Evacuation & Rescue from a Deep Tank

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ABSTRACT

During a review of maintenance cost for overhauling a reactor clarifier (RC) at the Māngere Wastewater Treatment Plant (WWTP), it was identified that several different methods of egress were recorded as rescue plans from a confined space (a tank 6+ meters deep) by different internal and external parties. The cost of these alternate methods also varied from a few thousand dollars to tens of thousands of dollars.

A series of workshops were held to better understand why there was such a difference in method and cost. Professionals within the rescue and first aid space were invited to participate in these workshops.

Outcomes of the workshops revealed that different groups placed greater weighting on their own approach to ensuring a rescue plan was in place. Some had used minimum cost solutions to provide cost-effective pricing such as davit arms with winches or narrow scaffold towers with ladders, while others selected costly options such as a crane with a man cage on standby. Nobody had trialled the evacuation option they had selected, and all assumed that their preference would work.

Some rescue plans considered it the emergency services role to rescue anyone that was severely injured or who had suffered a medical event. Fire and Emergency New Zealand (FENZ) and St Johns both said they would always attend site and help, but ultimately, the company had a duty to ensure a rescue plan was in place. Looking more closely at some of the noted rescue plans, it seemed that some would be considered a technical lift (lifting greater than 6m) and would be more appropriate for FENZ to perform. However, this approach was challenged with the counter that the rescue plan was probably not appropriate if set up for someone else to perform the rescue.

After considering several options, a scaffold tower with 4 flights of 1.4m wide stairs was constructed inside both the reactor and clarifier zone of the RC. Over several weeks multiple exercises were run with a mixture of WWTP staff, contractors, FENZ and St Johns to trial the option. The exercise involved rescuing an 80kg dummy in a stretcher up the stairway structure.

Many lessons were learnt, and constructive and informative feedback received from all involved. Having staff involved throughout all the workshops and exercises in this H&S matter provided hugely positive outcomes. The endorsement of FENZ and St Johns in the proposed rescue solution and the familiarisation they gained of the facility was priceless. Consideration for design of access hatches in future infrastructure projects was noted as required in safety and design and setting a minimum standard for egress for a rescue plan another worthwhile outcome.

KEYWORDS

Evacuation, Rescue Plans, Deep Tank, H&S, Safety in Design

PRESENTER PROFILE

Based at the Māngere wastewater treatment plant, Jonathan has worked for Watercare Services Ltdfor nearly 20 years. Holding a degree in Environmental Engineering & Diploma in Wastewater Treatment, Jonathan is also a Chartered Engineer with ENZ. Over his career Jonathan has held multiple roles within wastewater operations from Process Engineer through to Operations Controller, Regional Plant Manager and is currently the Production Manager for the Māngere WWTP and the eight regional WWTPs in the south Auckland area.

1. INTRODUCTION

The Māngere Wastewater Treatment Plant in Auckland treats the load from a population equivalent of around 1.4 million people, from domestic, commercial, and industrial sources.

The treatment plant utilises primary, secondary, and tertiary treatment, discharging, on average, 320,000 cubic metres of treated wastewater into the Manukau Harbour each day.

Due to the scale of the facility, Māngere has many large and often deep tanks for containment of wastewater within the different unit processes.

The secondary treatment stage utilises biological nutrient removal (BNR) and is performed within nine reactor clarifiers (RCs) on site. The RCs are 77m in diameter, six metres deep and hold 32 million litres. The reactor surrounds the clarifier with a common wall between the two.

There is currently a five-year overhaul cycle for the RCs with two overhauls performed each summer. Occasional unplanned failures also require work to be performed on RCs.

During a review of maintenance costs for overhauling a RC, it was identified that several different methods of egress were noted for rescue plans from a confined space by different internal and external parties. The cost of these alternate methods also varied from a few thousand dollars to tens of thousands of dollars. This presented a puzzle for us: which method was best, and how would we know?

We decided to hold a series of workshops to better understand why there was such a difference in method and cost options relating to egress/rescue from a RC.

