Netcare Unitas

Date: 11/02/2016

Document relates to an: Investigation into water quality, chemical buildup and biological concerns at Unitas hospital.

General:

The report pertains to the Netcare Unitas hospital situated in Gauteng, Centurion. It is a 469 bed hospital. Our water is currently supply by Rand Water and distributed by Centurion municipality. We have three bulk water storage tanks, a 14000 liter tank supplying a doctor's wing at the hospital. A combination of a 470 000 liter tank combined with 35 000 liter bulk tanks for hospital domestic (hot and cold) consumption. Our consumption on the main hospital complex averages 200 000 liters per day.

Our concerns relates to:

1. Buildup of scale on heater elements (autoclaves) causing failures.
2. Buildup of scale also increases electrical consumption.
3. Buildup causes breakages of heater elements when the elements need to be taken out to clean the boiler.
4. Replacement of strainers in the autoclave water circuits
5. Replacement of Asco valves (not seating)
6. Replacement of safety valves on autoclaves (sediment causing failures due to valve not to seating)
7. Electrical consumption on the main hot water plant.

The largest consumer in the hospital of water is the CSSD department (Central sterile service department) with 11 autoclaves (including flushes) and 1 ERNA unit.

The main plant chillers are cooled via two cooling towers their consumption is determined by evaporation mainly in the summer time when the units have higher demand. Other consumers include the humidifiers with higher consumption also during summer times.

The hospital has 3 hot water receivers (1 x 15000 liter, 2 x 10000 liter) with heat generation by two Heat pump assemblies and thyristor controlled heating elements as back up. Numerous "hydro" boils situated throughout the hospital and a limited amount of under counter geysers. Air handling units humidifiers also "use" water based on demand.

For the purpose of the trail we compared:

- Pricing
- Availability
- Current systems in use: Feedback supplied by Ferncrest in Rustenburg where a filtration plant has been in operation from the same company supplying proposal for Unitas.
- Ease of installation
- Requirements / maintenance
- Secondary advantages not as a primary concern.

<u>For the purpose we have the following options:</u>

1. Water softener – salt type

   We had previously operated on the salt water type softener. Uses electricity and salt and the unit takes up space also limited amount / volume of water that it can treat unless two units are involved. Salt needed to be check weekly. A water softener is a mineral tank and filled with small polystyrene beads, also known as resin or zeolite these are negatively charge and will change polarity of passing water. The system cannot be used constantly and has to have time to regenerate and charge again before it can be used

2. E-Afrifil - Filtration plant – Netcare Ferncrest

   Feedback relating to a 3 filter filtration plant installed by e-afrifil in Rustenburg. Their system was installed approximately 4 years ago, their hospital consumption equates to 110 000 liter of water per day. The service from e-afrifil is good the color of the water remains constant and there are no odors present. The hospital however still employs water softeners (assume salt type) at the autoclaves.

3. Insight scale controller / Scale watcher – Electronic water descale / softener

   Electronic descale unit was recommended by our autoclave manufacturer and installed. The electronic unit works by sending out a computerized modulated signal which agitates the Calcium and other minerals, causing them to come out of solution and become suspended. The effectiveness of the treatment may vary on the ability to retain the effectiveness of the magnetic field on the particles which “may not be far”. Parameters for the effective operation is the type of pipe, flow, TDS and diameter of the piping, it would be fair to say should any of these change the effectiveness will change.

   Scale watchers - effects

- Ridding the system of lime scale
- Reverses corrosion into a magnetite layer
- Will rid the system of Legionella’s disease due to riding the system of lime scale as this is where the disease breads.
- Riding your system of black mold and thus algae should also be certainly removed

- Savings on electrical of 1mm of lime scale to 7-10% more energy usage on elements in boilers and on pipes due to pumps having to work harder to push the same velocity of water through a smaller size pipe
- As much as 80% water savings on cooling towers for blow downs.
- No more chemicals are required to soften your water.
- You can use our technology to keep the pipes in air-conditioners clean and sterilizer machines working at their optimum
- Can be used on Dishwashers, washing machines, coffee machines etc.
- Maintenance free and should work for 20 years plus
- Easy maintenance with no intrusion or cutting of pipes
- Protection of investment of equipment due to corrosion
- Can work with high TDS such as sea water and as high as 50 000 TDS levels
- The original descaling technology.

4. Nimbus O – Zone enrichment water

   It is the most powerful water sanitizer available for domestic and commercial use. Is up to 3000 times faster acting than chlorine, yet leaves no chemical residues in the water. The only by-product from the sterilizing process is Oxygen. Rapidly kills bacteria, coliforms, viruses. If correctly applied, Ozone is also effective against Giarda and Cryptosporidium cysts. Is effective for the removal process of iron, manganese, organically-bound heavy metals, cyanides,(some), phenols and some other organics. Does not require the water to be clear to be totally effective. Can eliminate the use of sanitizing chemicals in your water supplies. Is a completely natural products that is produced on-site from electricity and air. Running costs are very low (about the cost of a 100 watt light for the ozone generator depending on size). It is tasteless, odorless and pH neutral but would require a process plant and power.

