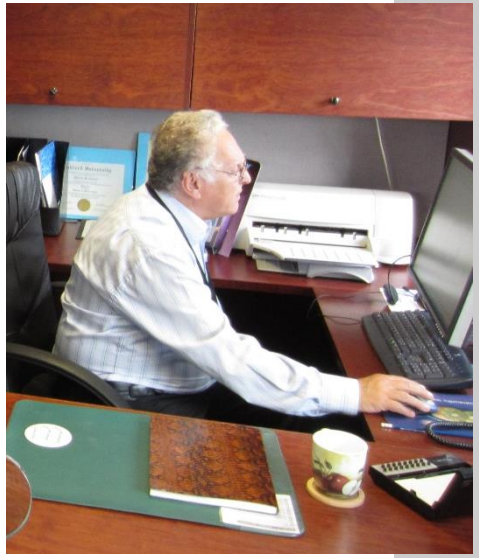
HYDROPATH

THE COMPANY

Hydropath was started in 1992 by Dr. Danny Stefanini who, based on his theory of crystallisation, developed the first prototype model for treating limescale within the home.

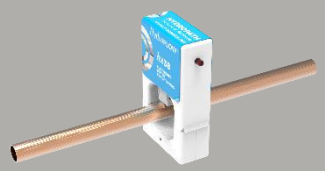
An early model extensively tested by British Gas Plc at their Watson House Research Station and in the Regions. This showed they could save tens of millions of pounds per year in reduced maintenance. As a result British Gas venture capital partners invested in Hydropath. The investment has since matured, but the commercial relationship continues with British Gas.

The investment allowed the expansion of the company and the development of new products and applications.



UNITS FOR ALL SIZES OF PIPES

The same patented technology is used in all of our units:

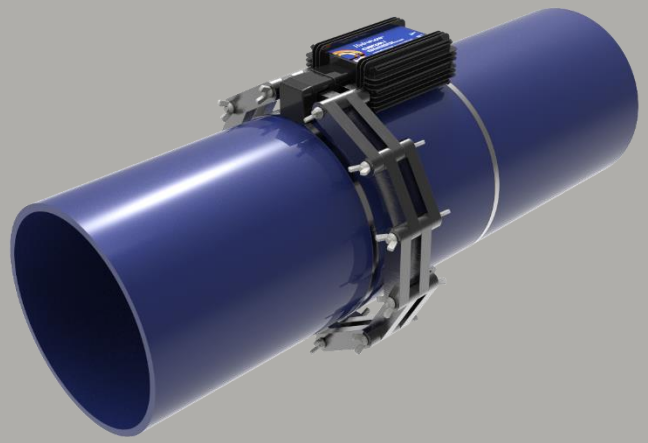


38mm

1 1/2”

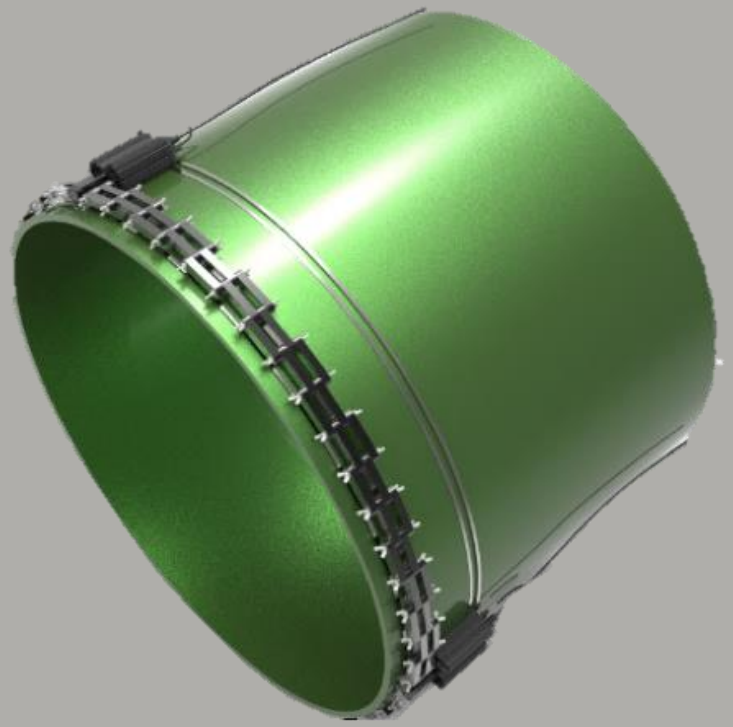
100mm

4”



250mm

10”



1.5m

56”

INDUSTRIES

OUR GLOBAL NETWORK

WHAT WE DO

APPLICATIONS

Prevention and Removal of Limescale

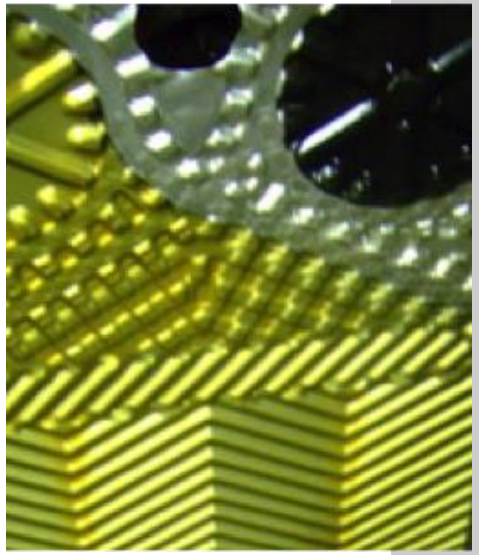
- Increased cooling efficiency
- Lower maintenance costs

Algae and Bacteria Control

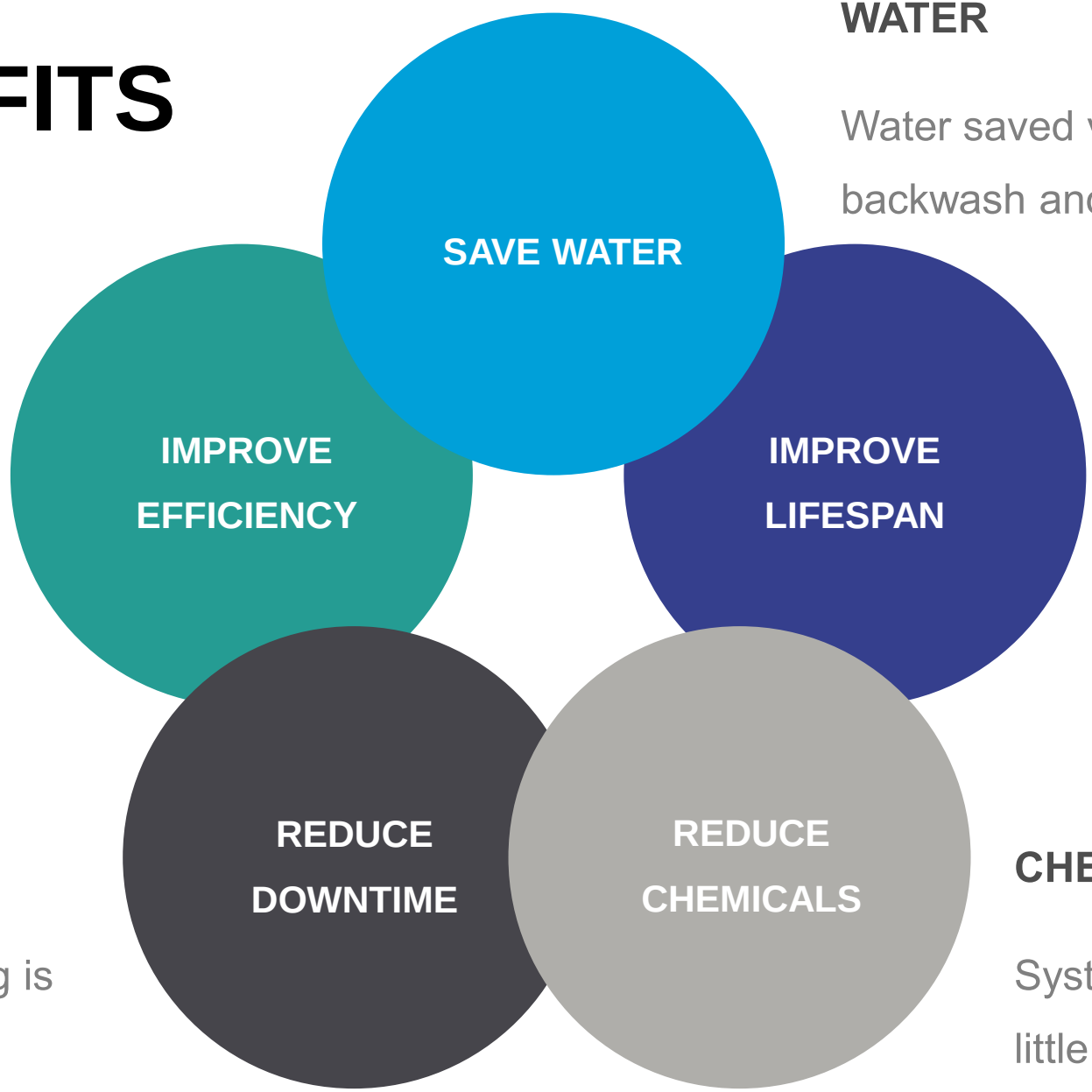
- Prevention of biofouling
- No biocides required

Flocculation

- Flocculation
- Reduction in backwashing



KEY BENEFITS



WATER

Water saved via reduced backwash and increased cycles

EFFICIENCY

Heat transfer improves and pipelines become clearer, saving energy

EQUIPMENT LIFESPAN

Equipment works more effectively and lasts longer

DOWNTIME

Downtime for cleaning is less frequent and cleaning becomes easier

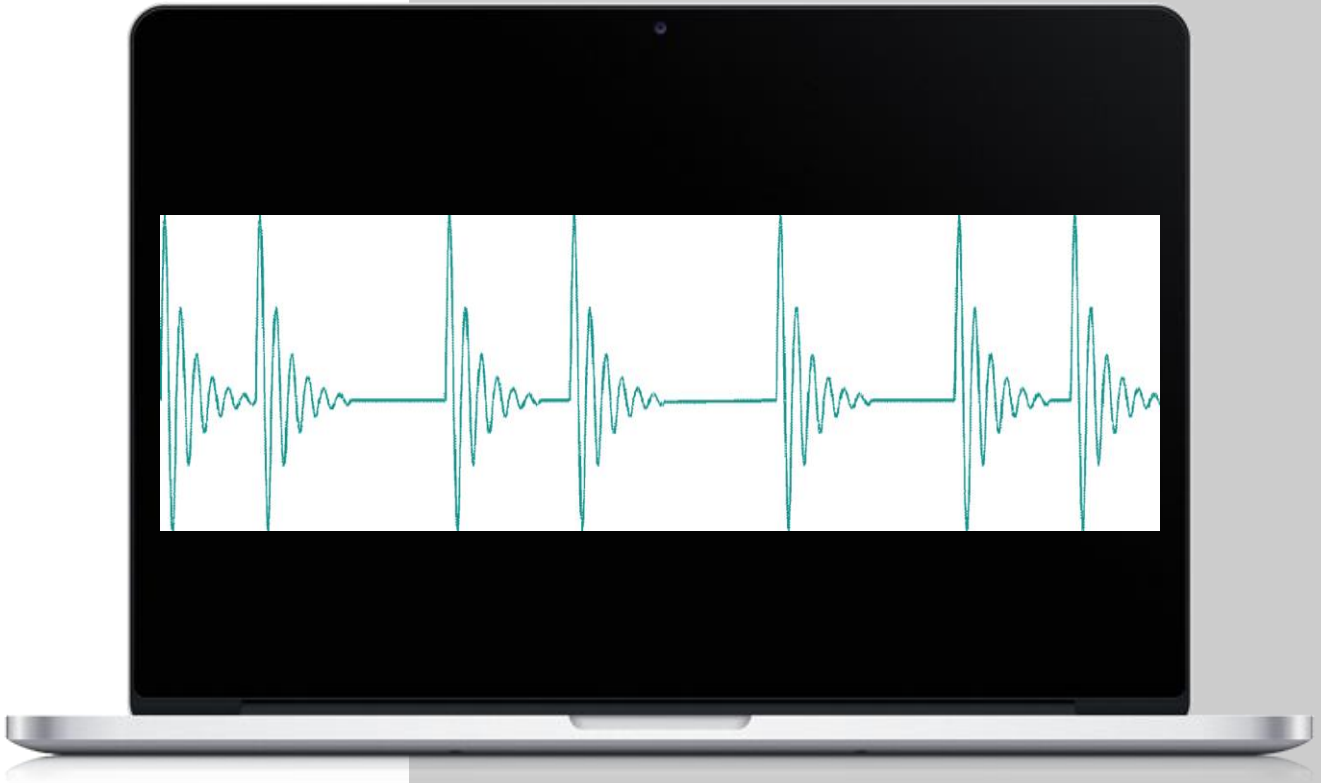
CHEMICALS

Systems are protected with little or no need for harmful chemicals

THE HYDROPATH SIGNAL

THE HYDROPATH SIGNAL

- The Hydroflow signal is a decaying sine oscillation
- Around 120 kHz
  - 2000 times faster than mains!
- Pulse separation time varies to work in a range of situations
- Extremely low power
  - **1.2 W domestic (£1.50 /yr)**
  - **~20W Commercial**



