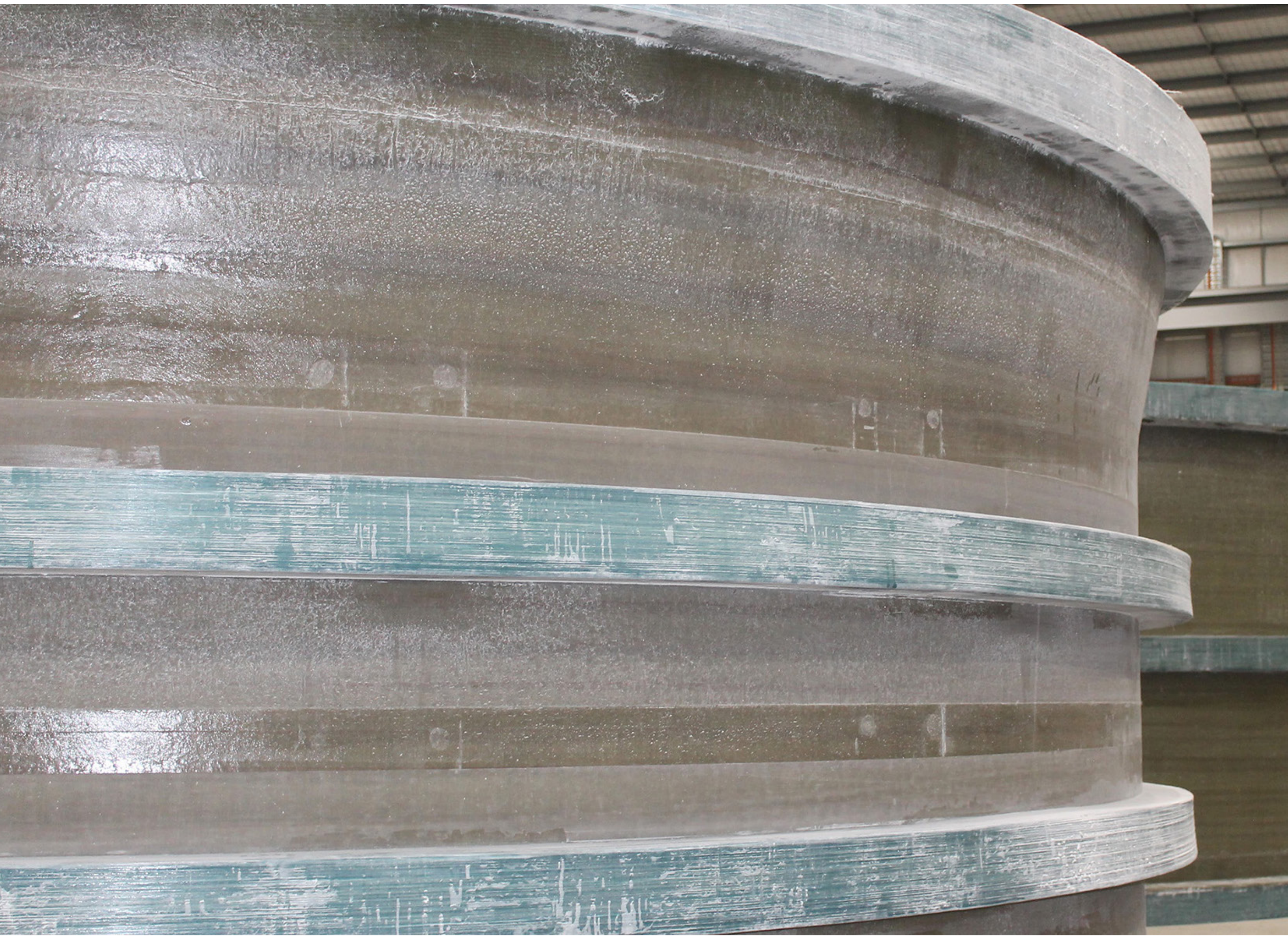
The shafts have been designed in two operating halves, whereby water drops down one side of the shaft, allowing air to vent and rise on the other.