5. Wellan ring – Fixed harmonic control

   The ring is constructed of pure Aluminum, proportionately of silicon which can be used to create the ring specific frequencies to compensate for the chemical analysis of the water and neutralize the charge of the molecules. This in turn prevents additional ionic bonding of chemicals to create new substances.

   Wellan ring - effects

   Ridding the system of lime scale.
   The frequency patterns loaded onto the silicon in the ring cancels out the frequency pattern of the rust molecule making it dormant so the rust cannot form. Any rust that is accumulated in the system is then broken down by the energy field.
   Legionella is formed by water standing. By energizing the water we stop any threat of legionella disease forming. Taking out Lime Scale completely also solves the problem. The ring also takes out e-Coli.
   Frequency patterns/energy field lazered into the silicon in the ring – removes black mold and algae
   Lime scale deposit of 3mm requires a 25% increase in the amount of energy required to heat up a constant amount of water to a set temperature within a certain amount of time. The ring system removes all lime scale so greater energy savings are experienced. The elements and

boilers become cleaner and work more efficiently and last Longer. The boiler also need less maintenance and therefore you have less downtime and save more on costs.
Cleaner water going to the cooling tower means the cooling tower works more efficiently saving more cost on downtime and maintenance.
No chemicals, salts, filters, magnets or power supply is used in this system. It is known as gentle green technology. It is maintenance free because it is a solid state design.
The Ring technology keeps any appliance free of the impurities therefore it is ideal for keeping air conditioners cleaner and sterilized

Maintenance Free – Product will continue to work as it is solid state product. Has been fitted Worldwide for over 20 years.
NO Maintenance – no cutting of pipes. Ring splits in half and wraps round the main pipe. Installation takes 5 minutes and starts working straight away
Protection of investment of equipment due to corrosion. Again protection of investment due to the fact we remove all elements of rust – thereby reducing the risk of corrosion to pipes, pumps, equipment etc.
Works with all TDS levels
Wellan 2000 is of German invention and manufacture and is a global company and has been operating worldwide for over 20 years. In the Technical Brochure you will find examples of installations, case studies etc.. We have testimonials for your perusal. The products are used throughout Residential, commercial, industrial, manufacturing, mining, farming, hospitals, worldwide.
The Wellan technology is being continuously developed to combat the changing characteristics of the world's water supplies. This product is not just a Lime Scale remover – it is a world class Water Purifier. We remove the risks of known impurities, Lime Scale, Algaes, Rust, eColi, Legionella. The Water is also energized to a greater level than Himalayan water, which is reputed to be the most energized water in the world. This is very good for our bodies and our health. It is agreed that the quality of the water is much improved whilst keep the pH level at a balanced level which again is good for the human Body

Exercise 1

During the planning phase of the theater complex and CSSD we made an attempt to increase the theater sizes and CSSD flow. This meant that we removed the "dirty" passage behind the theaters. The old type water softeners (salt type) was situated in the passage and had to be removed due to this request. We accepted a recommendation from our autoclave manufacturer to install electronic descale controllers (Insight). We installed 4 units 2013 to 2014 during the theater and CSSD project.

After the installation we had several heating element failures on the autoclaves. During this time we had several opportunities to inspect the elements being removed and the condition of the boilers. Initially the cause of the failures was contributed to "dirty water" and calcification and scale buildup. After further investigation it was found that the elements were of an inferior quality and all blown elements were replaced free of charge.

Throughout the period we noted there was a buildup of scale on the elements. Our concern was conveyed to the supplier of the “Insight scale controller” to verify the installation. The vendor installed the installations and confirmed that all were installed correctly (Only a slight adjustment to one units coil was made).‘An additional supplier has emerged and according to the supplier they are the company that patented the technology. Their product is the “Scale watcher” and “works” on the same principals as the “Insight scale controller”. When doing a design or trail they require the Schematics, water Flow, TDS, pipe diameter, pipe material and a brief description of actual issues experienced and where in the process to ensure we are clear about where to place the units strategically. The unit uses power with a 5 year warrantee on the electronic components. No mention is made to the extent of the treatment (length of piping treated).

Our investigation intensified due to the replacement of Safety valves, Asco valves and strainers. After further discussions with the autoclave manufacturer we agreed to install an inline filter to ensure no solids (scale, calcification or rust particles) could reach the boiler or the elements. Due to concern we initiated a weekly blow down of the boilers to minimize the buildup in the boilers of the autoclaves. The autoclave manufacturer also had a 2 weekly cycle where they visited the hospital for routine inspections where they also initiated blow downs.

On the 05-11-2015 we installed our first trail of the “Wellan ring” on the CSSD water supply pipe.