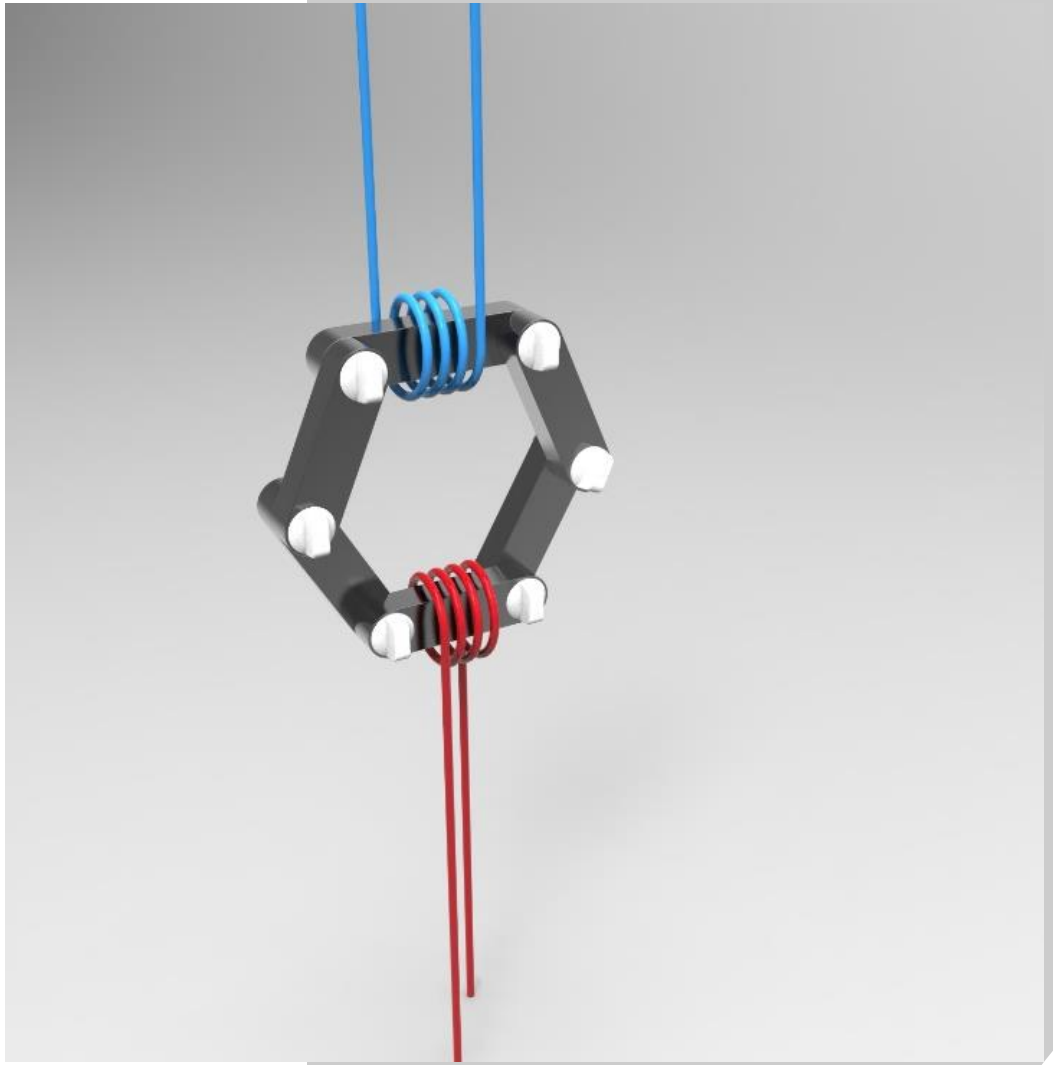
APPLYING THE SIGNAL

How do we get a signal into the pipe?

Start with a transformer…

Make secondary single loop…

Make loop bigger...



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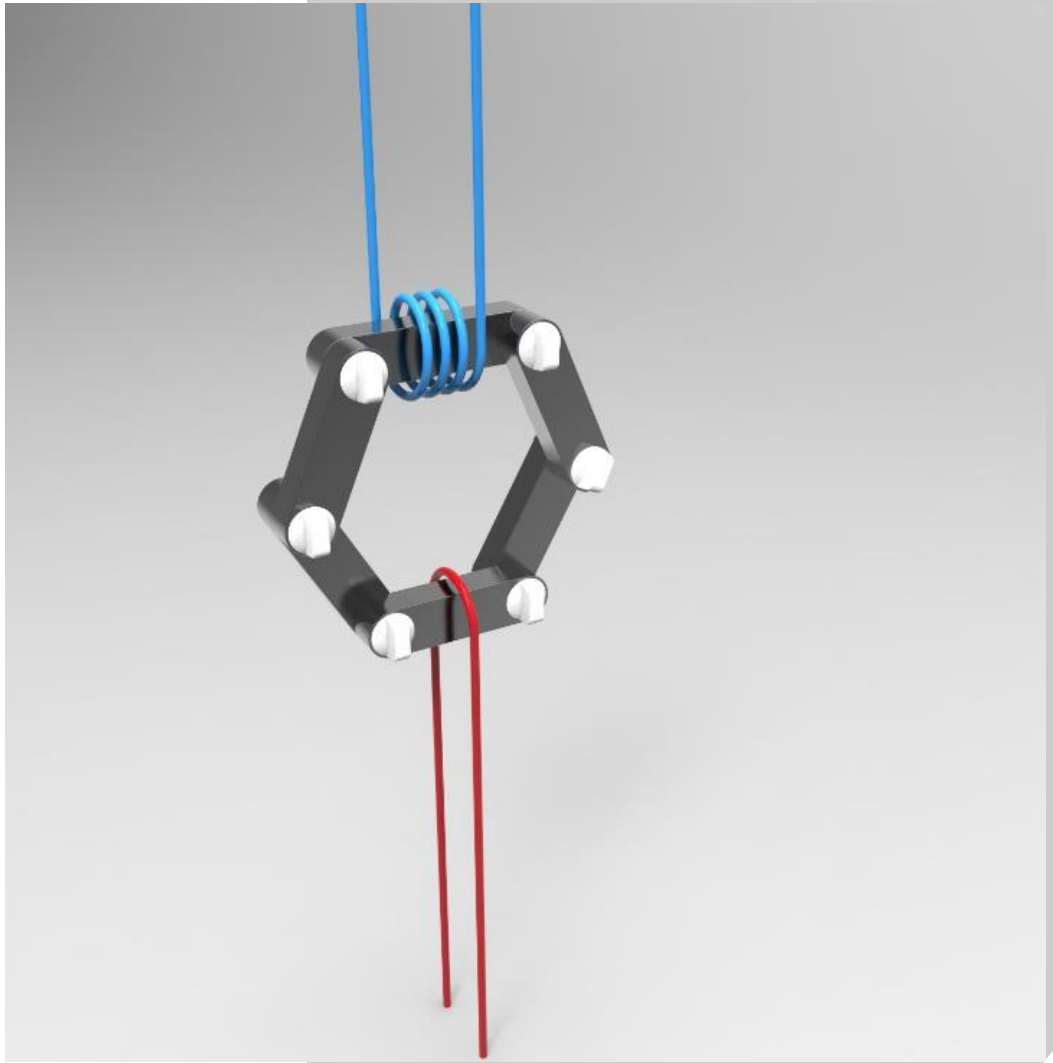

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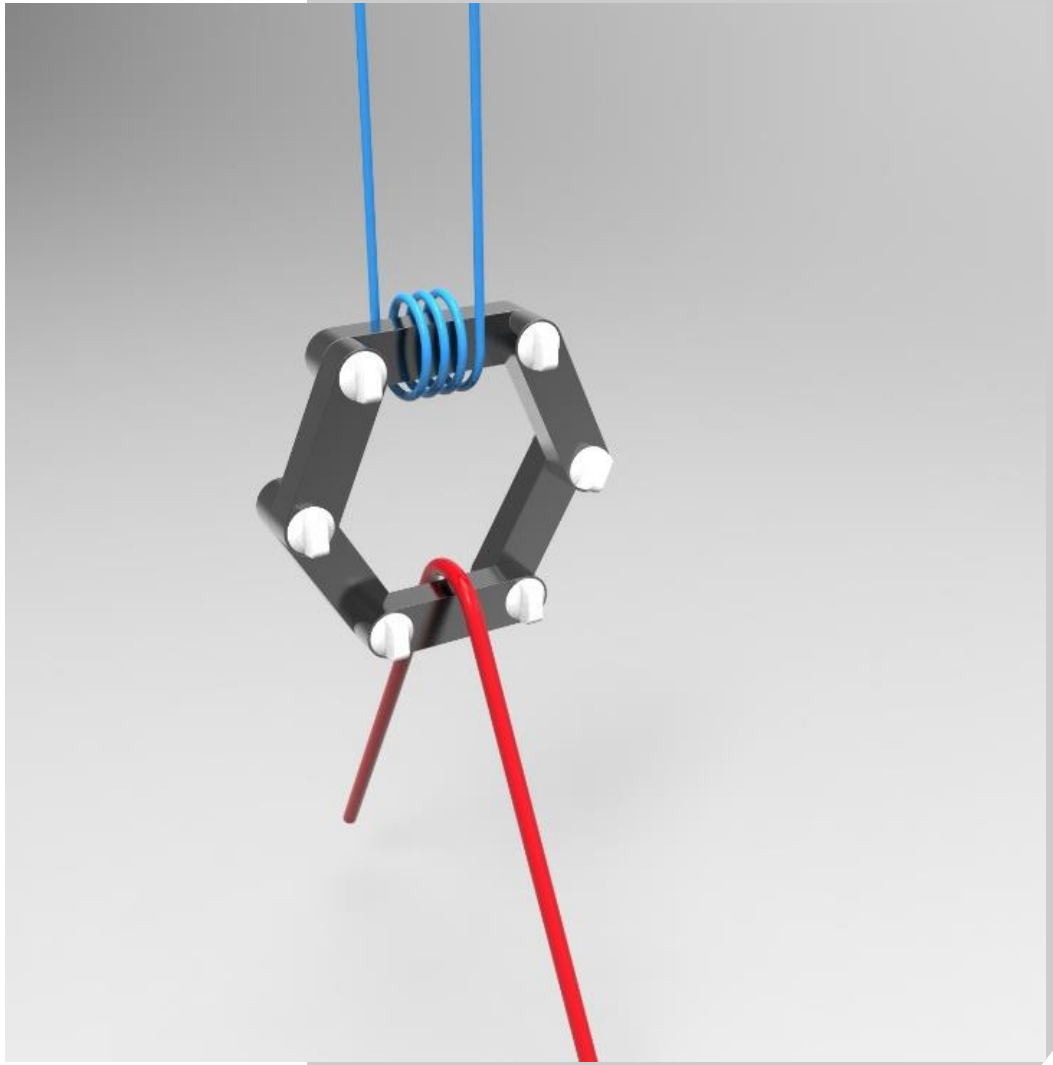

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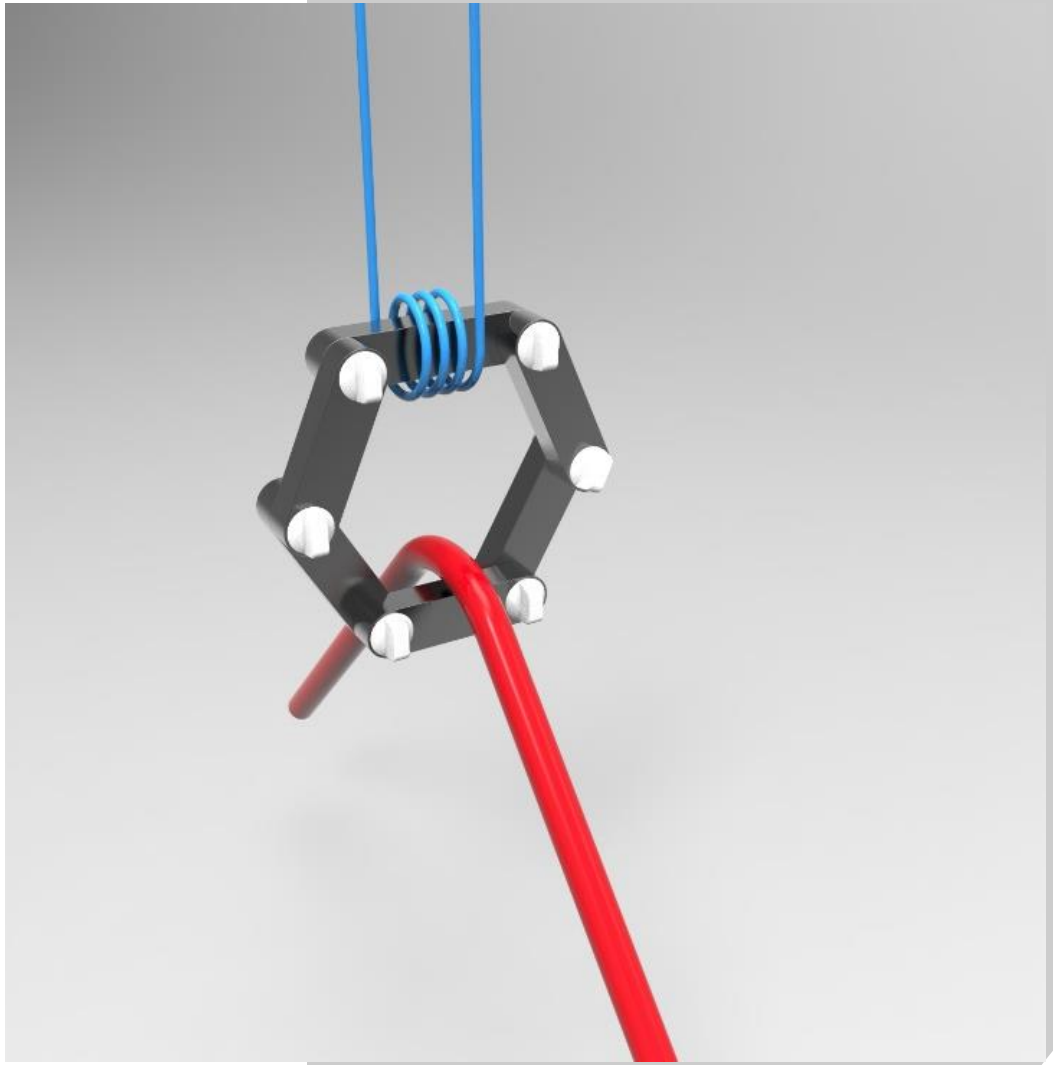