Picture 1. Empty Reactor Clarifier

2. WORKSHOPS

The aim of the first workshop was to engage with staff and other experts to discuss the different options used, and their reasons, for a safe and effective rescue of an injured person, or someone who has had a medical event, from a deep tank or structure on a Watercare facility.

Staff from WSL Operations and Maintenance Delivery, along with contractors used at site, (scaffolders, tank cleaners, engineering fabricators) and professionals within the emergency rescue, medical and First Aid space, (FENZ, St Johns, Safety N Action & A1 First Aid) were invited to participate in the workshops to better understand when and where their expertise would come into play.

After a meet and greet around the room and an overview of what we wanted to achieve that day, the group was separated into two teams comprising of an even mixture of people and expertise. The two groups were then taken around the Māngere WWTP to the different civil environments within which our contractors and staff work with when overhauling or fixing a deep tank.

Numerous containment vessels that undergo emptying and overhaul works were shown to the groups including seven floating roof digesters (7,500m^3, 10m side wall depth) and one fixed roof digester (8,500m^3), two open to air BNR reactors (17,000m^3, 6m deep), nine reactor/clarifiers (32,000m^3, 6.5m deep), two covered gravity thickeners (5,050m^3, 3.5m deep), and twelve primary sedimentation tanks (2500m^3, 70mx12mx3m deep).

The main point of focus was an empty RC. This gave the groups a sense of scale and the opportunity to observe the restrictions and complications that might occur during different types of rescues from these structures.

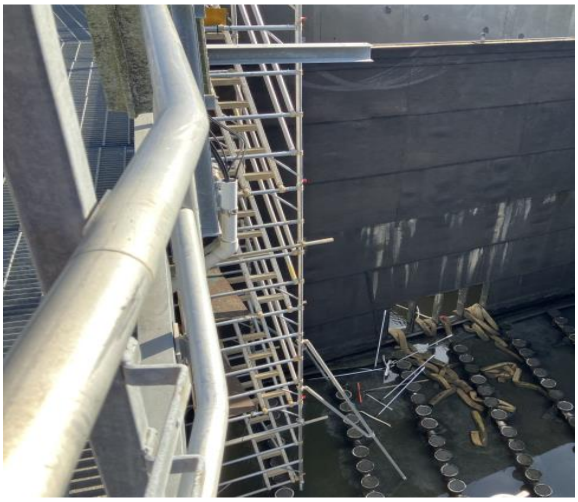
Once back in the conference room, the current range of different methods outlined in rescue plans were shared, and input was requested on the rationale behind why the participants felt that this method was best.

Conversations revealed that different groups placed greater weighting on their own approach to ensuring a rescue plan was in place when working for up to six+ weeks overhauling an RC.

Some had used minimum cost solutions to provide cost-effective pricing such as davit arms with winches ($1,000-$1,500) or narrow scaffold towers with ladders and platforms ($5,000-$7,000), while others selected costly options with a fast rescue in mind such as a crane with a man cage on standby ($20,000-$30,000).

Picture 2. Davit Arm System.

Picture 3. Narrow scaffold tower.



Picture 4. Man-cage.

The higher cost options, such as cranes, tended to put in place by departments that had no budget ownership, relying on another department to pay the invoice.

More commonly noted was that nobody had really trialled the evacuation option they had selected, assuming their preference would work. As there had not been an incident at the Māngere WWTP, related to someone falling into~~,~~ or needing evacuation from~~,~~ a deep tank in over 20 years, it is likely that a certain amount of complacency was present.

Some rescue plans considered it the emergency services’ role to rescue anyone that was severely injured or who had suffered a medical event within a deep tank. This was based on the theory that providing first aid, then waiting for the emergency services was better than trying to move the injured person and causing further harm.

There was a mutual consensus that some of the egress options put in place, such as the narrow scaffold tower using ladders and platforms, would work for an evacuation of physically able people, but it would be impossible to rescue someone who was unconscious or significantly injured with, say, a broken limb.