- Beam tests
- Full scale first article tests
- Seismic deformations

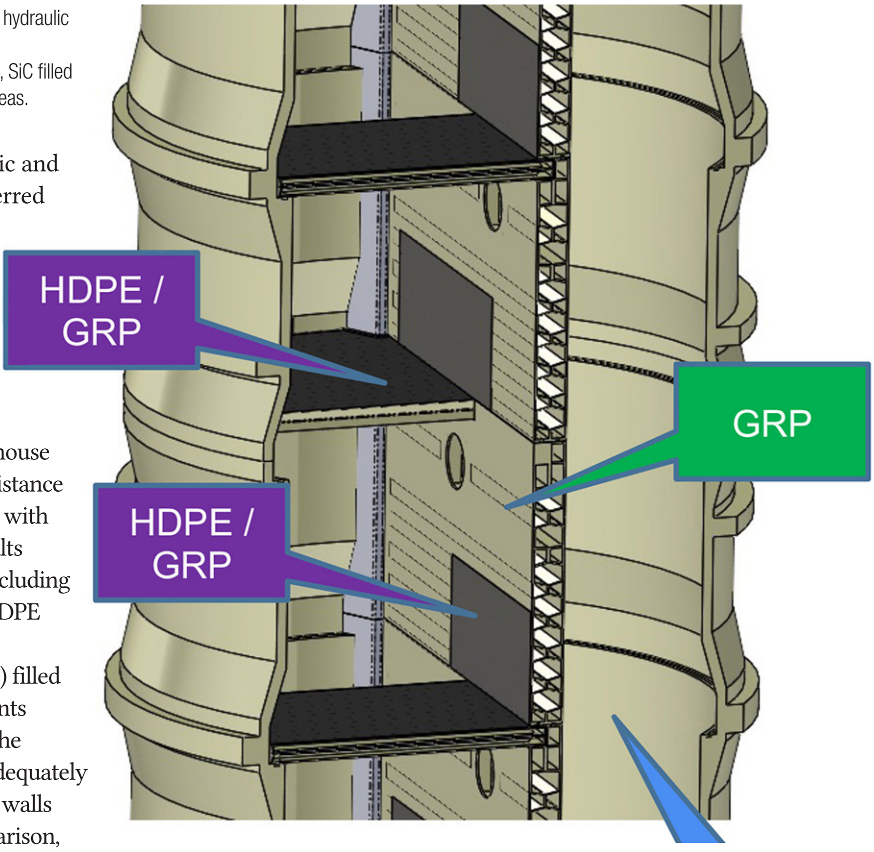
The test results were subsequently reviewed and incorporated in the detailed FEA analysis modelling to verify both short term and long term properties of the laminates.

The project called for a cross section of GRP manufacturing processes including conventional hand layup, vacuum infusion moulding, adhesive bonding and filament winding including in-house purpose built automated vertical winding for the DN7500 modules.

The cascade drop structures are designed for wastewater to cascade down the shaft, dropping from a series of alternating shelves. The spacing and size of each shelf is engineered to manage the velocity; the design hydraulic flow; dissipate hydraulic energy; minimise odour and mitigate health effects and corrosion from hydrogen sulfide (H2S) caused by the bacterial processes in wastewater. The liquid falling



Right. The GRP Cascade structures were designed to dissipate hydraulic energy and minimise H2S emissions. A range of materials was required including 3 mm HDPE liner bonded to flat GRP panels, SiC filled GRP for the cylindrical shaft, and unfilled GRP in less critical areas.

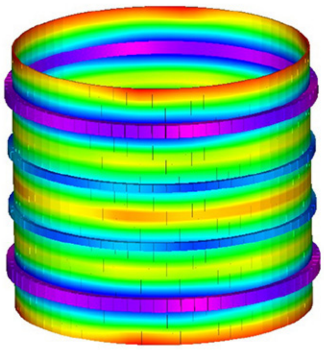


between the shelves results in both hydrostatic and fluctuating hydrodynamic loads being transferred into the composite cascade shelves and back into the concrete annulus encasing each composite shaft structure. The shafts have been designed in two operating halves, whereby water drops down one side of the shaft, allowing air to vent and rise on the other.