Exercise 2

Part of the Burger Radiologist upgrade included a new air handling unit. Less than a year after the installation our plant room was flooded. The cause of this had been calcification inside the humidifier causing obstruction to the drain valve causing seepage which the drain could not accommodate thus flooding the plant room.

During the investigation by Luft technik they took photos of our air handling units humidifier tanks to indicate that it was water and hospital related.

Trauma Theater

Trauma Unit

Theater 11

Theater 8

Theater 7

Theater 6

Theater 5

Theater 1

Theater 2

Theater 3

Theater 4

We opened the humidifier for the radiology unit and took photos.

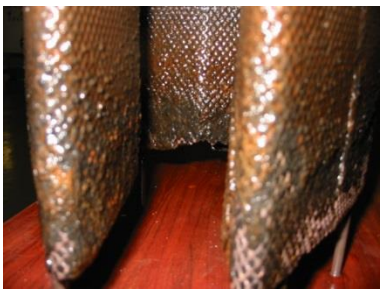
The calcification was clearly visible. The “scale” and debris in the container was hard and did not disintegrate when dried out. Note: humidifiers only fill when humidification is required varying the amount of water exposed to the element for steam generation. Once humidification is reached and stabilized “dumps” the excess water and fills again when required.

There is no real manual intervention which can be applied. Only other option would be to disengage the humidification but that would contradict the operation.

A hospital request to isolate the “theater 18’s” autoclave, offered a “solution” to the problem and a way to confirm our opinion about the affectivity of the electronic scale control. We installed the autoclaves unit on the humidifier in question. Unit is suitable to a pipe size of 20mm outside diameter.

Theater 18’s unit installed

Coil connected and installed as it was removed



Elements soaked in pool acid solution to clean before trail commences

We did a visual inspection end of November 2015 without opening the humidifier looking at the deposits collected on the inside of the tank. Could not verify any change in the condition of the buildup.

Exercise 3

Proposal 1 e-Afrifil – Filtration plant

During the initial planning phase of the hospitals bulk water tank we included a filtration system. The system was proposed to be installed in the main water supply.

The system included:

1. Sand, Carbon, Softener, Brine tank.
2. UV Sterilizer
3. Automatic backwash

Advantages:

According to the supplier the unit would be able to soften the water supply. Supplied the required information regarding water consumption and the supply pipe size.

Advantages would also include disinfectant properties ("killing" bacteria).

Constraints

Could not confirm the "extent" of the treatment.

UV light has to be replaced yearly

Filters must be replaced regular

Electrical supply need to be available

"Space" required for installation

Would not be able to do a trail due to determine the viability of the installation. This due to the size and how the filtration plant needs to be installed.

Proposal 2 Wellan – Ring

Advantages:

- Hassle-free installation
- Completely maintenance-free
- Guaranteed for 10 years with Zero Cost of Ownership!
- Works regardless of whether water is flowing or not
- Saves on energy costs
- Doesn't require chemicals, electricity, magnets, or filters
- Saves you money on cleaning agents
- The energized water assists in keeping your taps, sinks, shower heads, toilets, fittings, etc. cleaner (significantly reducing the need for abrasive cleaning products)
- Your shower glass and shower tiling will become free of lime scale stains
- Dishwashers, Washing Machines, Irons and Kettles will perform more efficiently and their components will last longer

- Your Geysers and elements will perform better and last longer - saving you money
- Calms the water so that is gentler, leaving your skin smooth and your hair soft
- Gentle technology, meaning that your water is treated without harsh chemicals
- Energizes, revitalizes, and detoxifies water
- Prevents the growth of algae and germs
- Neutralizes some of the harmful bacteria in the water
- Dissolves lime scale and rust deposits in piping and machinery
- Reduces lime scale build-up
- Improves water pressure in pipes that are susceptible to rust

After a discussion with the “Wellan Group” we were offered a trail. We discussed the option with the project team (Bulk water project) and the mechanical engineer. He would then leave “room” for a filtration plant and funds to install the filtration plant if the trail did not have the desired effect. He will also evaluate the product (He did contact the supplier and verified the trail and information) and ensure that he is satisfy the results as “proof” of a successful trail and to be able to support his recommendation which ever it might be. We had taken water samples of the municipal supply water and two other areas (Plant room feeding radiology AHU and the first “tap” from the supply side). The samples where tested for biological and chemical agents by “Swift Siliker” – water testing the results was send to for perusal by the mechanical engineer. A water sample was also send by them to America by Wellan. The ring is “compiled” taking in account the composition of the chemical analysis of the specific site.

We commissioned the bulk water storage container on the 4th December 2015. Wellan representative came to site and did their installation on the 8th December 2015. I was present and it took 8 minutes to install the ring.