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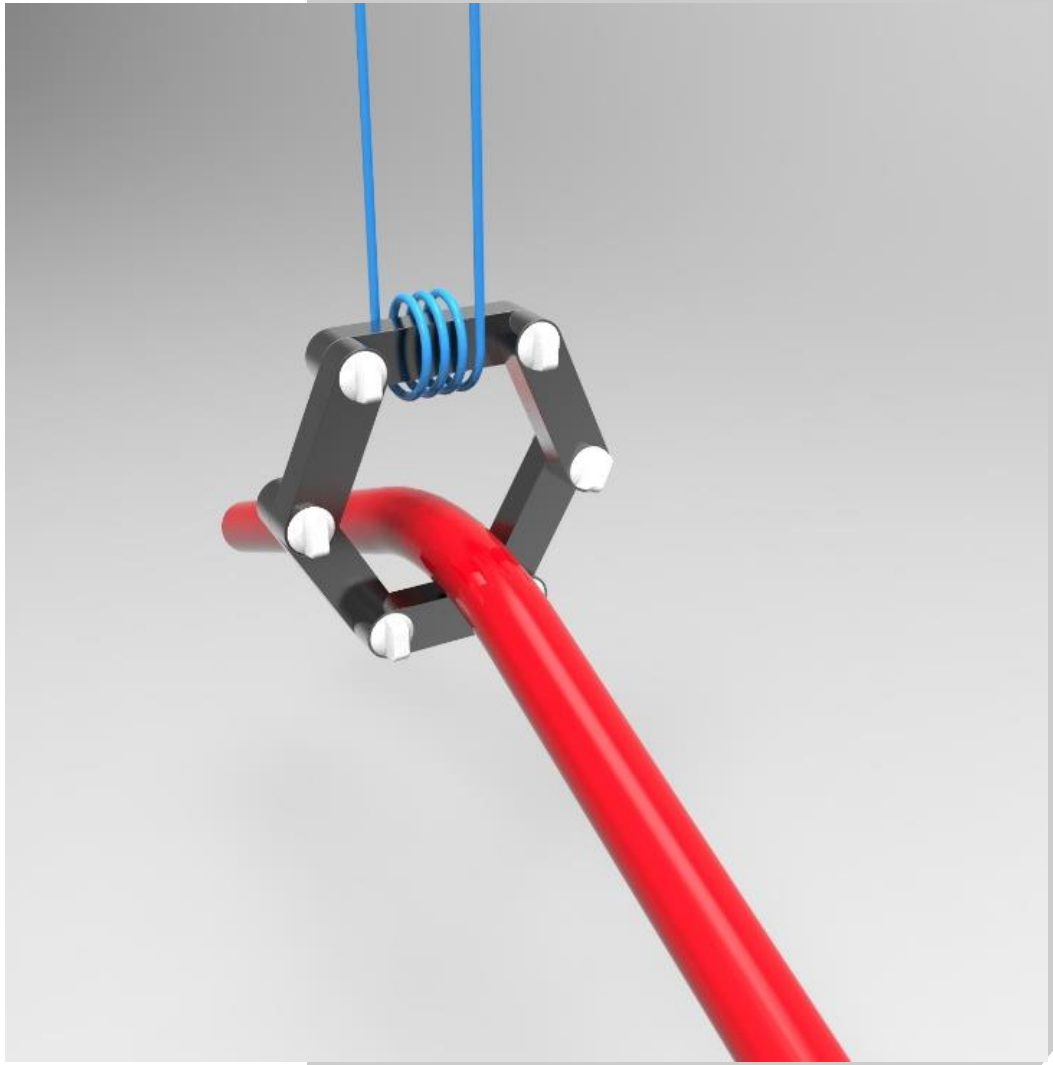

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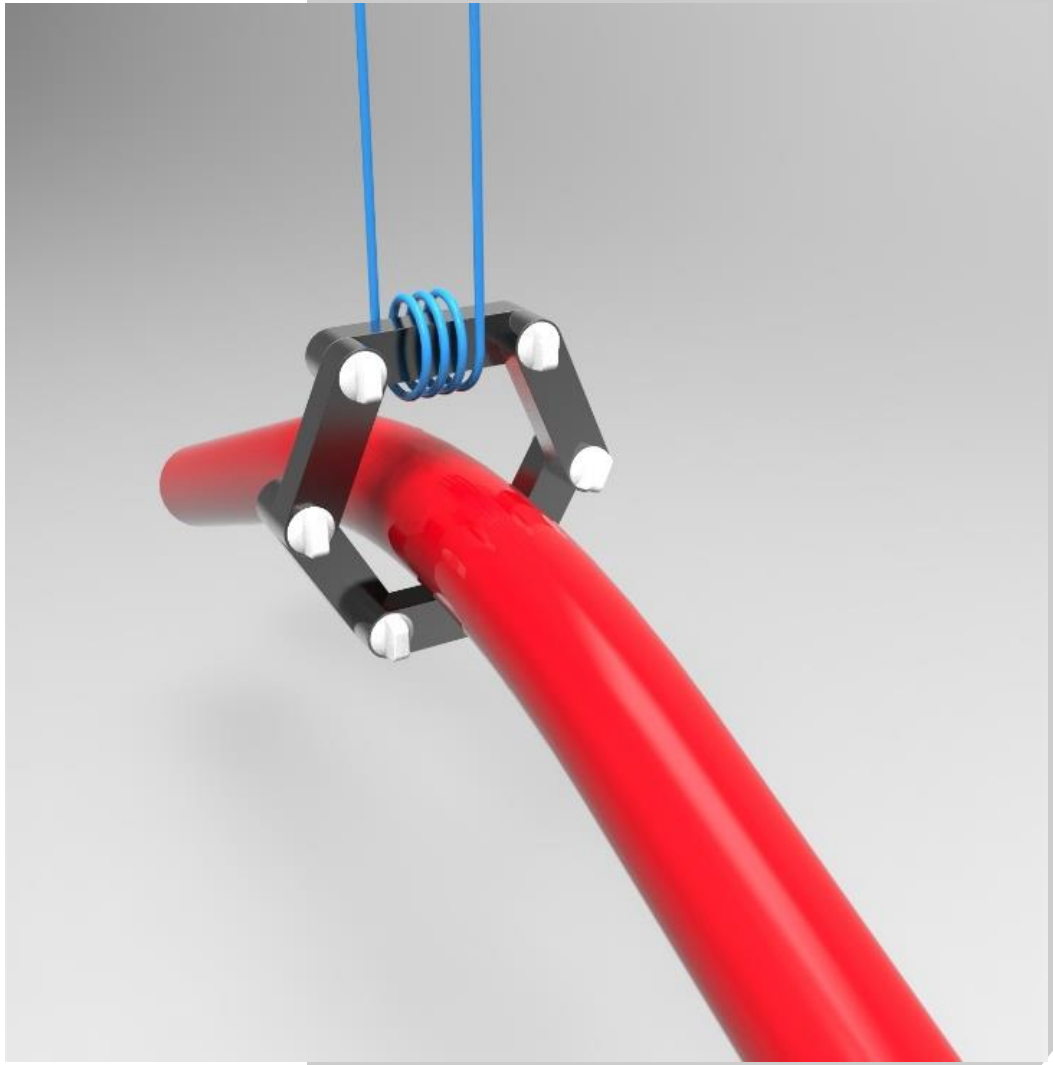

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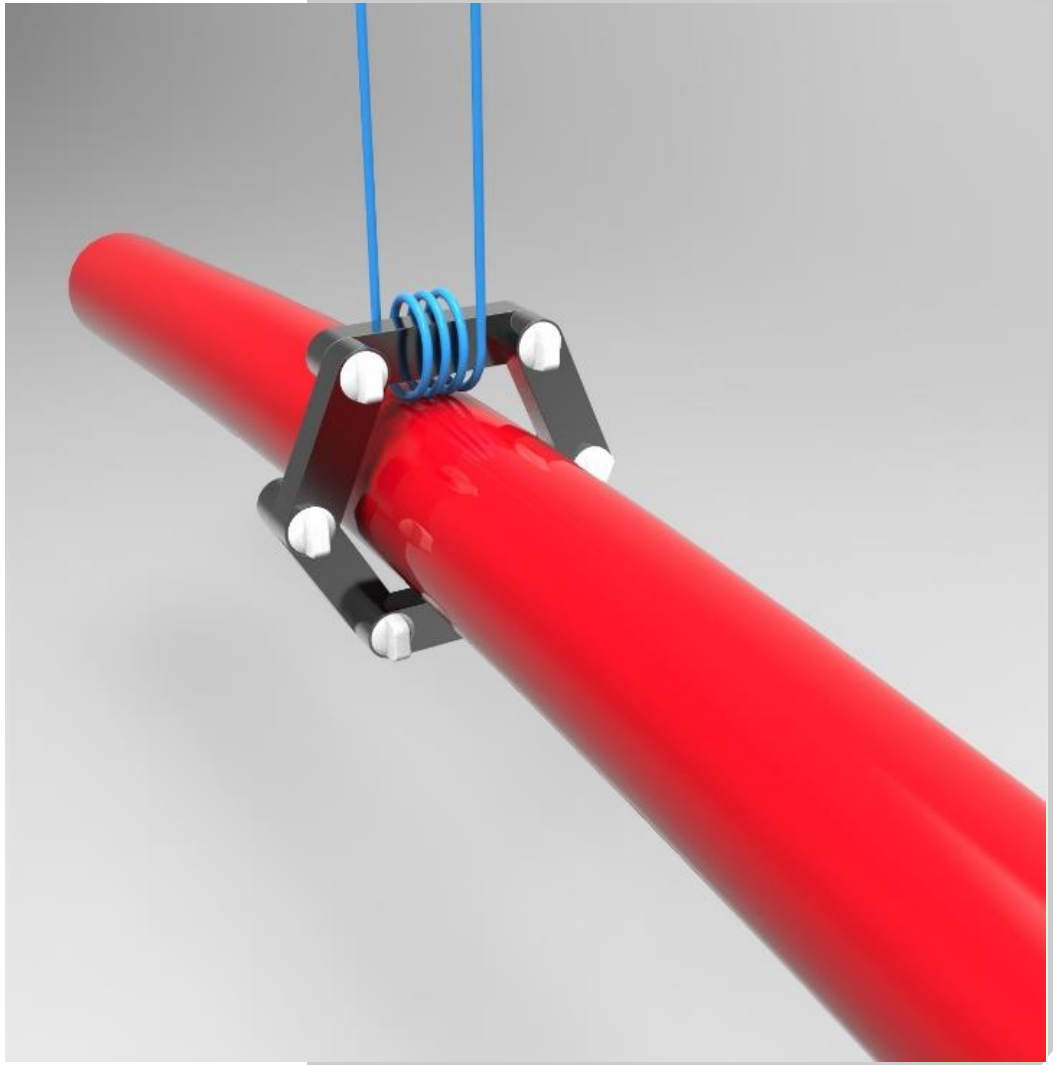

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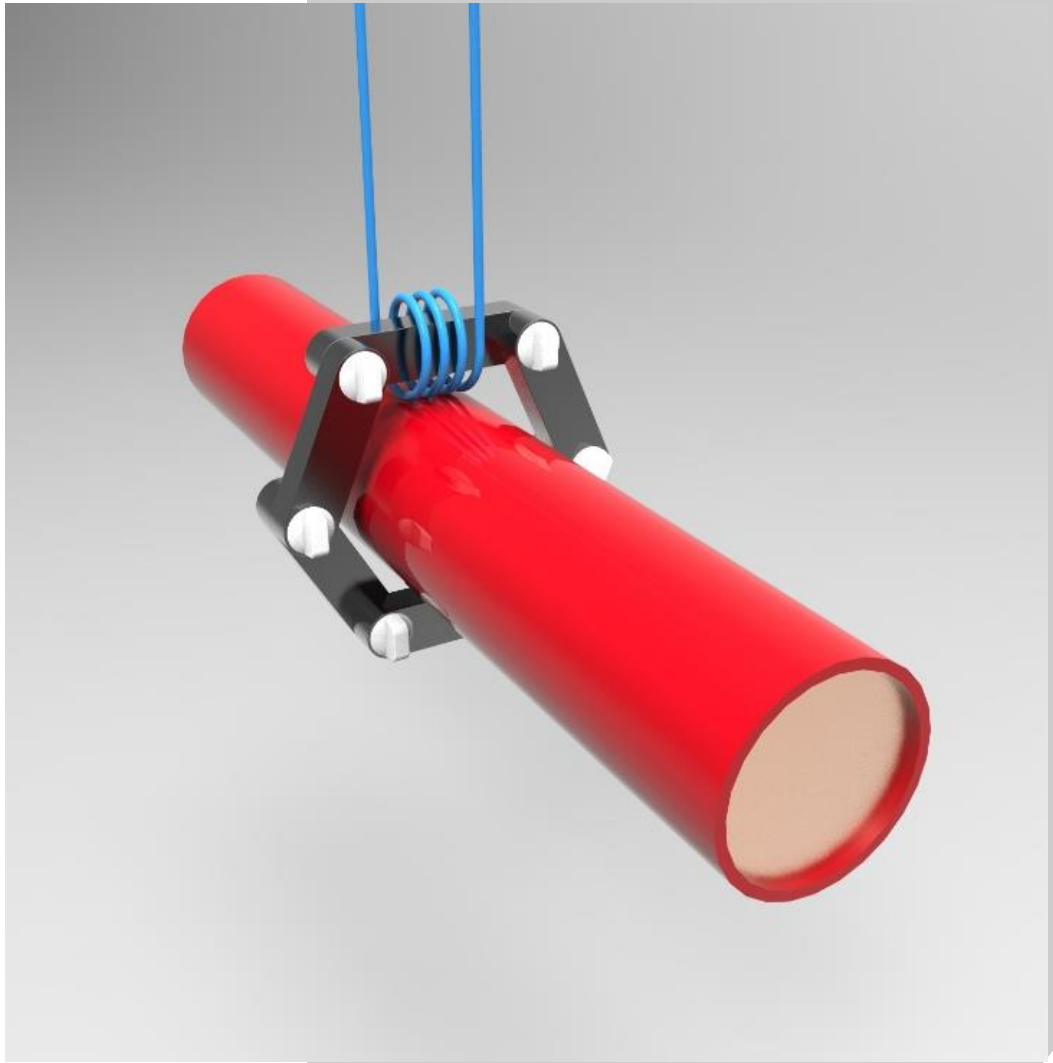

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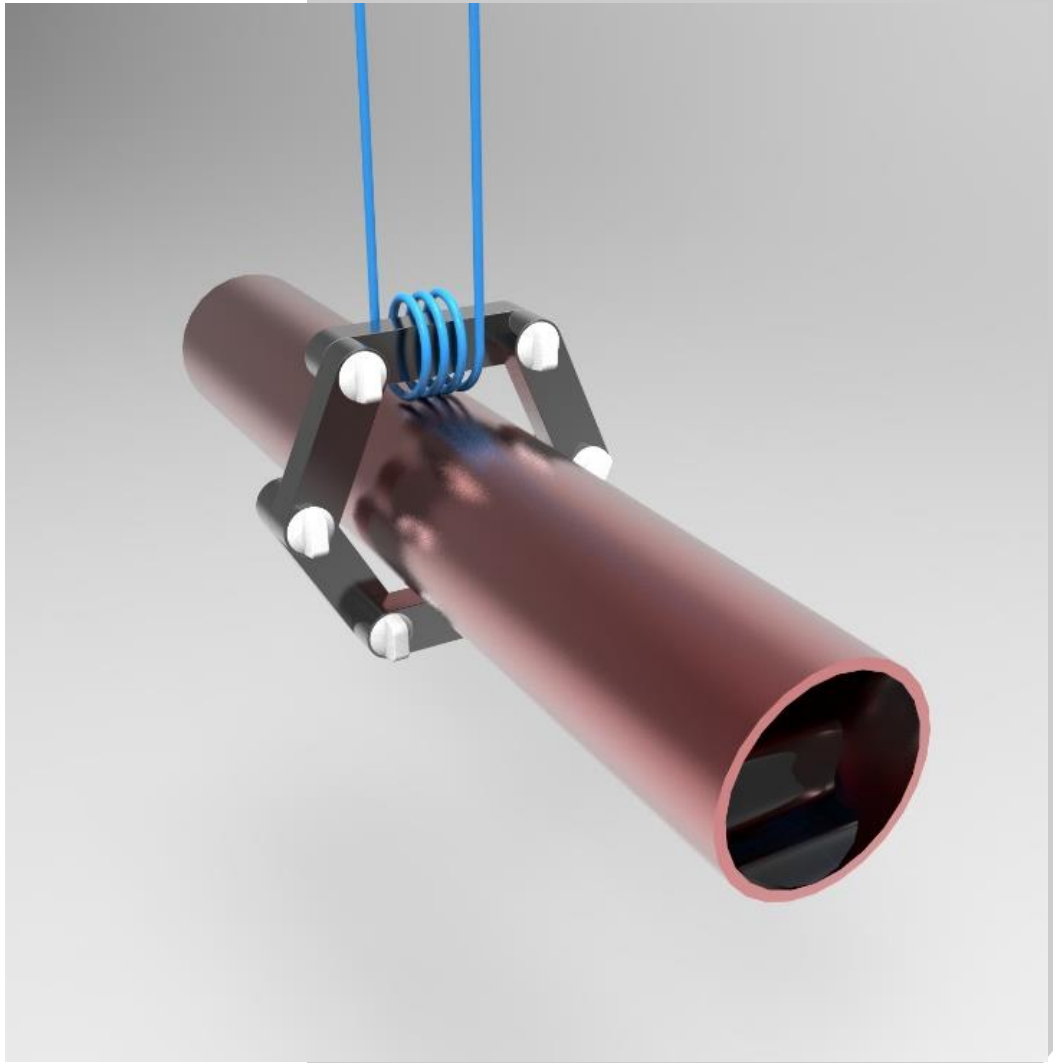