The design requirements led to a series of in-house fatigue and abrasion tests to verify the wear resistance and long-term strength of GRP cascade shelves, with and without additives and/or coatings. The results demonstrated that for the areas of high wear, including the cascade shelves and dividing walls, 3 mm HDPE liner bonded to flat GRP panels would meet the performance requirements. Silicon Carbide (SiC) filled GRP in the corrosion barrier met the requirements for the areas exposed to medium wear such as the cylindrical shaft, and unfilled GRP performed adequately in less critical areas such as the vertical internal walls away from the splash zone. As a material comparison, GRP out-performed all other alternatives.

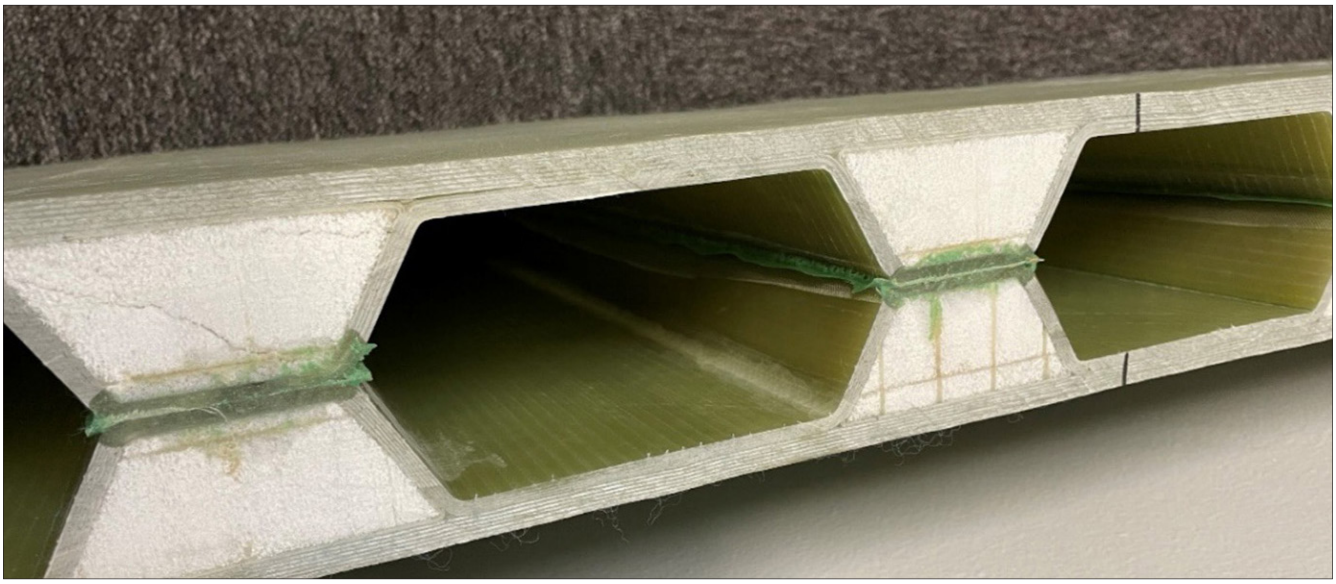
Available long term fatigue performance data validating the specified 3Hz cyclic loading and 100-year durability requirements of the GRP shelves was also required. After a global search, RPC turned to experts in the US, to reference and augment data, on the fatigue performance and condition monitoring for composite wind turbine blades, which have over 30 years of test data and proven performance.

The horizontal cascade shelves and vertical dividing walls are manufactured using a variety of advanced



Left. Fatigue performance data from composite wind turbine blades was adopted in the Central Interceptor Project. Fibre to resin volume fraction was the key for reducing long term fatigue.

Below. For the cascade shelves, a unique corrugated profile was developed in two halves and joined together with an epoxy prepreg similar to that used in other products used in RPC's Defence projects.