Looking more closely at some of the noted rescue plans, it seemed reasonable that some rescues would be considered a technical lift (lifting greater than 6m) and would be more appropriate for FENZ's technical team to perform.

Listening to professional feedback on best practice experience by FENZ, they commented that none of the structures shown to them at the Māngere WWTP posed any major concern when it came to getting in and out. FENZ and St Johns both said they would always attend site and help but it was the company who ultimately had the duty to ensure that a rescue plan was in place.

Any approach with rescue plans relying solely on the emergency services to get someone out of a deep tank was challenged by FENZ. They pointed out that the rescue plan was probably not appropriate if it was set up for someone else to perform the rescue.

There was some debate on this matter with a rebuttal to FENZ that staff and contractors working at the WWTP are not trained professionals when it comes to technical lifts, and we could cause more harm by dropping someone when trying to lift them up 6m+ via a davit or winch. At this stage, the conclusion of this deliberation was left open with the question of, 'who has the duty of care and who would Worksafe place the responsibility on?'.

It was agreed that another workshop would be held to concentrate on discussing options for a future practice rescue exercise involving FENZ & St Johns.

2.1 Follow-up Workshop

A second smaller workshop with FENZ and St Johns was held a month later to look more closely at best practical options on how professionals within the emergency rescue & medical organizations would extract someone from the bottom of the reactor or clarifier who had had a serious injury or medical event.

The use of a stretcher is the most common method for the emergency services to transport someone to a safer location or ambulance as it stabilizes the patient on a firm base and provides a tool to assist with the physical lifting and navigation of the person.

After a quick discussion on what we wanted to achieve that day, the group headed out on-site to an empty RC. Rather than a desktop exercise, being out on-site provided a closer look at the RC to hypothesize how a stretcher could be lifted from the 6m+ depth.

The inspection of the area highlighted complications with the ability for practical lifts due to having either structural elements, launders, or services like cable trays, in the way. Another impediment was the handrail. In place to protect from falls, unfortunately the handrail placed another obstacle in the way which made a simple lift more awkward.

Ideas on building a scaffold platform which protruded out into the reactor and clarifier (therefore missing obstacles) was mooted. A winch could then be attached to a pole suspended above the platform to provide the lift.

One of the main fears the facility staff expressed was that if we were trying to lift someone in a stretcher, or harness if the situation allowed, and the winch slipped just as we were trying to get them over the handrail and/or onto the safety of the walkway or a platform, this would cause the person to be dropped from height.

A winch tends to operate well lifting the person but when you put it into reverse to provide some slack to draw the stretcher over and back down onto the landing, it posed a serious potential for disaster to occur.

While on the RC, discussions were held about using existing equipment in places like the davits which held the anoxic zone mixers or designing and installing lifting devices for the sole purpose of rescue equipment.

Many ideas were put forth and noted down which would require time to research and contemplate before trying to decide the best course of action.

At the close-out of the second workshop, further discussion on who needs to provide the evacuation solution was raised. FENZ again pointed out that it was really our responsibility to have a good rescue and evacuation option in place that we were comfortable with. They reinforced that they would always attend when called, but they shouldn't be seen as the rescue option, rather the assist option.

3.0 The Proposed Solutions

The different options were tabled and the practicality of each was contemplated along with the estimated cost of each solution.

Primary consideration had to be given to ingress and egress, with the egress being the most important. Overall, the solution had to consider, and be accepted by all individuals who would be working within the structure. Cost efficiency was a secondary requirement which factored potential capital expenditure (capex) and operational expenditure (opex) costs when compared to current expenditure.

Using FENZ and the Westpac Rescue Helicopter was touched on. People had imagined that an extraction from an RC could be done with the use of the rescue helicopter. It is most likely that a helicopter would create a wash of downwind within the tank that would cause a stretcher to end up in an uncontrolled spin. Also, based on the discussions held with FENZ, it was concluded that they could not be listed on an evacuation plan as the sole option for a rescue.