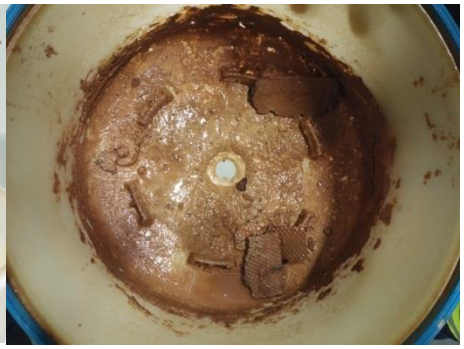
After the installation we stopped (switched off) the electronic scale control units in the hospital supplying water to the CSSD and the Radiology department.

Result:

On the 15th December 2015 we experienced leaks in the hot water as well as a leg feeding the nursing managers department. These were pit holes which started to leak. The coincidence between the installation of the Wellan ring and two leaks at the same time after the installation might indicate that sediment is being dissolved in the reticulation lines. The smaller diameter pipe in the nursing manager office stopped during the investigation.

We opened the humidifier of the Radiology department to do a visual investigation and although not in the hot water line it was in the same vicinity as the other effected pipes.

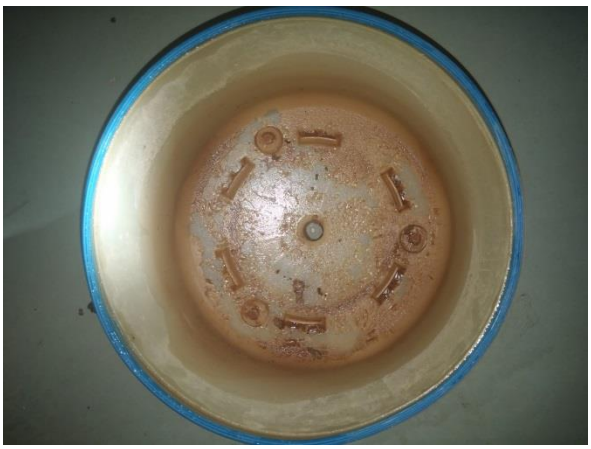




We already noted an improvement. Due to the extent of the trail and the fact that I want to see the result in the boilers of the autoclaves (We removed approximately 2 Kg worth of hard scale from every boiler during very service) I had requested our handyman which does the blow downs on the autoclave boilers to suspend that operation so that we might collect and measure the buildup. We had to replace a discharge valve, due to the fact that the remaining material in the boiler is much finer in texture it now moves easier but also creating a grinding media wearing the seating in the valves. Where high volume, pressure release takes place the “damage” prevents the valve from closing properly. Due to this we will start regular blow downs again so that the bulk can be flushed by means of a manual valve.



As the trail was drawing to a close we opened the humidifier of the radiology unit to do a visual inspection.



The results speak for themselves. It also became apparent the amount of damage that is being caused by the calcification as well as the corrosive action to the elements. I had also taken photos of the humidifier tanks in the plant room as comparison to the previous ones that had been taken by Luft Technic.

Theater 11 the tank became brittle we suspect heating and reheating on the calcified areas caused the damage.

Theater 3

Theater 7

Theater 6

Theater 8

Theater 5

Theater 8

Trauma operating theater

Casualty

Theater 2

Theater 1

Please note that theater 1 we are waiting for a humidity sensor, Trauma and casualty units hardly ever work (due to demand) and theater 8 Pc board is faulty and theater 11's tank need to be replaced. The condition of the remaining humidifier tanks theater 2, 3,4,5,6, and 7 are functioning. The discoloration of the tanks is gone as well as the residual marks from previous calcification buildups.

We opened autoclave no 3 to investigate.

The amount Residue

Residue soft in nature and exposed to sun dries to powder

Residue removed

The residue on the elements was soft and we wiped it off with a rag. Once drier we used compressed air to remove the rest of the powder.

Residue wiped off

Condition of the element after being wiped down

Elements after being dried in the sun and blown down with compressed air.

Conclusion:

I would like to note that we have not had the same success with the "electronic descaling" device as Netcare Blaauwberg Hospital. Contributing factors may include the fact that their device might be in a closed system where the concentrations does not vary. It may also be the operating temperatures of the water being treated are "low". It could be that our units were inferior and even installed wrong (Although the installation was verified). The units that had been installed had also been installed even within a 6 meter distance from the autoclaves.

The "water" that we are having issues with is heated to boiling point and evaporation of water takes place leaving residual elements in the water which increases in concentration thus the buildup / scaling.

From our trail (Wellan ring) we can only observe and confirm some of the advantages. The installation is seamless no additional cutting into existing piping, no power requirements (only requirement is that it need to be installed more than 300mm from any induction source and a water sample). When Wellan refer to maintenance-free, it is exactly that. Scale buildup reduced significantly in the humidifiers and the autoclaves.

We did not have to ensure:

- Regulated power source has been installed if not available.
- The power has not tripped and is "on".
- Unit must be installed where it can be observed at any given time.
- Whether an electronic component has failed without giving indication on the unit.