The automated vertical winder hydraulic collapsing mandrel was built in RPC's Corio plant in Victoria to reduce labour cost and mould turnaround times.

materials and customised engineered processes designed to last well into the next century. Leveraging technology developed in-house by RPC, high strength/stiffness bespoke sandwich structure panel, capable of supporting up to 70,000kg/shelf were manufactured and supported using a combination of glass and carbon fibre panels.

Material and process options for the cascade shelves were dictated by high hydraulic and cyclic loads, the differential pressure across the vertical flat dividing walls as well as cost and weight. A simple yet solid GRP centric flat panel design was not feasible as the through core shear stresses were too high for traditional core products. A tailored 'sprung yet ridged' corrugated flat panel was developed to be manufactured in two separate halves and joined together with an epoxy prepreg adhesive tape. This construction reduced the panel weight and enabled inspection testing prior to assembly and precise adhesive distribution on the mating surfaces. Peel ply was applied during the infusion process to ensure consistent high quality surface preparation prior to bonding. The test specimen to validate the fatigue strength of the GRP corrugated/ sandwich panels passed 10 000 and 250 000 cycles which was well within the limits of BS EN 13121.1.

As the cascade structures will be subject to earthquake activity and must withstand both seismic and static loading, consideration was given to both the 'ovalling' and raking' response of the GRP shaft liners, due to seismic ground motion and soil-structure interaction of the concrete/GRP shafts. The GRP shafts liners that house the cascade shelves were designed to withstand a combination of load cases including groundwater and soil loadings , along with the unbalanced seismic loads that exert the 'maximum external pressure' on the GRP shaft liners; 'maximum internal pressure' for when the shaft is flooded; 'dynamic loading' on the cascade shelves and walls of the shaft liner due to falling water; 'surge loading' on either side of dividing walls; 'geyser loading' on the underside of shaft roof; 'buoyant uplift' for when the shaft is empty and seismic deformation.

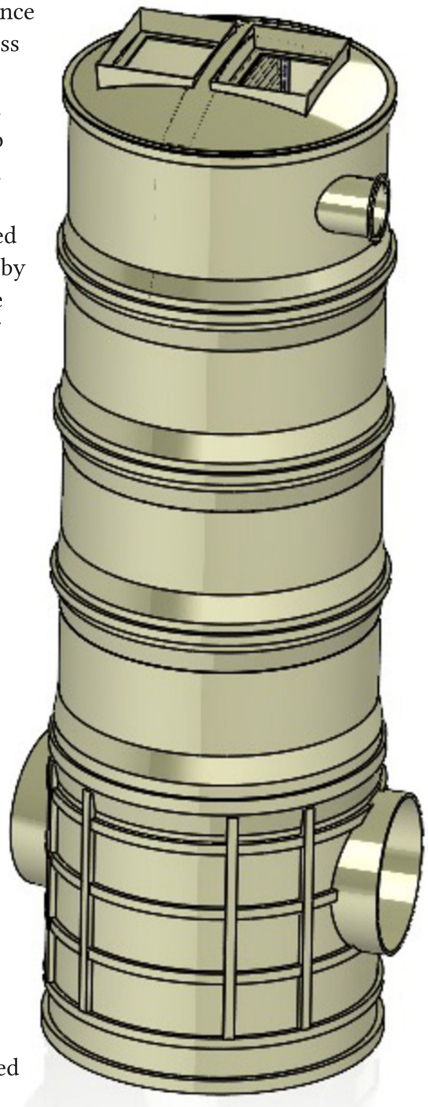
As no specific design codes are available for large diameter manholes or underground structures the design adapted BS EN 13121.3-2016 GRP Tanks and Vessels – Part 3 Design and workmanship, as the standard provides a design basis for both Ultimate Limit State Design and Serviceability Design, along with fabrication, inspection, testing and verification methods, augmented by FEA (Finite Element Analysis) modelling.