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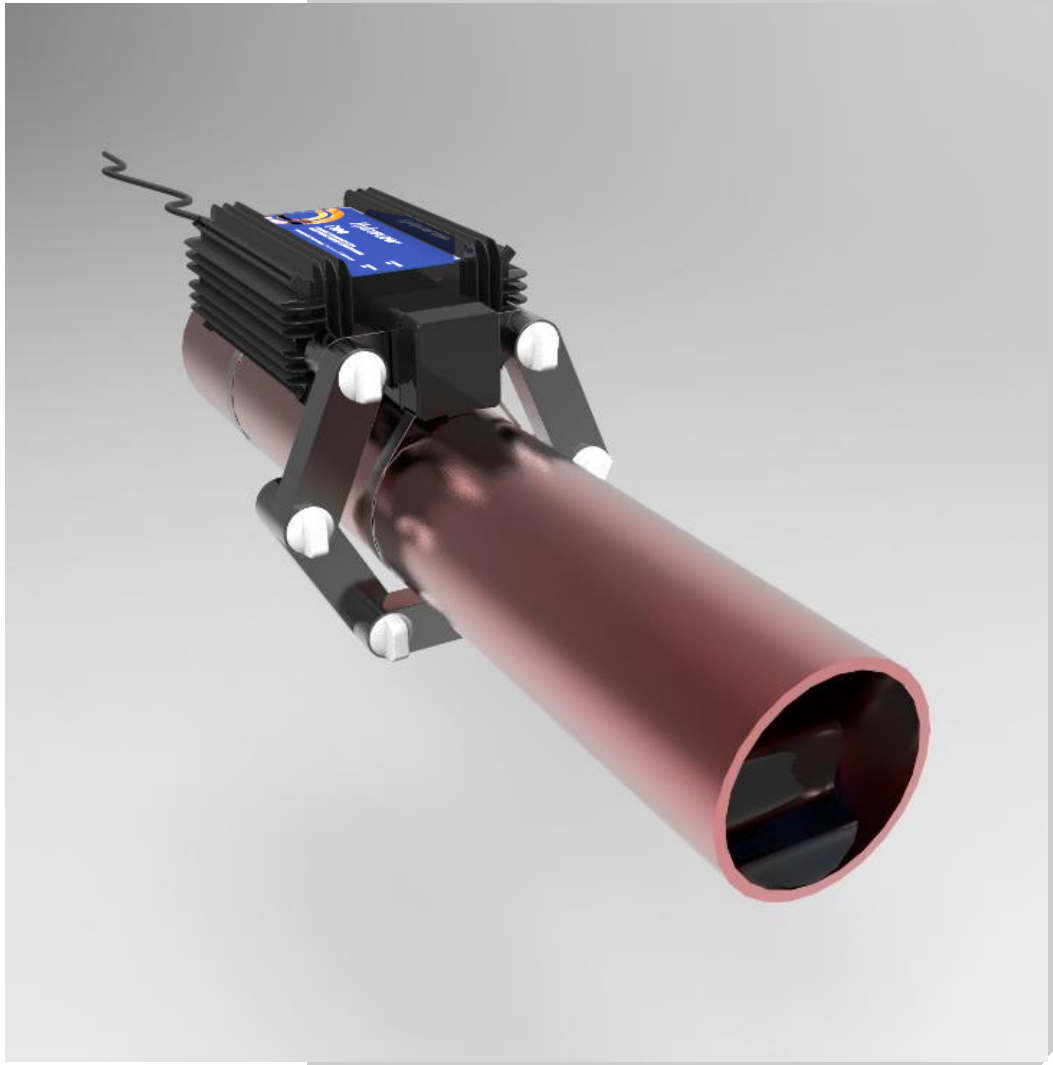
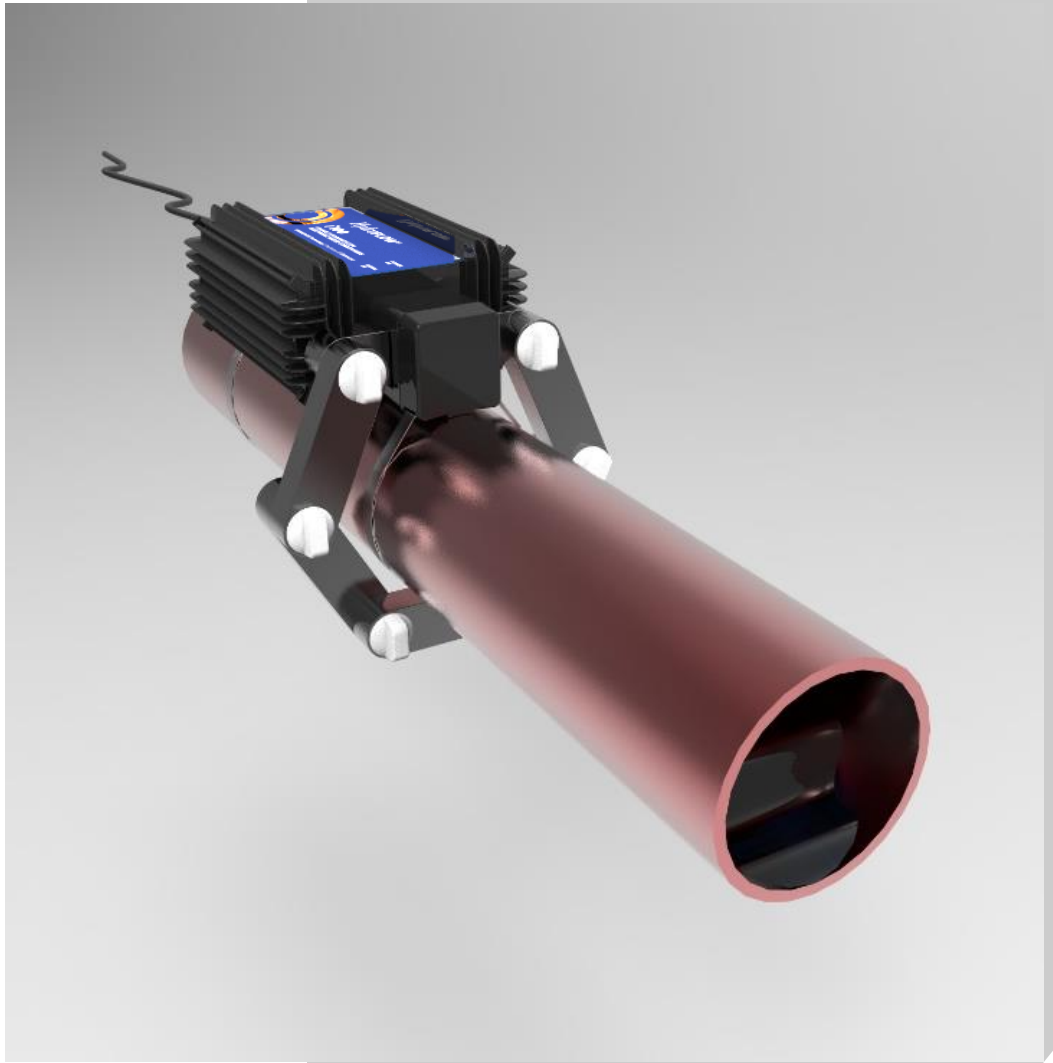


APPLYING THE SIGNAL

Only care about pipe passing through the unit

Don’t care about

- Alignment
- Position
- Insulation



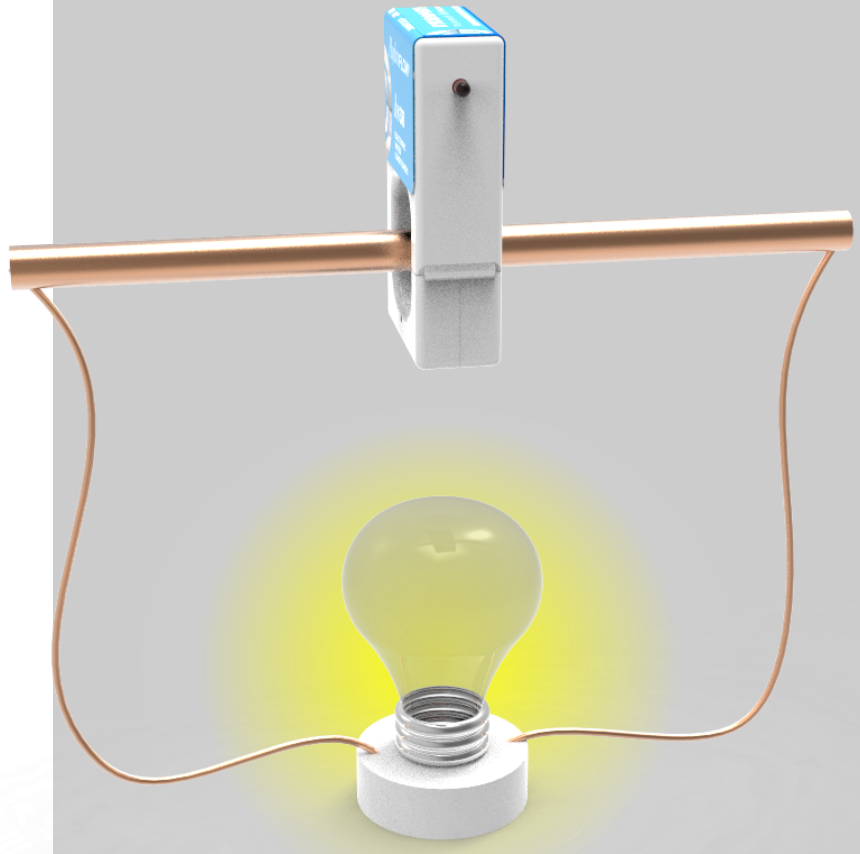
PROPAGATION OF SIGNAL

We have induced a voltage in the pipe

Like a battery – one side is negative, one side is positive

If we were making a real transformer, we would want current to flow...

Connecting either side of the unit in a “loop” makes a complete electrical circuit and allows current flow



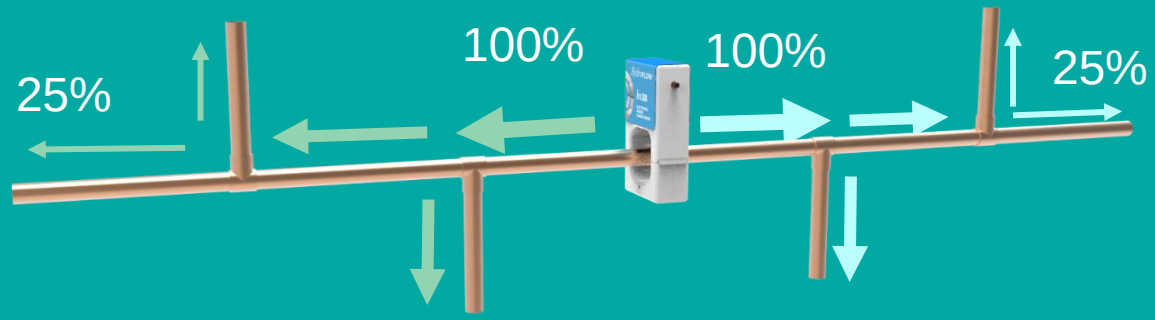
PROPAGATION OF SIGNAL

The signal is “trying” to return to the other side of the unit

The signal travels in both directions along pipe

Signal will travel through whole piping system

Splits (roughly) 50-50 at each junction



ALTERNATIVE TREATMENTS

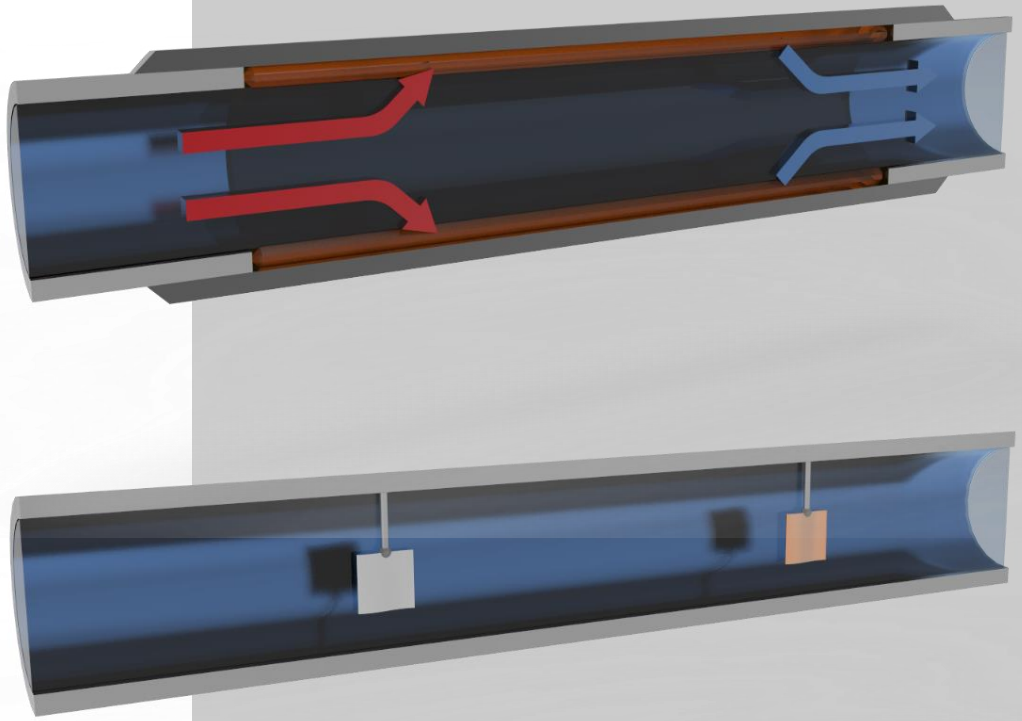
CHEMICAL

Softeners

- Change Composition of the water
- Beneficial minerals in drinking water reduced
- Need regular replacement

Electrolytic

- Finite lifespan
- Can actually scale up!