We have seen the effect of hard scale dissolving in powder. We can safely assume that our electricity consumption has gone down (because not individually monitored cannot provide proof but it is a fact that congested elements and piping do absorb more energy before the effect can be noted).

This would also mean that the restriction in our hot and cold water reticulation system is less thus increased pressure and flow (Our booster assemblies will work less). I have made the decision to move the ring to the primary side of the bulk (470Kl tank) thus the treatment will start from the municipal supply and would include the "treatment "of the bulk tank and the lifting pump set. We currently treat / clean our bulk water tanks once a year for algae etc. If the results stay as positive continued this treatment can be re-evaluated.

The extent of the hospital piping exceeds 2,5 km of piping, although the concern for the hot water reticulation is reduced due to the fact that the ring feed brings the hot water in contact with treated water in the receivers propagating treatment, this does however not happen with the cold water circuit. Thus we will have to investigate the effect at the end of the cold water circuit, installing secondary rings closer to the end of the circuit.

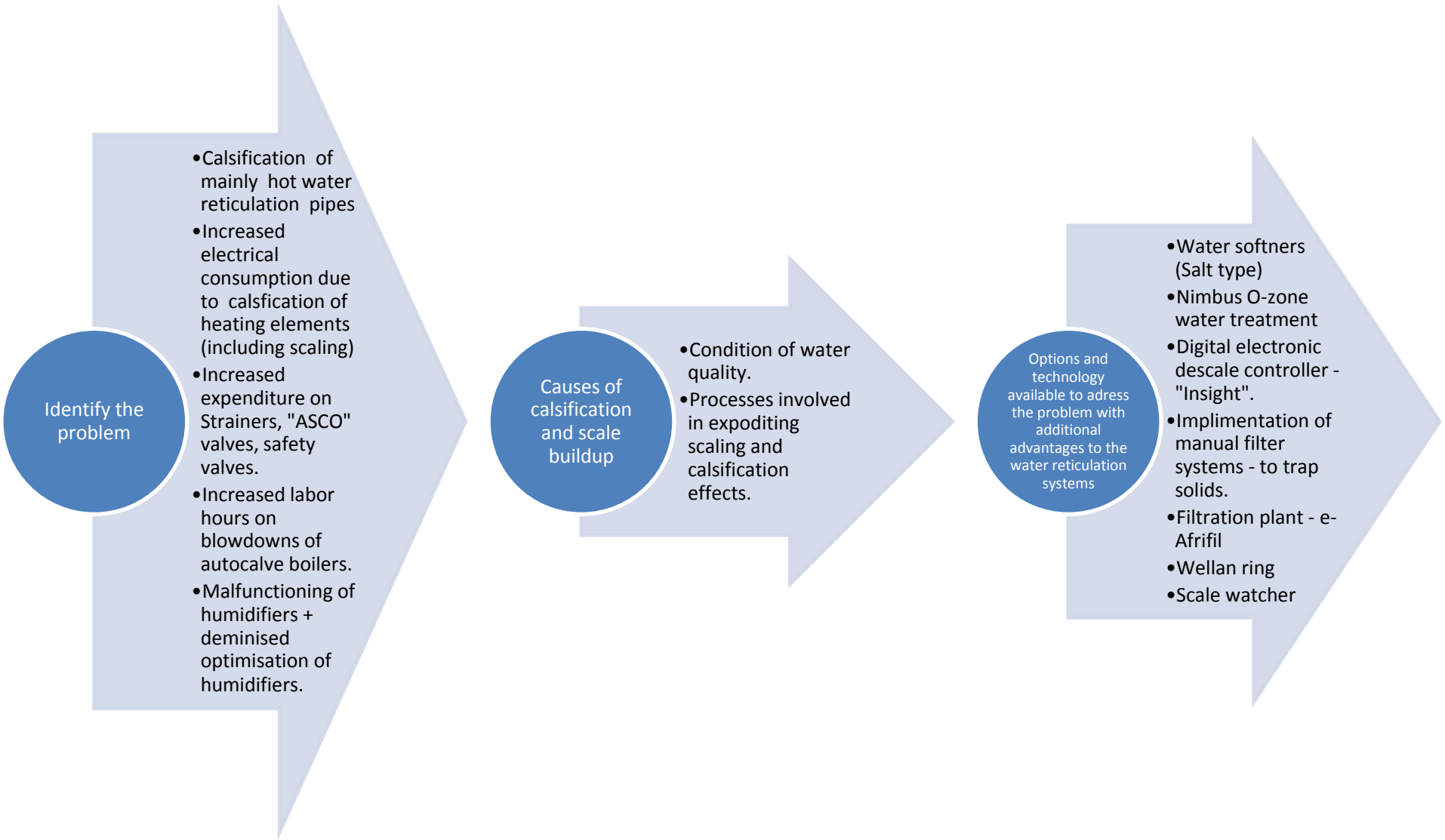
The biological component also in terms of the bacterial and fungal growth cannot be verified as our tanks had been cleaned.