At 72 m long the largest shaft is constructed with over 20 individual 'cans' or modules that are bolted together. The sheer size of the 'cans' required they be wound vertically. Specialised equipment which was procured and commissioned in the company's Corio plant in Victoria, designed by the RPC engineering team in Seven Hills, Sydney, along with an hydraulic collapsing mandrel to reduce labour cost and mould turnaround times.

To counter gravitational disturbance on the resins imposed by the process of vertical winding, a UV cured resin system - originally developed for dental technology - was used to wind the larger flanges and ribs on the modules. This relatively new technology for composites increased productivity and improved quality by removing the need for interim cure stages and reduced cure stresses of thick laminates.

Extreme external forces also affected the lower sections of the some of the shaft liners which was further complicated by the large intersecting pipe connections. The solution of a thicker laminate exceeded available crane capacity and was less than cost effective. Again, RPC engineered and developed a multiple layered corrugated wall construction not dissimilar to the flat panel construction but with equivalent attributes of weight reduction and production efficiencies brought about by lower exotherm and reduction in curing stages.

The 'Central Interceptor' is an herculean engineering, manufacturing and underground construction project that has pitched design, manufacturing, material, process and logistical engineering challenges at every stage.



Centre. Extreme external forces on the lower module of some of the shafts that are also complicated by two large intersecting pipe connections, called for an extremely rigid GRP cylinder to be fabricated.

Shayne Cunis, Watercare executive programme director: "The Central Interceptor is one of the largest infrastructure wastewater projects taking place in the Southern Hemisphere at the moment.

"We pride ourselves on innovation, excellence and safety in everything we do. The cascade structures made by RCP exemplify all of these goals and we're delighted to have them on board as a construction supplier."

RPC is a leader in the design, engineering and manufacturing of glass reinforced composite (GRP) solutions, and special fabrications. It has delivered world-class engineering projects in the transport, renewables, defence, infrastructure, water and wastewater, mining, and architecture sectors for close to 50 years. The RPC family consists of 500+ engineers and skilled staff employed throughout Australia in NSW, Victoria and South Australia, and in South East Asia. Over the past 20 years RPC has delivered in excess of $1.0 Billion of projects.

Enabling the clean energy revolution

GRP Tank Solutions

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

According to a company media release, BHP's recently built Kwinana Nickel Refinery located south of Perth, Western Australia (WA), is the 'first of its kind in Australia and will produce enough premium nickel sulphate to make 700,000 electric vehicle batteries each year.' The processing plant commenced operations in late 2021, converting nickel metal powder into a nickel sulphate hexahydrate crystal product used in lithium-ion batteries. The shopping list of industrial equipment required to process the mineral ore includes leaching tanks, purification technology and reactors built to generate high purity lithium with a relatively low energy input.

GRP Tank Solutions - the WA division of Tank Solutions is one of the local manufacturers to pick up orders from this sizeable shopping list. The company has fabricated five fibreglass leach vessels (tanks) and four reactors in the first of six development phases planned for scaling-up the BHP nickel refinery.

With the largest item measuring a mighty eight metres by 10 metres - or three storeys high - this suite of equipment was built to exacting engineering specifications and is performance and material intensive.

The equipment was hand-lay contact moulded using Derakane™ 470, the epoxy novolac based vinyl ester resin designed for thermal and chemical resistance. The Derakane resin also offers high resistance to solvents, acids and oxidizing substances such as chlorine, with a high retention of strength and toughness at elevated temperatures.

The inside of the fibreglass tanks required a corrosion barrier (or liner) using a combination layer of carbon fibre tissues (or veils) against the inner process surface, followed by three layers of ECR-Glass surface mat. Each resin-rich layer acts as a defence against chemical attack. The carbon fibre tissues and veils are designed specifically for the chemical and petrochemical industries and are used to reduce the likely risk of explosion by dissipating any surface conductivity and static charges. Silicon carbide powder was also added to the resin used on the inside corrosion barrier to strengthen the surface and reduce wear.