MAGNETIC

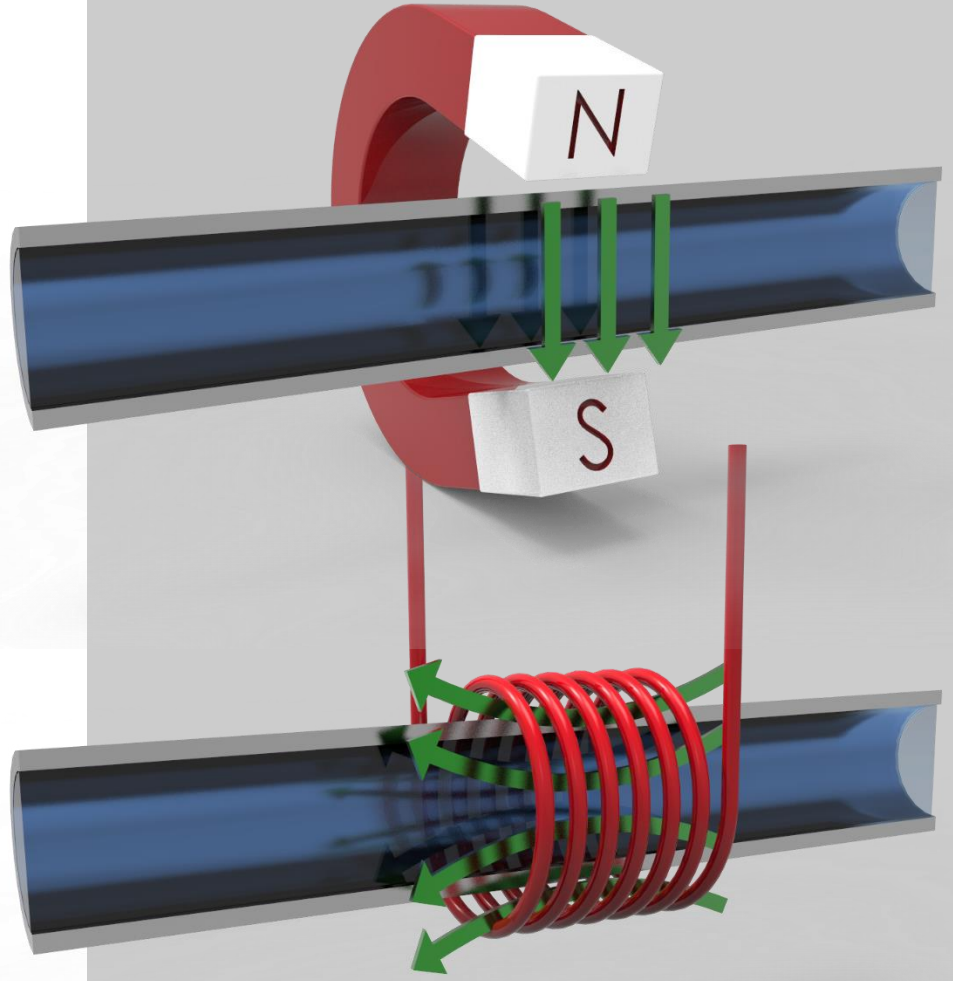
Permanent or electro-magnets

Magnetic fields (not Electric Fields)

Local (point protection only)

Only works when water is moving (and at right angles)

Very weak (E = c B)



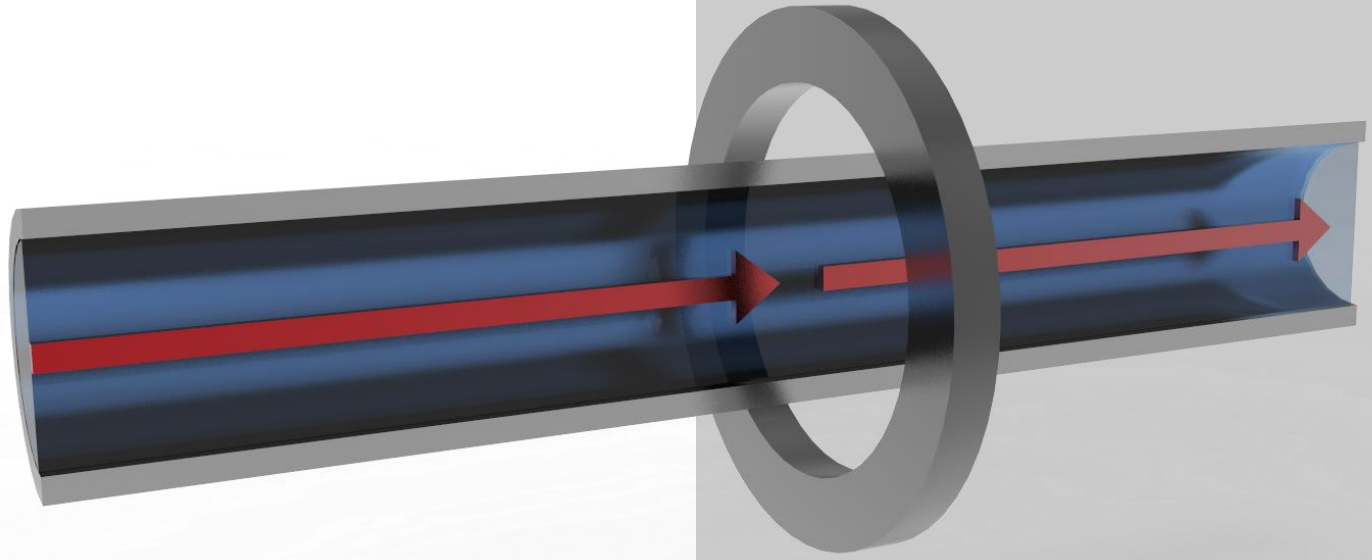
COMPARISON VS HYDROFLOW

Electric field induced along length of pipe

Stronger effect than magnetic field

Present all through plumbing system

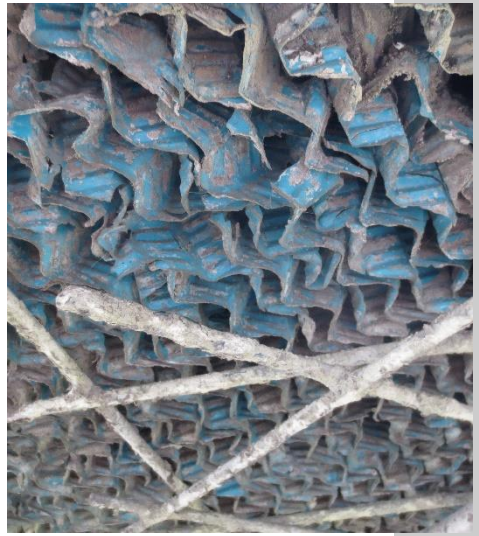
Independent of flow



LIMESCALE

LIMESCALE

- Calcium dissolved in water
- Forms a hard mass on surfaces
- Pipes and heat exchanger surfaces (e.g. boilers)
- Reduces heater efficiency and water flow
- Causes blockages, leaks and damage



COSTS OF LIMESCALE

The Costs of Scale in Boiler Systems

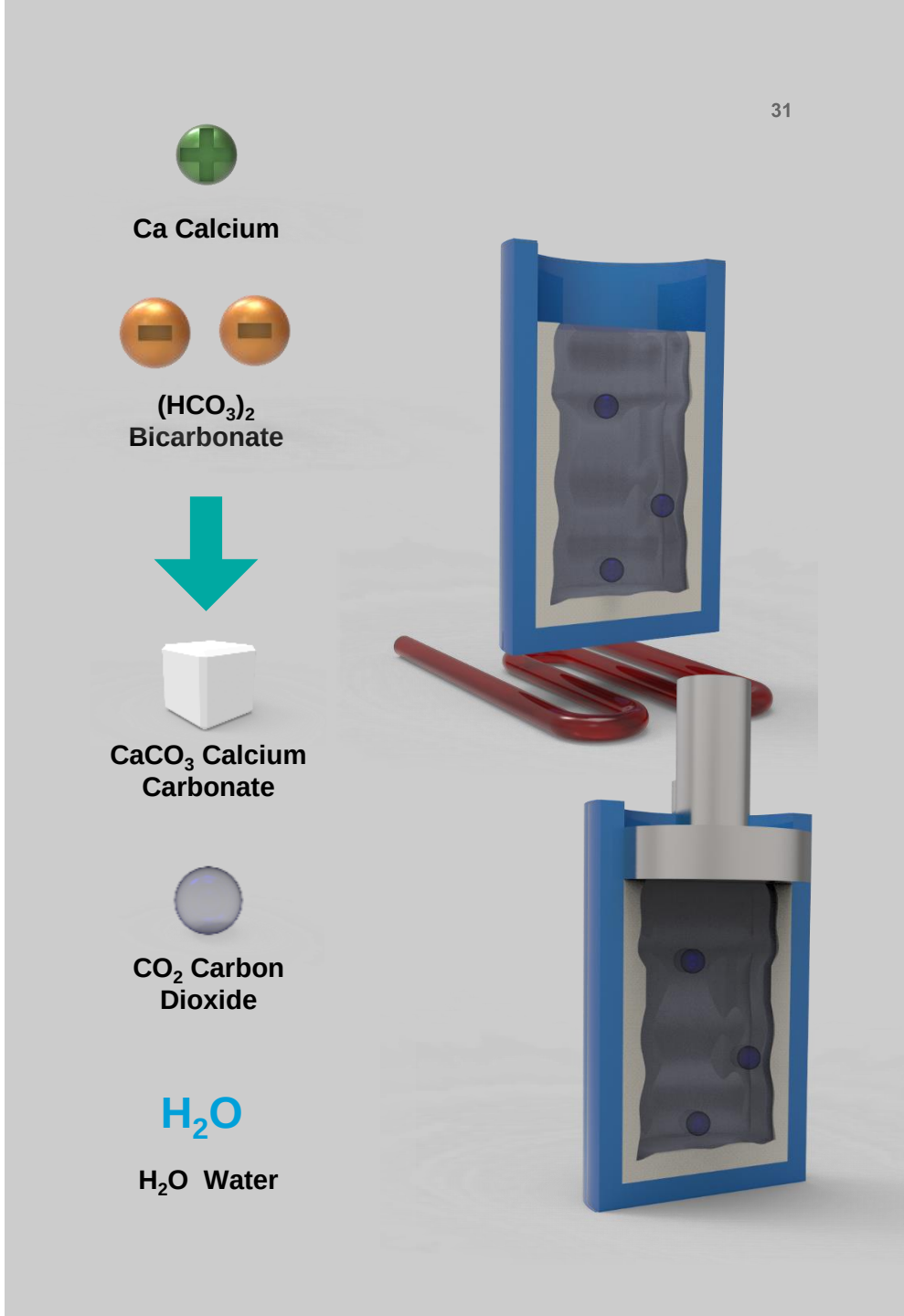
Scale thickness (mm)	0.4	0.8	1.6	3.2	4.8	6.4	9.6	12.7	15.9	19.1
Gallons of Oil Wasted per 1000	40	70	110	180	270	380	480	600	740	900
Pounds of Coal Wasted per Ton	80	140	220	360	540	760	960	1200	1480	1800
Gas Wasted per 1000 Cubic Feet	40	70	110	180	270	380	480	600	740	900
Average Efficiency Loss	4%	7%	11%	18%	27%	38%	48%	60%	74%	90%

The Costs of Scale in Cooling Systems

Scale thickness (mm)	0.5	1	2	4	6	8	10	12.7
Decrease in Condensing Capacity	40	70	110	180	270	380	480	600
Increase in Condensing Temp (ºC)	80	140	220	360	540	760	960	1200
Increase in Energy Required	40	70	110	180	270	380	480	600

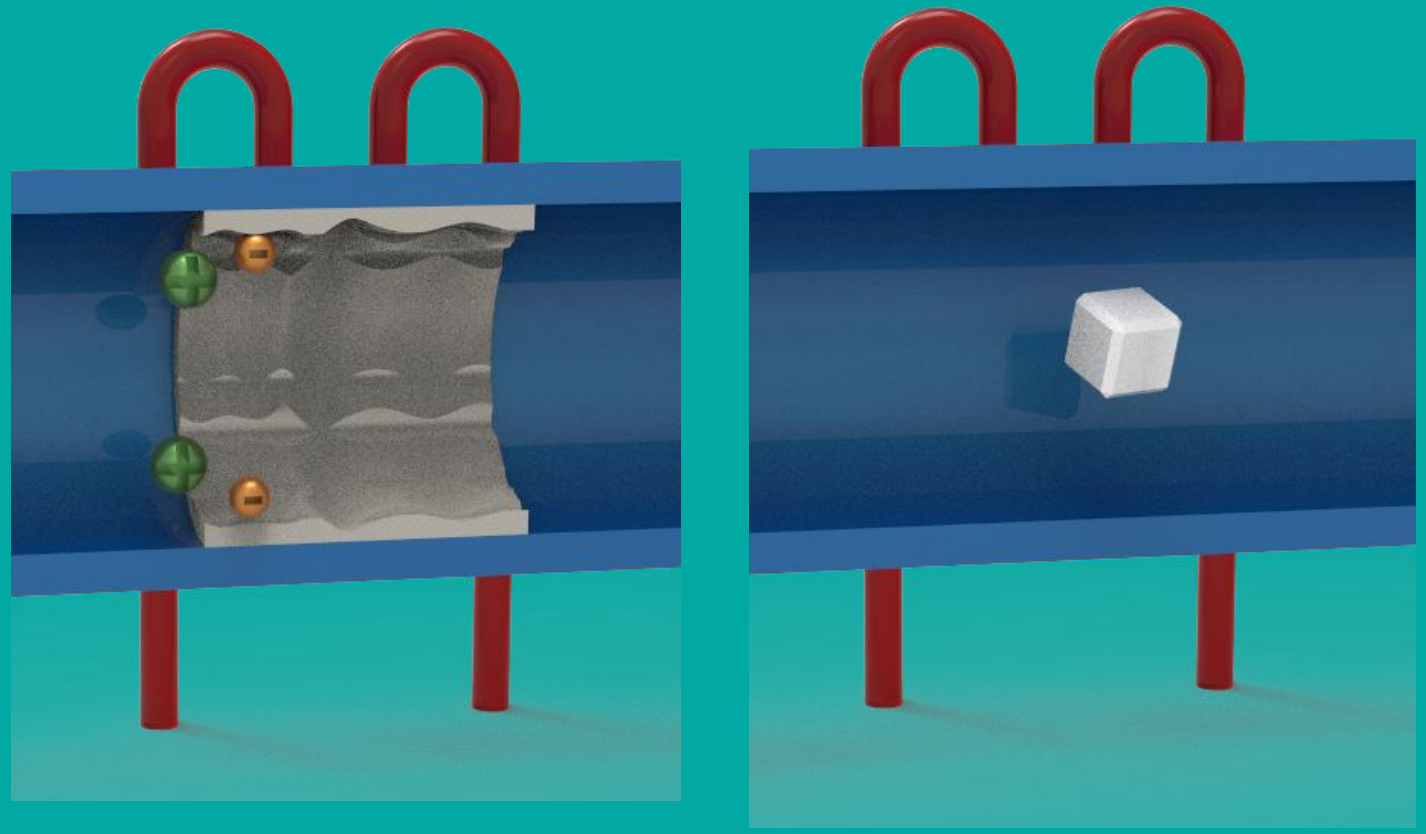
WHEN DOES SCALE FORM?