Continuation of having a crane with a man cage as the method for entry, exit and evacuation/rescue was the costliest option. The cost of a crane at $3000 per day soon adds up. Required anywhere from 3 to 10 working days over the 6-week period of an RC overhaul, invoices for up to $20,000 weren't uncommon. Although used to lift equipment and materials into the RC, after a few workers were transported in followed by the materials, the crane then sat onsite mostly unused, until it lifted those workers out again. It also had limitations such as the man cage only being large enough for two people and not designed to carry a stretcher. Should a mass evacuation be required again the crane would take too long.

The use of existing davit arm equipment was excluded as an option as they are designed for a certain purpose, lowering, suspending, and raising a large mixer. Trying to repurpose for an emergency winch would not be appropriate, as it only reached into the reactor, and again had obstacles in the way that would affect the smooth elevation of a stretcher.

New davit/winches or lifting gantry would need to be structurally designed and the potential for extra strengthening of where it would attach to the walkway needed to be evaluated. Similarly, like the other winch ideas, there were obstacles in the way which would affect the smooth elevation of a stretcher, and as noted before, raised concern about a winch being able to provide some slack to draw in the stretcher over handrails and back down onto the landing.

An electrical winch on a gantry system was offered, but guidelines specify that you should not rely on a motor-powered lifting system due to two main factors. 1) the mechanical/electrical system could fail just when you are using it. 2) if a stretcher or part of a human gets caught under a structural element or obstruction, then physical damage could occur to the person. Each RC would need a minimum of two of these designed and installed lifting devices, so the potential capex cost over nine RCs and then ongoing compliance started to become too expensive and time consuming.

Scaffolds with winches and landing platforms was the next option reviewed, which at first, was considered to have merit. The more it was looked at it, and then after engaging an experienced scaffolder for their knowledge and opinion, we realised that it wasn't a simple structure to build and the orientation to enable the operation of a winch to lift a stretcher kept on leaving people with concern.

One long scaffold ramp was suggested, but when the calculations showed the pitch of the ramp due to the depth and available space was too steep, the idea was quashed.

Scaffold tower with stairs was the next solution presented. A structure with flights of stairs and landings spiralling upward (simulating a stairwell in a building) was advocated. Dialogue moved to the risk of people within the RCs having to build the tower. Having restricted evacuation options didn't seem ethical for one group while they were building a safe egress option for others.

The recommendation to overcome this dilemma was building the tower outside the RC, then having it craned into place. Two people could be lifted into the RC via a crane with man cage to place wooden blocks down for the scaffold tower to sit on, and then help guide the structure into place. This would greatly reduce the time needed in the RC and the crane/man cage could be used as a temporary rescue or evacuation route.

The cost of these different solutions ranged significantly. Those which included design and installation of new permanent structures and equipment could have run into the hundreds of thousands across all the RCs and would have had ongoing maintenance and compliance costs. The use of temporary options brought in like cranes were known to cost up to $30,000 per RC. The other scaffold with ladder & platform options ranged up to $7,000. And when the whole period of the RC overhaul was considered all the ingress/egress/evacuation options currently used accumulated to around $40,000.

3.1 Selected Solution

The best practical, and most simple, option chosen was the scaffold tower with stairs.

Two towers would be needed, one for access into the reactor zone and one for the clarifier section.

Building them outside the RC and craning them in, and then out at completion of the overhaul, was the agreed installation method. This met the entry and exit needs of all individuals who would work within the units, reducing time anyone would be inside the RC before a practical rescue option was in place. This option landed midway on expenditure at $20,000 for building, placement, six weeks' hire, removal and dismantle of the scaffold tower with stairs.

The handrails of the RC walkway, where the towers connected, had to be modified to allow a smooth transition from the top platform of the tower stairway onto the RC walkway. The modification produced a removable section of handrail that unclipped and lifted out providing a level transition from scaffold to walkway and could be replaced afterward so the safety provided by the handrail was not compromised.