According to Mark Ridley, General Manager of GRP Tank Solutions, "Transporting the finished equipment to the Kwinana Nickel Refinery from our Bibra Lake site was logistically challenging. The sheer size of the equipment prevented safe transport to the plant, so we had to lease another shed with suitable production

Transporting the finished equipment to the Kwinana Nickel Refinery required lifting space and a direct transport route to the plant, unobstructed by overhead power transmission lines.

and lifting space that was on a direct route to the plant, unobstructed by overhead power transmission lines." Once transported, the hydro tests were done on the tanks in-situ in Kwinana.

Annual data released by the Department of Mines, Industry Regulation and Safety (DMIRS) shows Western Australia's resources industry achieved record sales of $230 billion in 2021 much of which was fuelled by unprecedented iron ore sales and a strong increase in gold sales. Lithium sales soared to an all-time high of $2.6 billion – a threefold increase, while nickel sales grew to $3.7 billion, the highest value since 2012. Economic forecasts predict that WA's significant range of critical and battery minerals, including lithium and nickel, will continue to grow as enabling inputs into the clean energy revolution.

Across two production sites in NSW and WA respectively, the Tank Solutions companies have specialised in fibreglass corrosion-resistant liquid storage for the fuel, chemical, oil and gas, and water and waste water markets for close to 40 years. With the recent boost from BHP's local nickel refinery, GRP Tank Solutions is currently doubling its WA manufacturing footprint by building a new facility in Rockingham - 25 minutes south from its present location – to be operational by early 2023.

Transporting the mighty eight metres by 10 metres - or three storeys high - finished fibreglass leach vessels (tanks) on a direct route to the plant, unobstructed by overhead power transmission lines.

FRP Tanks – Workhorses for sovereign manufacturing capability

Corrosion Technology Australia Pty Ltd

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

The concept of 'sovereign manufacturing capability' extends to servicing and enabling a wide range of crucial industries that Australia depends on, including the 'process manufacturing' sector. Process manufacturing is where individual raw materials and inputs are converted into a final product in liquid, solid, gel or powder form using a thermal, pressurised and/or chemical. process. Industries that use process manufacturing include minerals, foods and beverages, pharmaceuticals, paints and coatings, chemicals, cosmetics and personal care.

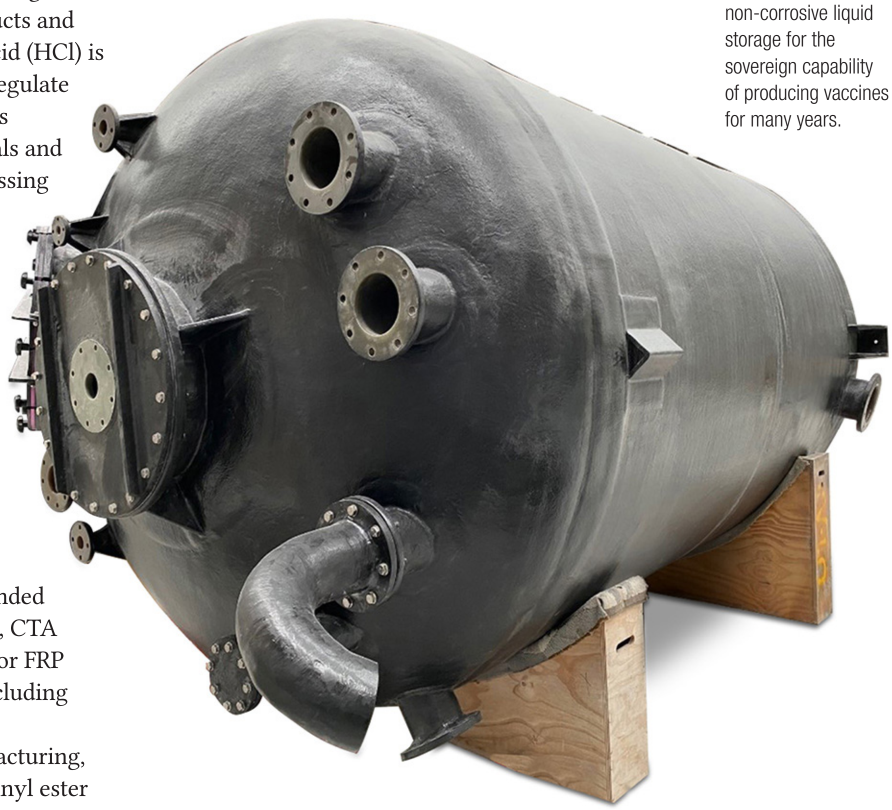
Fibreglass reinforced plastic (FRP) tanks play an important role in process manufacturing. These composite workhorses provide safe, non-combustible, non-corrosive storage of raw material inputs, formulated outputs, waste, and effluent. They house caustic solutions, oxidizing chemicals and won't react to chemicals with aggressive properties. Being lighter than steel they can be made to hold volumes and are not prone to thermal expansion and contraction.