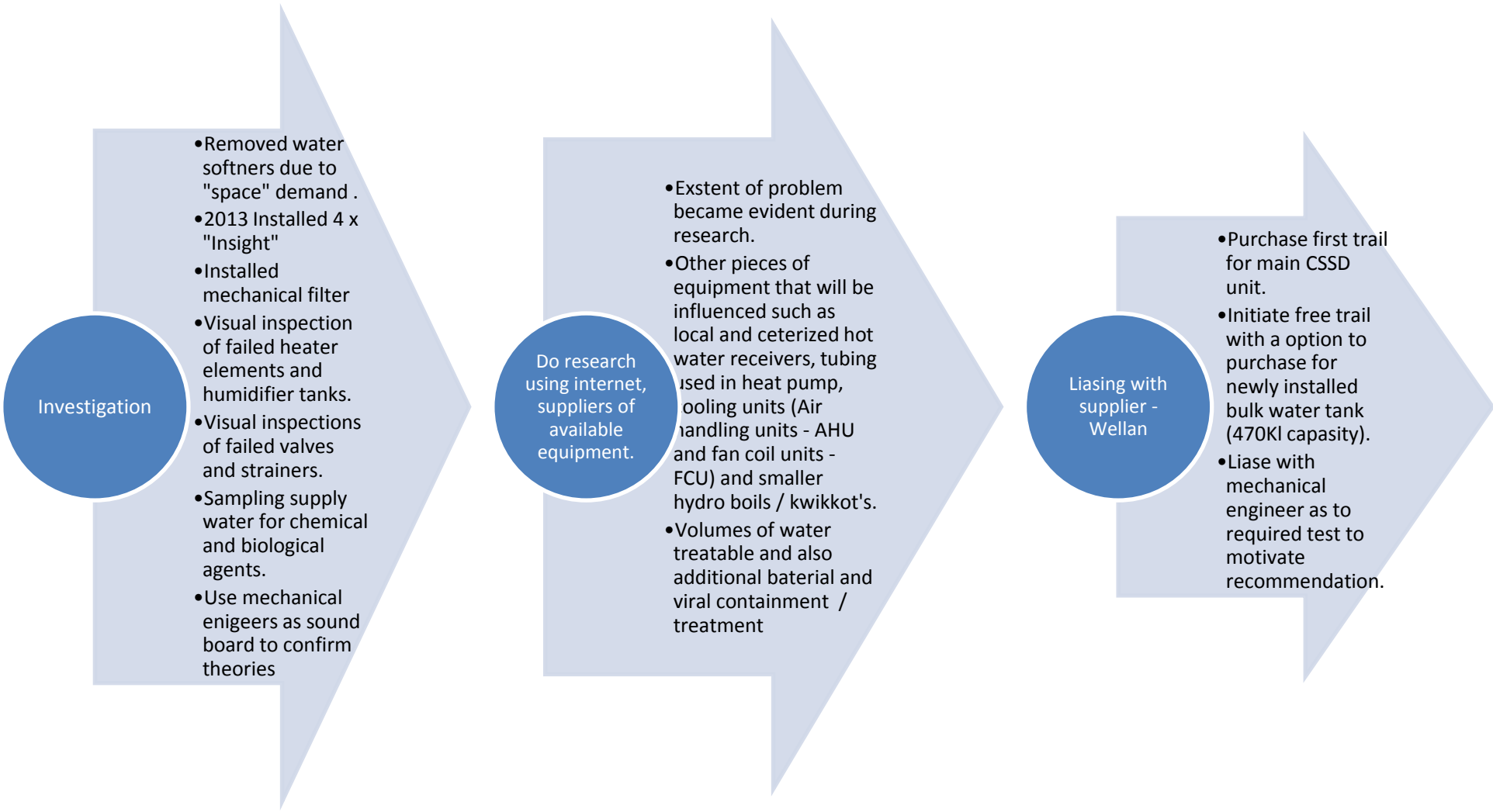
The true test of the system will be in the results of chemical analysis of the water. The result will indicate the **same amount** in chemical composition or even **higher** values. This would indicate that the chemicals do not adhere to piping, elements etc. or causing ionic bindings forming complex molecules / structures.