Picture 5. Scaffold tower with stairs installed in RC.

4.0 TRIAL EVACUATION EXERCISE

In the following week, the scaffold towers with stairs were constructed and craned into an RC that was empty, and clean, and secured in place.

A series of exercises were set up to trial the selected option for both normal entry and exit and for an emergency rescue situation. The exercise was designed to include staff from all phases of the RC overall.

These included onsite operations personnel (shift teams and day plant operators), maintenance delivery staff (supervisors, fitters, instrumentation techs and electricians), admin staff (ops controllers, process engineers and maintenance controllers), contractors used for engineering works and tank cleaning and the evacuation professionals, FENZ and St Johns.

Trial sessions were set at a maximum of eight people per group, ensuring a good mixture of the above mentioned. Two session per day, twice per week for three weeks was planned.

The reason for smaller groups was to make sure everyone’s voice was heard when it came to involvement and feedback. A reduced group size meant the exercise didn’t take too long, to keep engagement fresh, and was also safer with fewer people participating.

Several people from the H&S and operations team, including ops & process engineers, training centre and plant managers, were assigned as the guides for the exercise. The guides all rehearsed the activity so they knew what was involved and had some idea of what queries they might encounter from participants.

On each day of the exercise a briefing was held in a meeting room to inform everyone on the objective of the exercise: trial a new entry/exit and evacuation from a deep tank. The groups were informed of the background and given an agenda before heading out to the RC set up with the trial tower scaffold with stairs.

To execute the experiment with some realism, a pair of overalls had been filled with 80kgs of sand to make a dummy affectionately known as 'Sandy Deadweight'. Sandy was placed on the floor of the clarifier zone pervious to the activity starting.

As the empty, but clean, RC was still considered a low-level confined space, the guides tested the atmosphere before each session and wore a gas detector on their person.

Once everyone had reached the RC walkway, the guides made them familiar with the set-up. Then participants were asked to take the emergency stretcher down the tower scaffold and rescue/evacuate unresponsive Sandy, as though it was a fellow colleague who had experienced a medical event.

The guide would follow the rescue team down and offer direction where needed to help make the process successful and mitigate any actions that may cause harm whilst performing the rescue.

Once at the top of the structure and back onto the RC walkway, the stretcher with Sandy was put down and discussion was held on what people thought of the experience.

The first rescue squad was then asked to carry Sandy down into the reactor zone and the remaining four people were instructed to take the stretcher from the RC walkway and repeat the rescue of Sandy Deadweight again.

Once this rescue was completed, a robust discussion was held amongst the group as to the process as it was, improvements and/or concerns etc.

If any of the group wished to execute the rescue again, they were welcome to, after which Sandy was returned to the floor of the clarifier ready for the next group.

Everyone returned to the meeting room for a final debrief and a chance for the guide to record the feedback and discuss and note any questions raised.

Over three weeks 12 sessions were run involving 109 people made up of: 51 staff, 10 x 4-person FENZ crews, 8 St John medics & 10 contractors. Of the staff involved, senior managers also had a session extricating Sandy to show endorsement of the exercise and that no one was above doing this rescue.

Picture 6. FENZ & WSL staff performing rescue exercise.

4.1 Observations and Results of the Trial

Access into and out of the RC interior has been greatly improved, and now resembled a simple walk down and back up a flight of stairs rather than climbing ladders and traversing through platform hatches.

Taking tools and equipment that are manageable to be carried in and out of the RC work area also proved easier.

Lifting 80kgs on the stretcher was heavier than people expected. Two people couldn't carry this weight comfortably or safely on the stretcher. At least four people were required to adequately elevate and move the 80kg ladened stretcher.

Some participants noted sore hands due to the plastic hand carrying points of the stretcher and the weight imposed by Sandy.

Occasionally some voiced they had medical situations which prevented them from lifting the stretcher and so became observers.