Sodium hypochlorite (NaOCl) is a high strength industrial antiseptic or cleaning agent used in a variety of industrial applications including large scale water treatment, household cleaning products and pharmaceutical synthesis. Hydrochloric acid (HCl) is another industrial chemical often used to regulate the acidity (pH) of solutions where purity is important, such as food and pharmaceuticals and to neutralize waste in ore refining in processing minerals. Both chemicals have powerful acidic and toxic fuming properties that corrode most storage materials, particularly steel, and have serious health and environmental risks.

Operating from manufacturing sites across three states on the eastern seaboard, Corrosion Technology Australia Group (CTA) produces a range of FRP tanks and other composite products for petrochemical plants, utilities (water and sewage treatment and energy), food processing and other industry sectors. Founded in 1991 by Managing Director, Alex Brown, CTA services the growing nationwide demand for FRP piping, ventilation and storage systems, including chemical and waste water tanks.

"Built as 'workhorses' for process manufacturing, our tanks are made with specialty epoxy vinyl ester systems which are otherwise known as 'problem solvers'. Their properties exceed both polyester and epoxy in corrosion resistance and toughness and are typically used when high durability, thermal stability and extremely high corrosion resistance are needed," says Alex Brown.

Though built to the standard for Reinforced Thermoset Plastic Corrosion-Resistant Equipment (ASME RTP-1) and or to the standard for 'GRP Tanks and vessels for use above ground' (EN 13121), the recommended corrosion barrier for some chemicals has increased from 3 to 6 millimetres in recent years



This composite workhorse made by CTA, will provide safe, non-combustible, non-corrosive liquid storage for the sovereign capability of producing vaccines for many years.

Kerryn Caulfield with Paul Lomas, Sales Manager and Alex Brown, Director of CTA discuss the inner corrosion barrier, EasyVeil® made by Regina Glass Fibre

based on long term monitoring. "Proactive continual monitoring of FRP tanks by resin companies has enabled continual validation and improvement of the chemistry," said Brown.

Australian made EasyVeil® from Regina Glass Fibre is a C-Glass surface veil included in the corrosion barrier for most chemicals at the inner surface of the laminate which is the interface of the FRP composite and the stored corrosive material. The veil serves to provide a durable, resin-rich (90% resin) surface for the composite. The same resin matrix will typically be used throughout the composite structure with reinforcements used in up to three specific areas of the laminate. The tanks are post cured to drive the curing reaction by increasing the cross lining density and to maximise the resin and ultimate mechanical properties.

The production of a broad portfolio of vaccines is another example of sovereign manufacturing capability that Australia needs to protect and develop. Technology-driven and highly-regulated, vaccine manufacture is a challenging process manufacturing industry that requires large amounts of raw material, technical equipment and sterile supplies processed under exacting operational conditions. The Commonwealth Serum Laboratories (CSL) was established in Australia in 1916 to service the health needs of our nation isolated by war. CSL soon created the flu vaccine for the 1918 pandemic. In the wake of the COVID-19 pandemic, the role of vaccines in protecting and saving lives is as critical as ever. The federal government announced in March it had finalised a deal with global vaccine manufacturer Moderna that will see the production of mRNA vaccines from as early as 2024 at the new facility, also in Victoria.

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