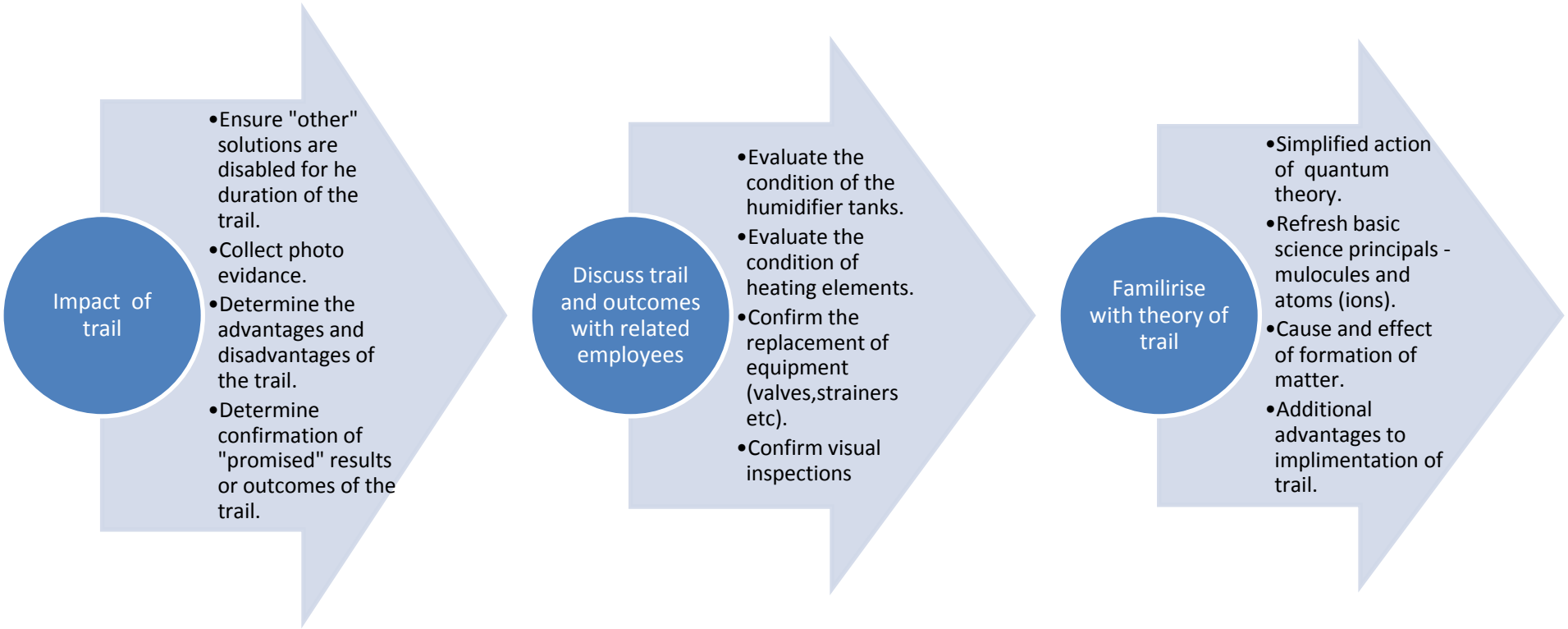
It also important to note that based on the pricing supplied end 2015 there was a significant saving between the Filtration plant installation R345, 000.00 and Wellan installation R80, 000.00. Thus a saving of R265, 000.00 (Excludes future electricity use, filter changes and UV light replacements). Latest pricing with increased tariffs need to be verified.

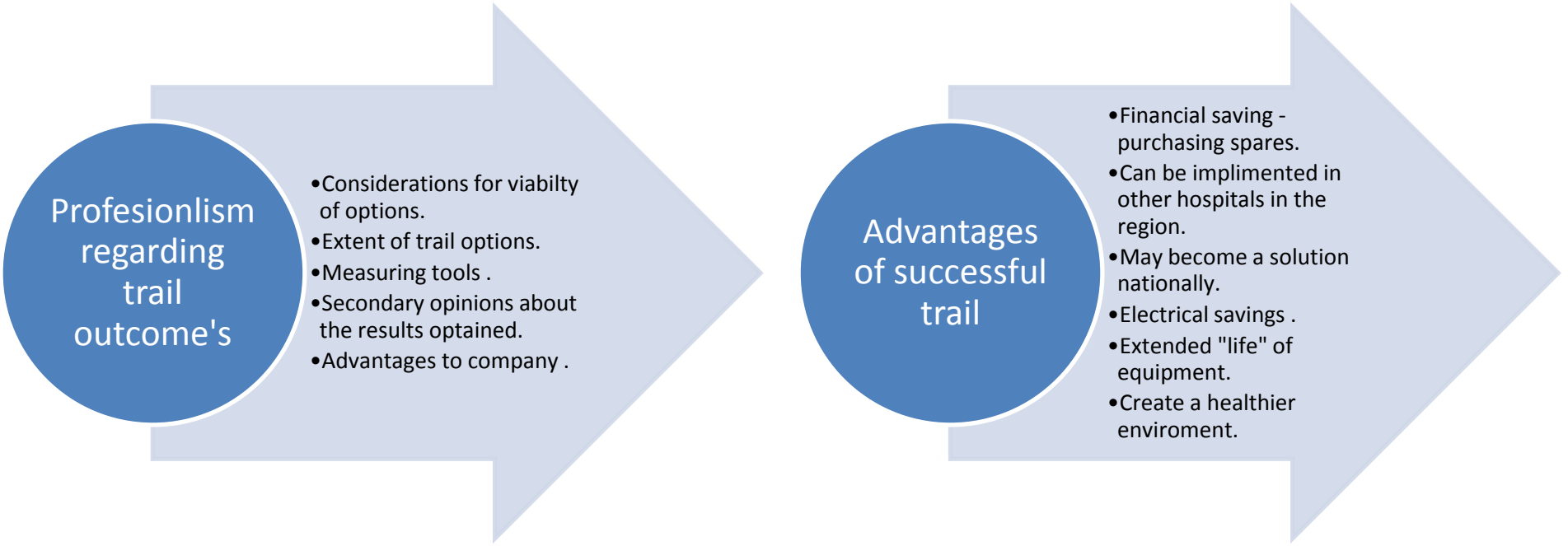
Based on the results of the trail I recommend that we "purchase" the trail for continued use at the facility. As mentioned in addition we can consider extending the investigation to confirm the "treatment" at the furthers end of the cold water system if additional rings are required due to the treatment range.