- Calcium and bicarbonate dissolved in water
- Water becomes super-saturated when
- Temperature increases or pressure decreases
- Ions precipitate as calcium carbonate: limescale



CHANGING WHERE SCALE FORMS

- Do not fight nature!
- Hydroflow induces an electric field so scale does not form on the pipe
- Instead, scale forms in the water and is washed away

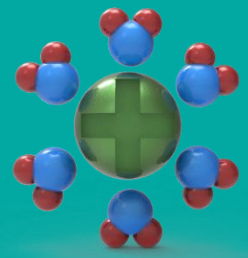


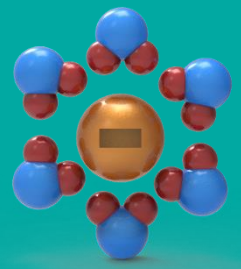
CLUSTER FORMATION

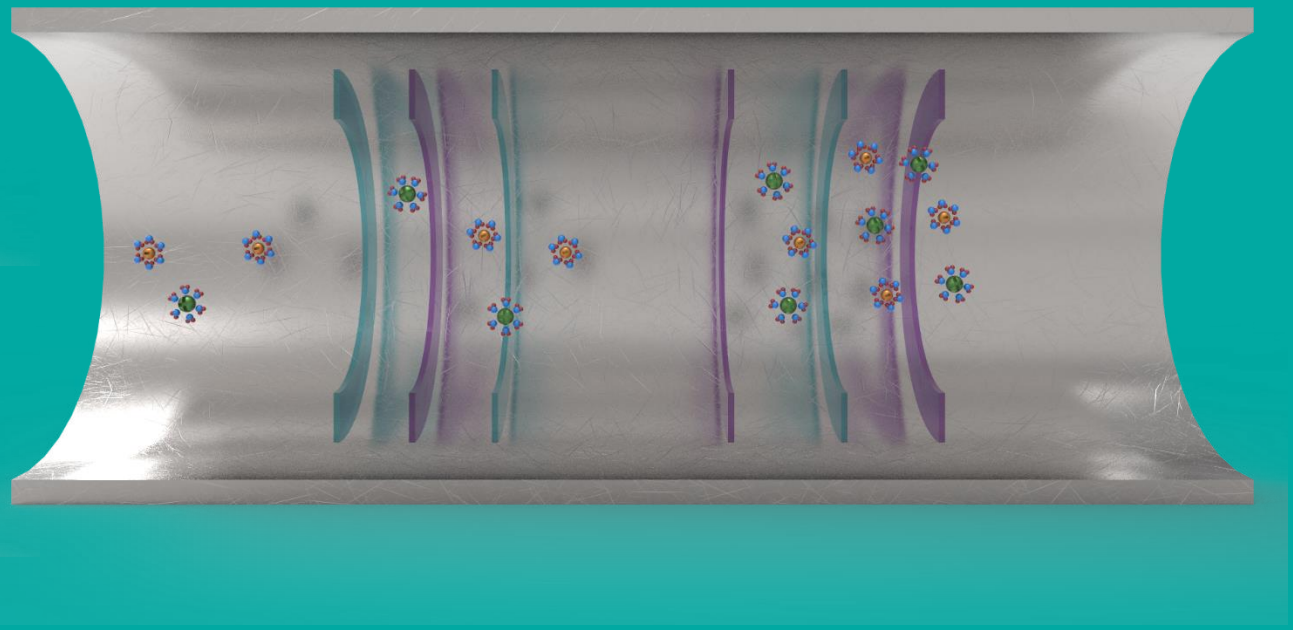
The Hydroflow signal encourages the ions to form clusters

These clusters then become seed crystals

Further crystalisation occurs on these seeds



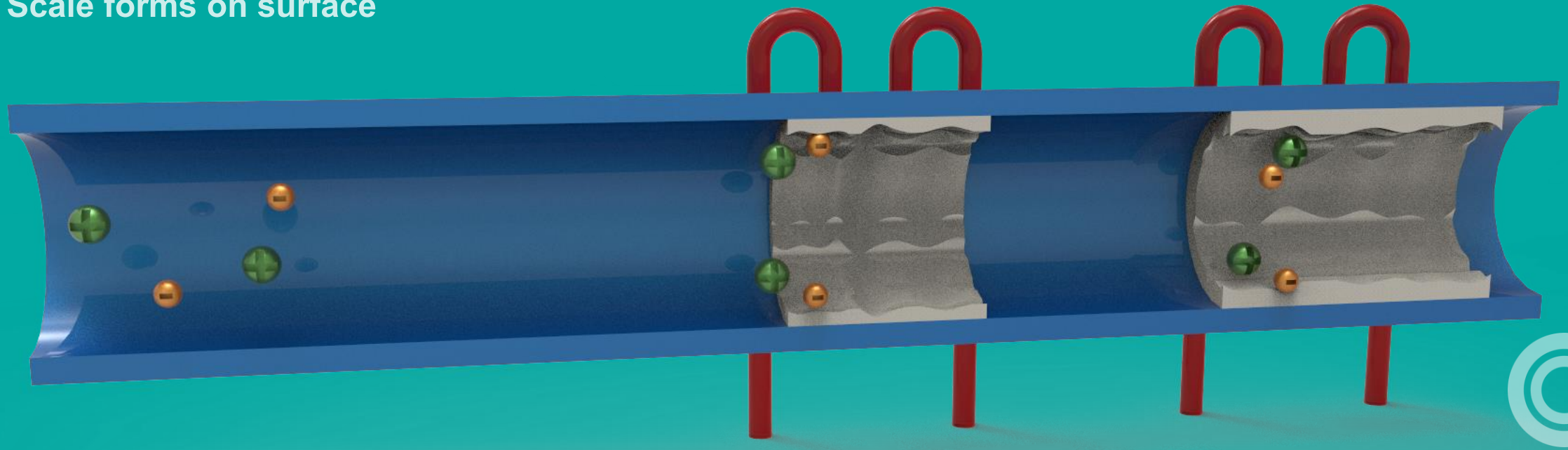




PREVENTION OF SCALE

Without Hydroflow

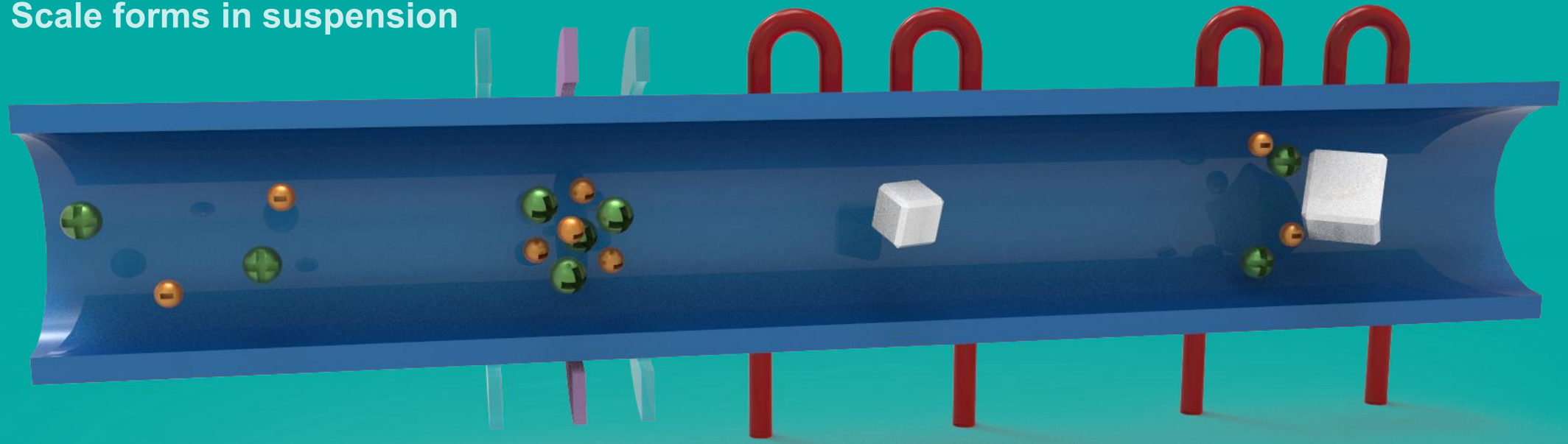
- Water is heated
- Surface provides nucleation site
- Scale forms on surface



PREVENTION OF SCALE

With Hydroflow

- **Hydroflow forms clusters**
- **Water is heated**
- **Cluster provides nucleation site**
- **Scale forms in suspension**



HOLIDAY HOMES, FRANCE

A single unit was used to protect 4 boilers supplying water to holiday homes

Previously had 200kg/ year scale in cylinders, with 5cm thick layer on heaters

With Hydroflow, <10kg/ year of light scale in cylinder, very little on heaters

Energy savings estimated at >50%, maintenance savings 50% plus replacement savings