Having FENZ at some of the first exercises was advantageous as they were able to give direction on how the restraint straps of the stretcher needed to be crossed over at the chest and the plastic block at the bottom end of the stretcher was meant for bracing a patient's feet to stop them slipping down the stretcher. Seeing FENZ in action showed how quickly and smooth a rescue via stretcher could be performed, providing an example to follow.

Navigation around the corner of each stairwell platform was tight. If people didn't take their time and communicate with each other, pinch and crush points were created for individuals carrying the stretcher. Four people worked reasonably well although even 80kgs was heavy, six people made the carried weight easier but it was a tighter squeeze around corners.

Where the scaffold connected to the walkway there were some slight height differences and minor gaps which created the potential for a trip hazard, especially when carrying a stretcher and concentrating on that activity rather than one's footing.

The design of the scaffold tower stairwell had structural poles installed across the width of the top and bottom of the stairs at a head height of around 180cm, which caused a potential head impaction hazard for anyone at or above that height.

5.0 Discussion

There were many questions raised over the course of the workshops and exercises.

Although many current processes seemed like an acceptable solution, they may have been more institutional views over time rather than what was practical and achievable for all emergency situations.

Most agreed that the previous rescue/evacuation options were lacking, and therefore a nearly full consensus on a shared approach to performing a rescue was agreed.

What is the best option? Every worksite situation must be evaluated and assessed to find the best option. This tower scaffold with stairs ended up being the best option for our situation.

Having a common and agreed approach is better for everyone as practicing rescues the same way means everyone has the mutual muscle memory of the process.

Some still believed that their existing approach was the better option. Using a crane to place people into and extract out of the RC, including a rescue situation, was the main method that featured in this discussion.

Although the crane option does work, it also has limitations. A single to two-person man cage doesn't allow a mass evacuation and does not work well for taking the stretcher. A larger man cage can be procured but at what size do you stop? In the rare situation, the crane could have a mechanical failure, which creates a potential risk that the tower stairwell doesn't have.

If a crane happens to be at the work site for another purpose and an emergency occurred, if the crane can be used for a safe rescue, then that is perfectly acceptable. One FENZ member commented to that effect, ‘if you are trying to save a life, use whatever means available at the time’.

But for a crane to be the only evacuation option and sit idle every time someone is working in the tank is cost prohibitive.

Should each work group and contractor be separately responsible? This was the existing situation and although some groups utilized the same ingress/egress fixtures in place, it wasn’t really dealt with as a universal evacuation plan and had not been tested together. Having separate plans often resulted in cheaper options which did not really meet the threshold for all emergency situations.

Who is responsible for ensuring a safe entry and exit from a worksite? The person conducting a business or undertaking (PCBU) is responsible. An entity can’t push this responsibility down to others and therefore should not only check but also be involved in witnessing a test of the rescue plan at their site.

The cost of having a structure like the scaffold tower stairway will ultimately fall onto the PCBU. Some funds are saved through not paying different contractors for their individual evacuation options and costs are certainly saved by not having a crane hired and used for just the entry/exit and rescue plan.

You cannot have a large scaffold structure sitting around for months. The 8m tower used in the RC cost $20,000 for six weeks and would cost another $1,500 to hire every week after that. Therefore, an overhaul or project needs to be planned, with float time for unknowns included, to come in on time or risk a more significant scaffold cost than budgeted for.

What is the minimal standard for an evacuation? Having a structure, or more if required, put in place that is accessible, fit for purpose and compliant for everyone is surely the bare minimum. Working with your H&S team to set a standard for minimum access/egress from certain deep tanks is something every facility should undertake. Again, include worker H&S representatives and contractors is helpful to ensure that you consider all aspects of the work required, that you don’t end up creating more bureaucratic processes than necessary, and that you don’t restrict how work can be done such that it costs more for no real added safety gain.

Confined Space or not? As this was an exercise and the tank was clean, it was considered a low-level confined space. However, it was raised that permits were not filled in, as would happen under normal working circumstances, even with a low-level confined space. As it was an exercise, it was felt that this was an extra step that took up precious time so was excluded from the practice. Concerns were also voiced that only the guide wore a gas detector. As the tank was clean and the atmosphere tested before the exercise, it was believed safe and again saved time not having to repeat this with the group.