Assessment					
Installation for consumption confirmed Afrifil and Wellan	Maintenance cost	Electricity consumption	Life cycle cost	Capex – Approximate values without escalation	Life span
e-Afrifil	UV lights, filters, electronic components	3.5 Kw / 13Amps	Electricity, filter and lamp replacement – In 5 year cycle excluding escalation R163,455.00	R396,000.00 – includes years service	Sand / softening resin – 5 years Carbon – 2 years 3 x UV lights – yearly Filter - yearly
Insight / Scale watcher	Electronic components	Not available	Electricity	R11,000.00	5 year warrantee
O-Zone "Nimbus"	Filters, valves, injectors, electronic components	517 watt - constant	Filters, injectors, valves, electricity	Not available – plant erecting – to be included	"Many years"
Wellan 2000	None	None	None	R80,000.00	10 year swop out warrantee


Identify the problem
•Calsification of mainly hot water reticulation pipes
•Increased electrical consumption due to calsfication of heating elements (including scaling)
•Increased expenditure on Strainers, "ASCO" valves, safety valves.
•Increased labor hours on blowdowns of autocalve boilers.
•Malfunctioning of humidifiers + deminised optimisation of humidifiers.
Causes of calsification and scale buildup
•Condition of water quality.
•Processes involved in expoditing scaling and calsification effects.
Options and technology available to adress the problem with additional advantages to the water reticulation systems
•Water softners (Salt type)
•Nimbus O-zone water treatment
•Digital electronic descale controller - "Insight".
•Implimentation of manual filter systems - to trap solids.
•Filtration plant - e-Afrifil
•Wellan ring
•Scale watcher


Investigation
•Removed water softners due to "space" demand .
•2013 Installed 4 x "Insight"
•Installed mechanical filter
•Visual inspection of failed heater elements and humidifier tanks.
•Visual inspections of failed valves and strainers.
•Sampling supply water for chemical and biological agents.
•Use mechanical enigeers as sound board to confirm theories
Do research using internet, suppliers of available equipment.
•Exstent of problem became evident during research.
•Other pieces of equipment that will be influenced such as local and ceterized hot water receivers, tubing used in heat pump, cooling units (Air handling units - AHU and fan coil units - FCU) and smaller hydro boils / kwikkot's.
•Volumes of water treatable and also additional baterial and viral containment / treatment
Liasing with supplier - Wellan
•Purchase first trail for main CSSD unit.
•Initiate free trail with a option to purchase for newly installed bulk water tank (470Kl capasity).
•Liase with mechanical engineer as to required test to motivate recommendation.


Impact of trail
•Ensure "other" solutions are disabled for he duration of the trail.
•Collect photo evidance.
•Determine the advantages and disadvantages of the trail.
•Determine confirmation of "promised" results or outcomes of the trail.
Discuss trail and outcomes with related employees
•Evaluate the condition of the humidifier tanks.
•Evaluate the condition of heating elements.
•Confirm the replacement of equipment (valves,strainers etc).
•Confirm visual inspections
Familirise with theory of trail
•Simplified action of quantum theory.
•Refresh basic science principals - mulocules and atoms (ions).
•Cause and effect of formation of matter.
•Additional advantages to implimentation of trail.


Profesionlism regarding trail outcome's
•Considerations for viabilty of options.
•Extent of trail options.
•Measuring tools .
•Secondary opinions about the results optained.
•Advantages to company .
Advantages of successful trail
•Financial saving - purchasing spares.
•Can be implimented in other hospitals in the region.
•May become a solution nationally.
•Electrical savings .
•Extended "life" of equipment.
•Create a healthier enviroment.