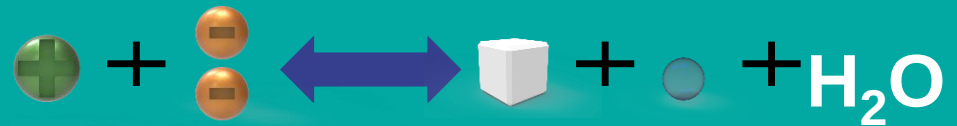
HydroFLOW™

REMOVAL OF EXISTING SCALE

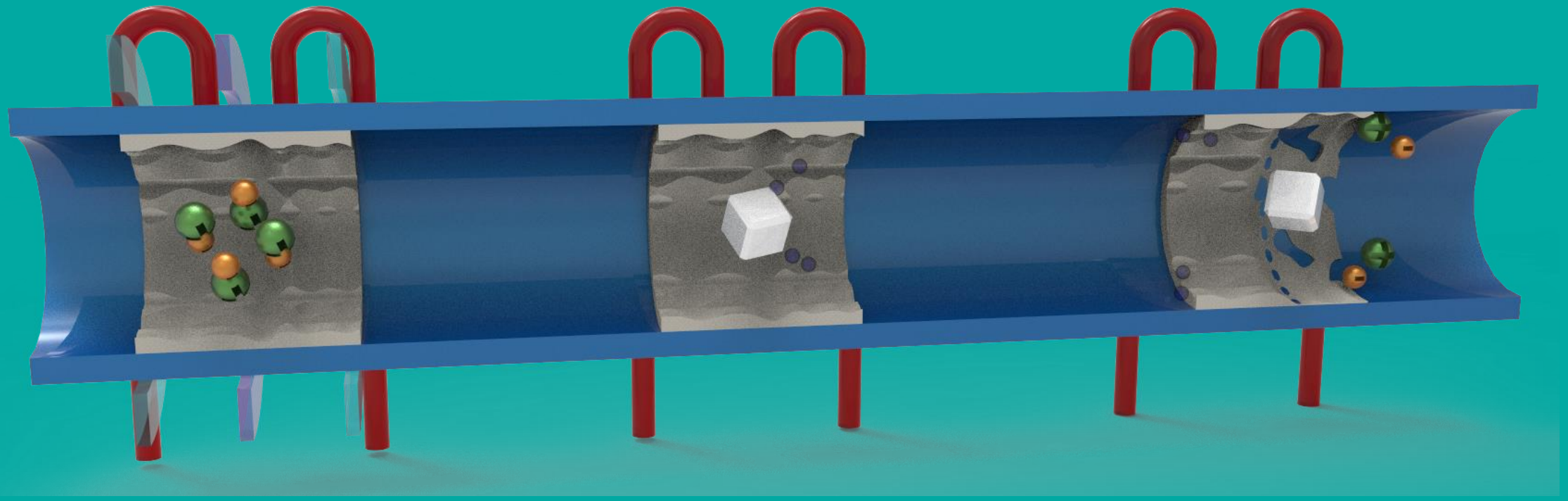
Crystals form

Creates Carbon Dioxide

Dissolves existing scale



$Ca + (HCO_3)_2$ $CaCO_3 + CO_2 + H_2O$



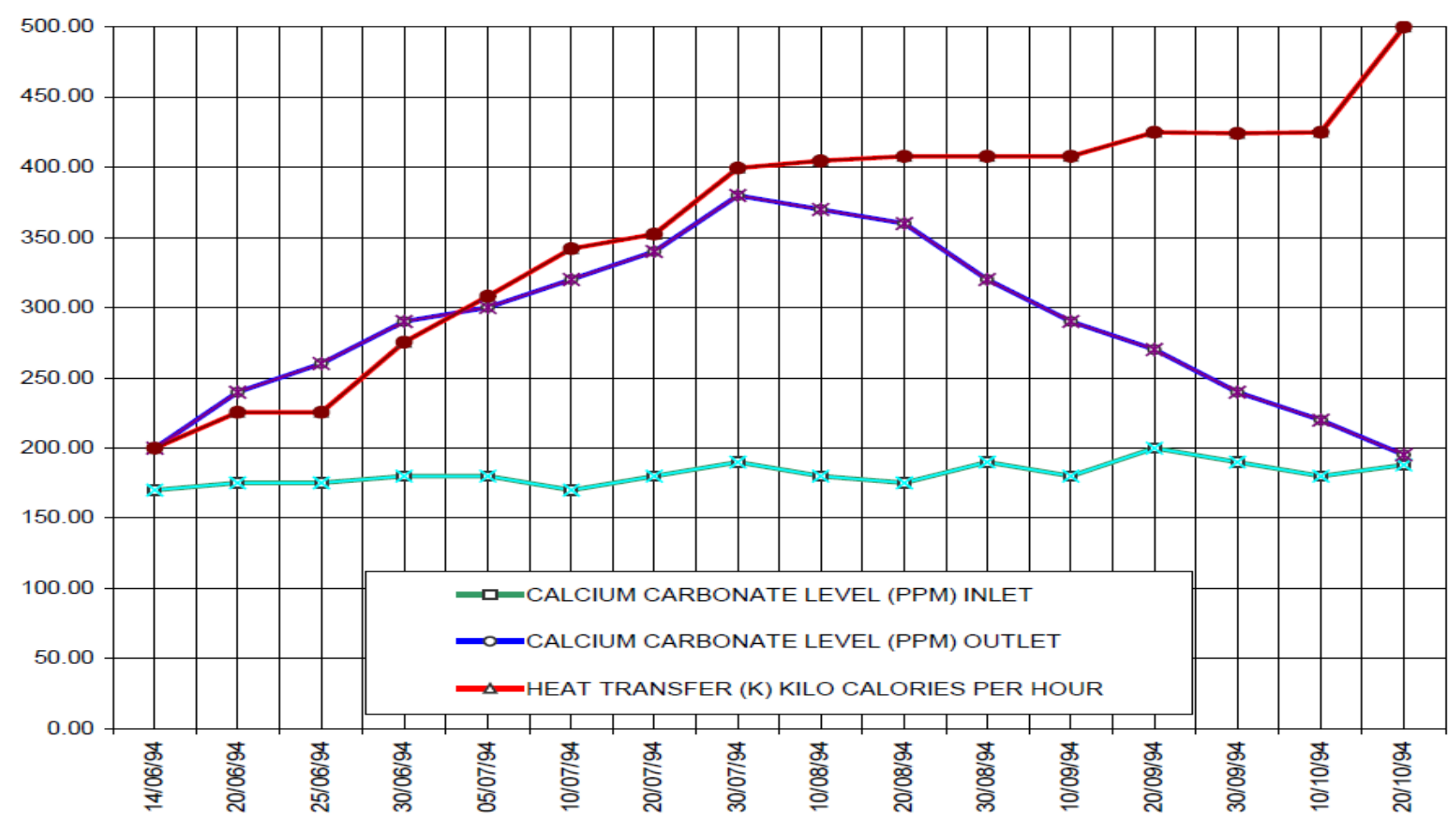
LINNEO DE PAULA MACHADO, BRAZIL

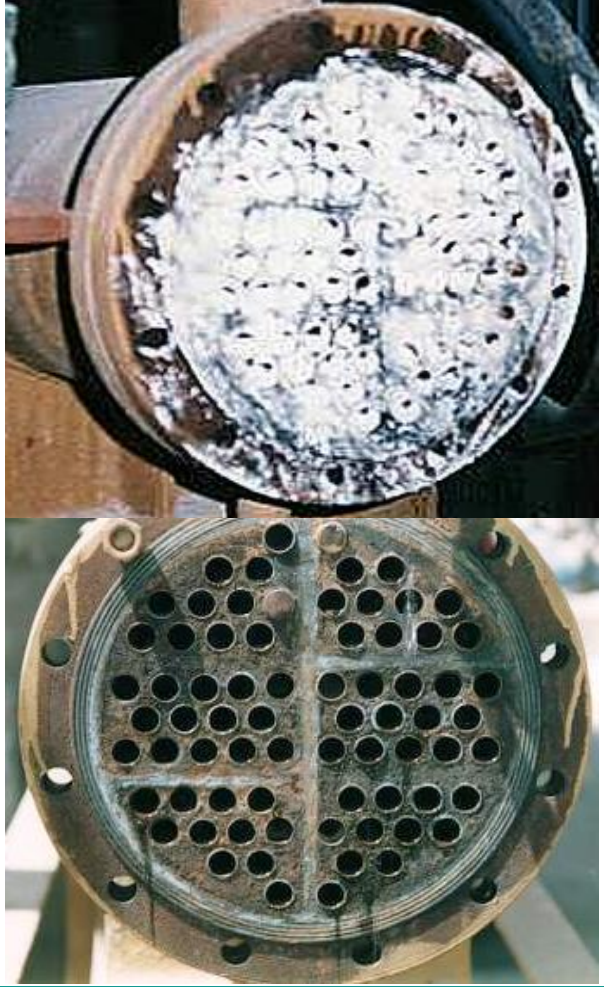
Cooling towers treated for a year

Existing scale removed, new scale prevented

Corrosion reduced

HydroFLOW™





Chemical factory heat exchanger - ready to be scrapped

Heat transfer goes up as Hydroflow cleans exchanger

Outlet levels of Calcium initially increase as HEX is cleaned

Once cleaned, the outlet Ca levels return to match inlet Ca levels

HydroFLOW™

LIMESCALE SUMMARY

Hydroflow prevents scale

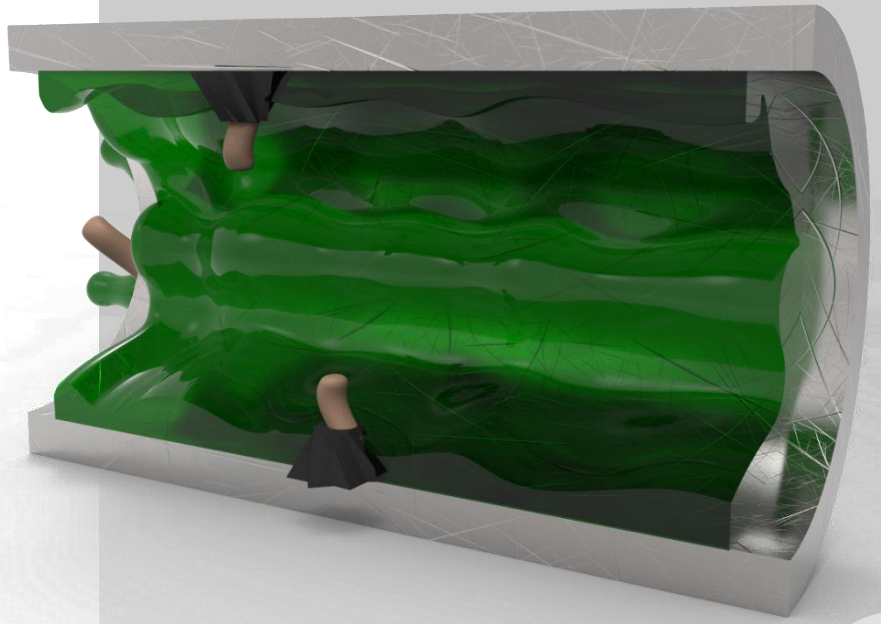
- Without chemicals
- Without changing composition of water
- Water is just as drinkable!

Hydroflow dissolves existing scale


BACTERIA

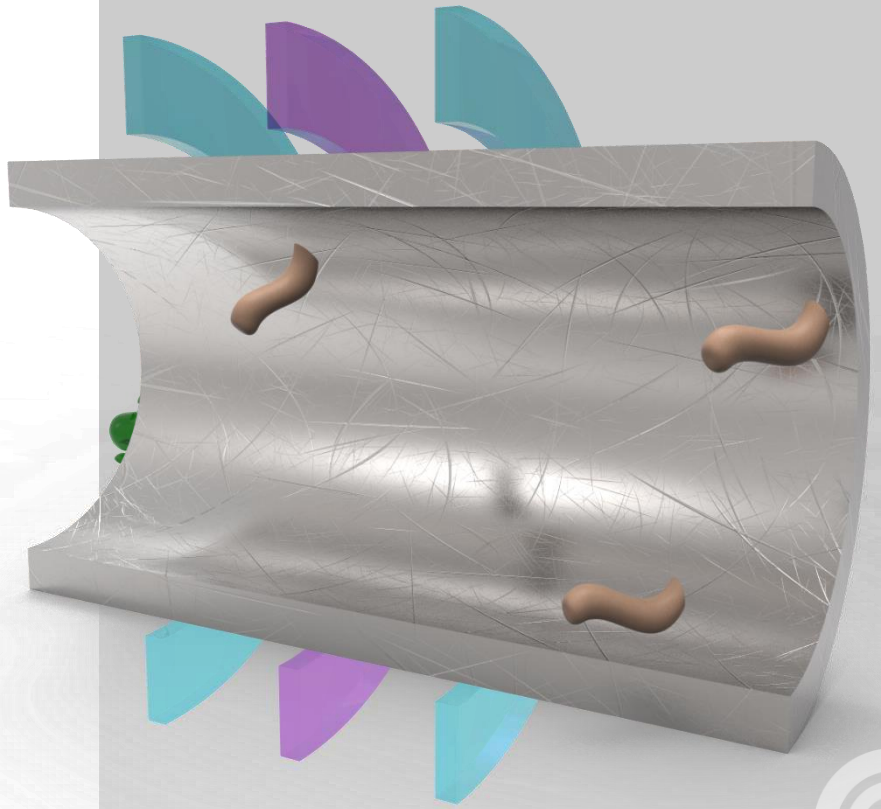
BIOFILMS AND BIOFOULING

- Bacteria cling to surface of pipe
- Form a layer know as biofilm
- Larger “macrofoulers” attach in biofilm
- This includes larvae
- Biofilm protects larvae
- Larvae grow into limpets, barnacles, etc



BIOFILMS AND BIOFOULING

- Hydropath signal charges bacteria, creating wetting layer
- Osmosis causes bacteria to swell and die
- No bacteria means no biofilm
- Larvae and macrofoulers cannot attach
- Washed away by flow
- Pipe remains unfouled



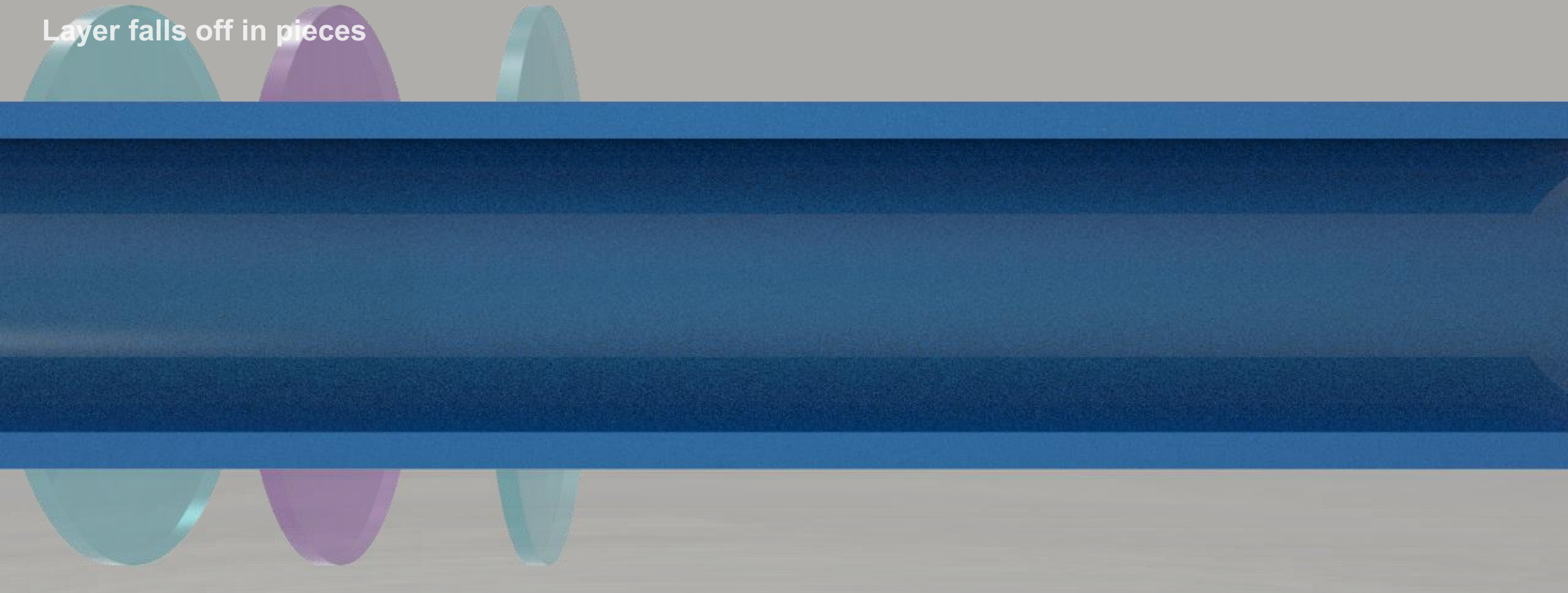
REMOVAL OF EXISTING BIOFILM

Bacteria form a thick layer on heat exchange surface

Reduces heat transfer efficiency and blocks flow

Signal disrupts biofilm layer

Layer falls off in pieces



BACTERIA APPLICATIONS

- Unit is not a steriliser
- Will not get perfect results on a once-through pass
- Works best in commercial/ industrial context

KARKHOV MEAT PLANT

- Biofouling present in steam boilers for 7 years
- Frequent shutdown required
- Units installed January 2016 for 105 days
- Biofilm removed – results visibly clear