Not everyone needs to wear a gas detector. In some situations, like during cleaning of the tank, not everyone wears a gas detector as the monitor can get covered in sludge and then cease to operate. After testing the atmosphere and checking the peak levels, hanging a gas detector within the work area has been an acceptable solution to mitigate fouling the devices.

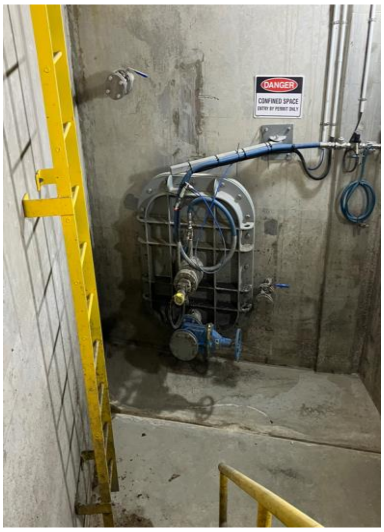
In hindsight, the next time any trials or exercises are run, permits will be filled out and the atmosphere peaks tested with everyone present, so the whole process is run through. This way it becomes the standard way, everyone sees the required process, and we will not have exceptions as this can lead to complacency which is when something can go wrong.

Fitness and/or strength of staff to help lift the stretcher in an emergency was raised. Some humans weigh considerably more than the 80kg dummy Sandy. When the time comes you would be amazed what adrenaline will do when it is a mate who needs your help. But people should not put themselves in harm’s way, even when it comes to a rescue, and that is why you also call the emergency services as soon as possible. If there are not enough able bodies to lift a stretcher out, get the patient onto the stretcher and then follow your first aid training until help arrives, be it the emergency services or more people from around site.

Future design solutions need to consider, where possible, appropriate access/egress engineered into deep tanks. Structure designers do not generally like holes put in their solid walls, especially if it is post tensioned. The cost can also start to rise when these design extras are requested as it is not just the opening in the wall, you also need access down to the doorway if the tank is sunken into the ground as your access point needs to be at the base of the tank.

In addition, you cannot just have one access, you really need one at each end of the tank. However, if you do include these hatchways, it does provide an easier entrance and exit/rescue and evacuation point and means you don't need to build large scaffold towers. Some water reservoirs will have stairways built within the tanks for future access. This is possible as it contains clean water, which is not quite the same with an activated sludge reactor or digester.

Picture 7 & 8. Access hatches designed into large tanks.



6.0 Conclusion

Every facility, or PCBU, has the responsibility to ensure that all people can be rescued from a workplace as quickly and safely as possible.

Performing workshops and exercises that include facility staff and contractors was extremely valuable as everyone had a chance to openly discuss the options and felt incorporated in the process and decision making.

Set a minimum standard for evacuation & recuses that your H&S team, staff, and contractors all agree on that does not create unneeded bureaucratic processes or restrict how work can be done such that it costs more for no real added safety gain.

Practicing the emergency response plans from a confined space and/or any work location is crucial in not only getting staff and contractors involved, and comfortable, but for also validating that the plan works. Not all situations require involving the emergency and medical professionals but getting them acquainted with your site and its hazards is well worthwhile.

FENZ & St Johns involvement was also beneficial as it gave increased confidence with their advice and ultimate endorsement of the selected approach and method and now we have multiple FENZ stations and St Johns crews familiar with the Māngere WWTP site.

With safety in design, make sure the total life cost of the asset is considered, not just capital spend, when it comes to a safe and efficient rescue option of our most valuable resource: our people.

Overall, Sandy Deadweight was rescued multiple times by many combinations of participants, from a variety of staff and contractors to emergency response professionals, in a timely fashion, providing confidence of a the right evacuation option for a successful rescue from the deep RC tank at the Māngere WWTP.

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