HydroFLOW™

CAR FACTORY COOLING TOWER, JAPAN

Unit used to treat oil cooler and cooling tower

Algae on cooling tower fins removed after 108 days

Oil cooler remained clear

HydroFLOW™


FLOCCULATION

FILTRATION

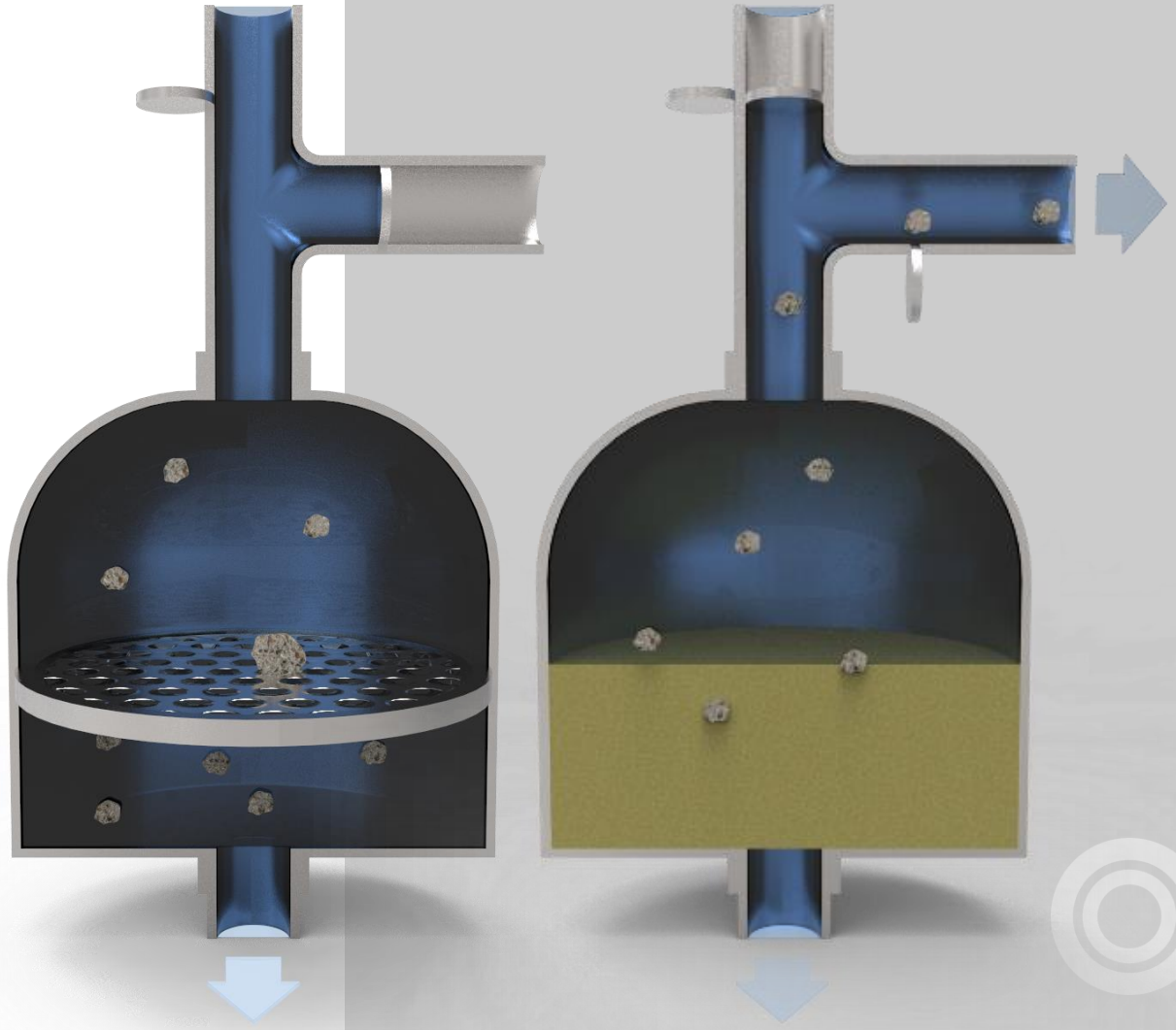
Physical material with holes (sand or cartridge)

Blocks dirt particles (of a particular size)

Filter eventually blocks (pressure increases)

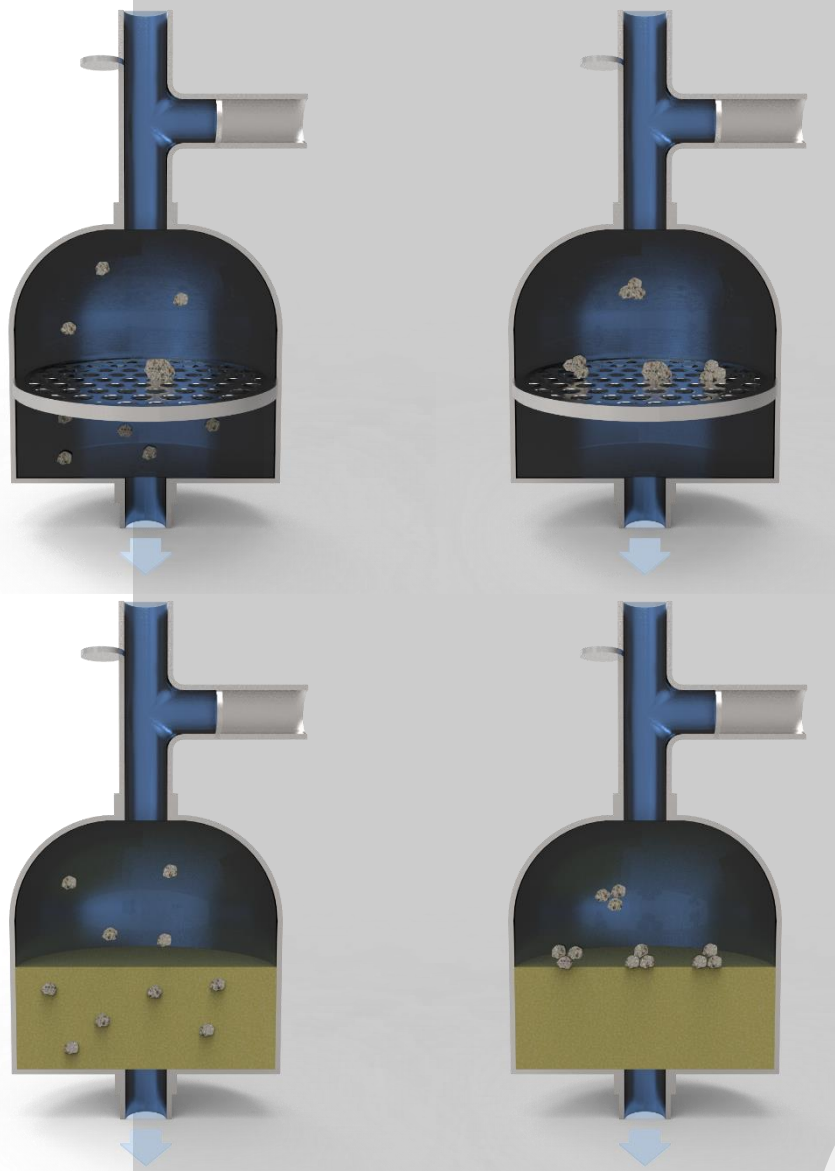
Need to “backwash” to clean filter

Wastes water (and heat, chemicals etc)



ENHANCEMENT OF FILTRATION

- Flocculation
- Clump to form larger “flock”
- Filter removes smaller particles
- Particles sit on surface of filter: easier to remove
- Can reduce the frequency and duration of filter backwashing (by a factor of four or more)
- Save on make-up water and effluent charges – no chemicals

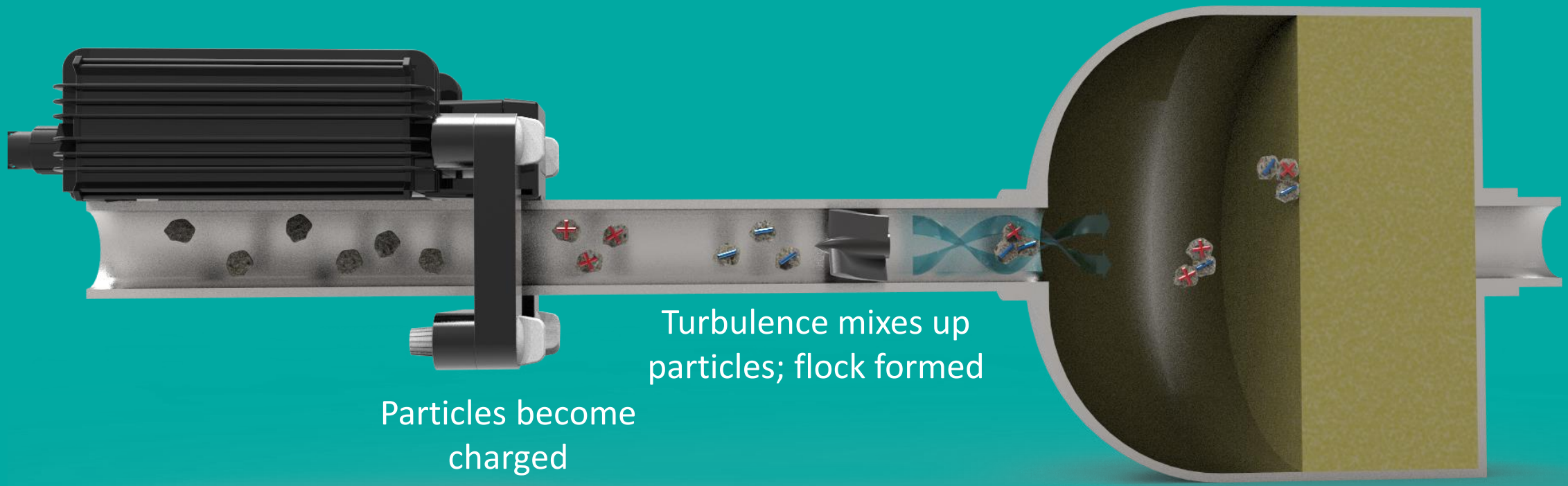


ENHANCEMENT OF FILTRATION

Particles charged by unit

Turbulence mixes them – positively and negatively charged meet

Clump to form larger “flock”



HA’MAPIL POOL

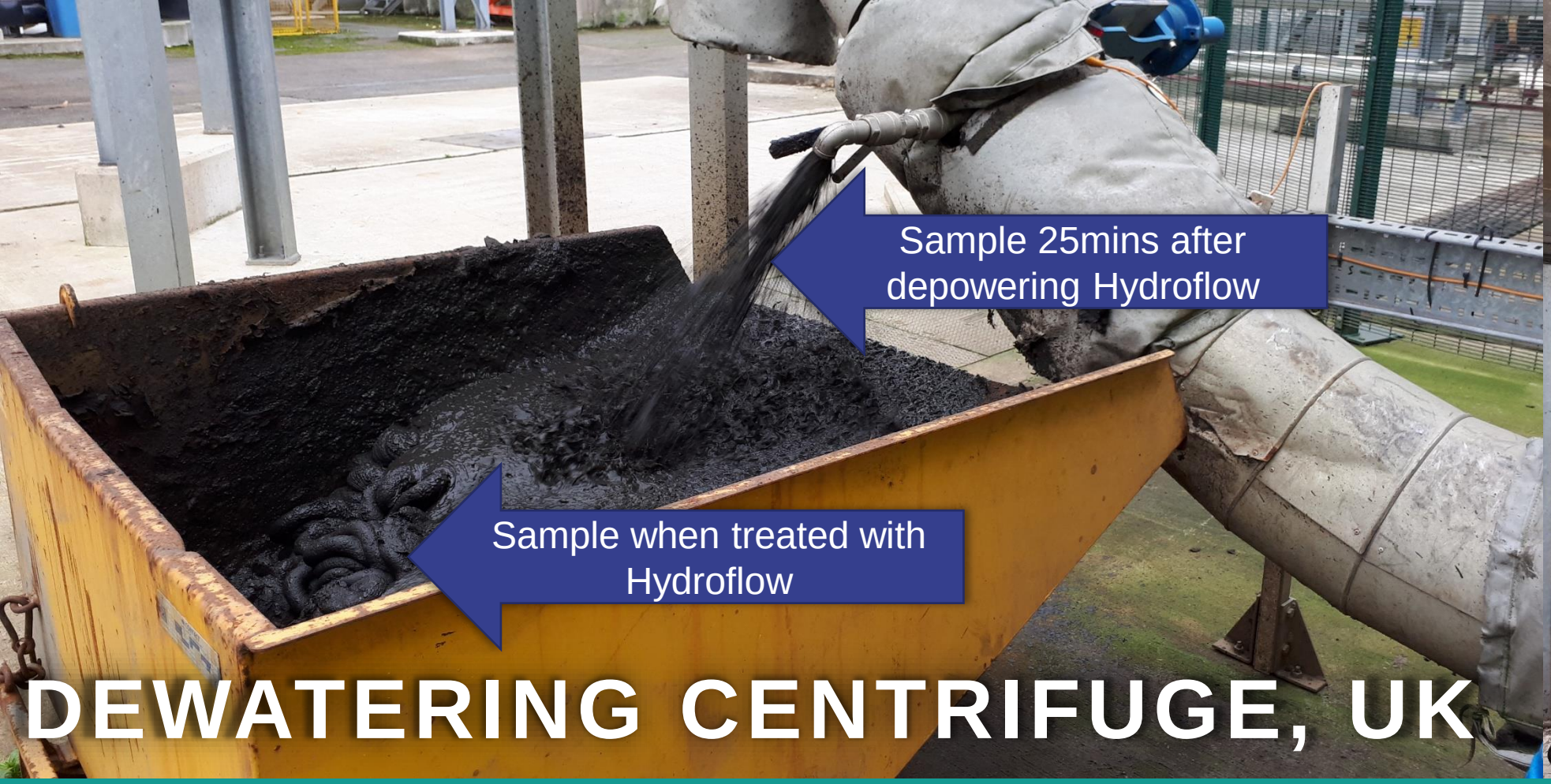
500 cubic meters (132,000 gallon) swimming pool (recently built)

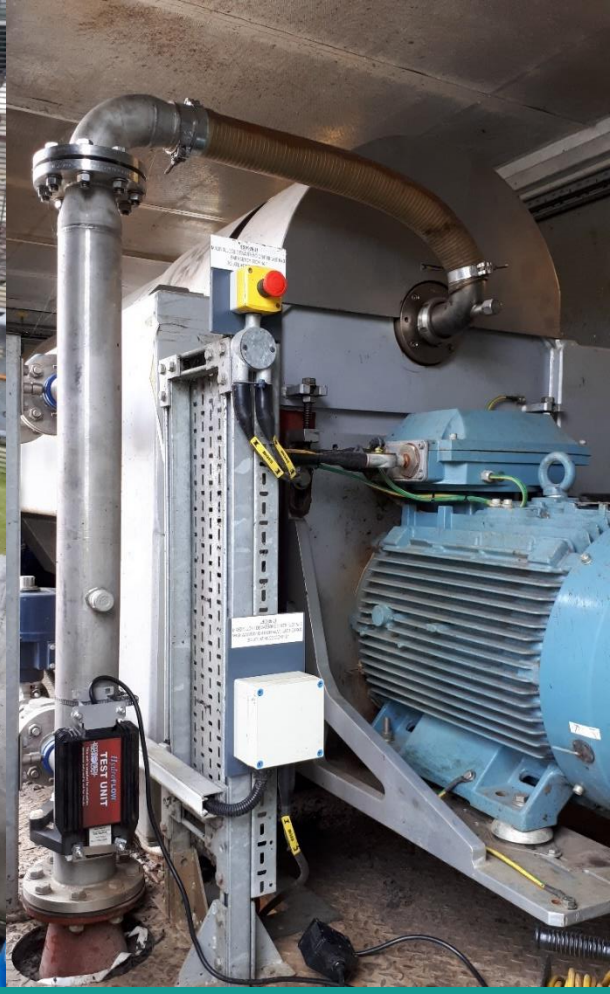
A 6" circulation pipe connecting to two 10 cubic meters filters, circulating 120 cubic meters per hour

Chlorine reduction by 47%, Acid reduction by 70%

Backwash reduced by 66% - Saving 48 cubic meters of water per month

HydroFLOW™





DEWATERING CENTRIFUGE, UK

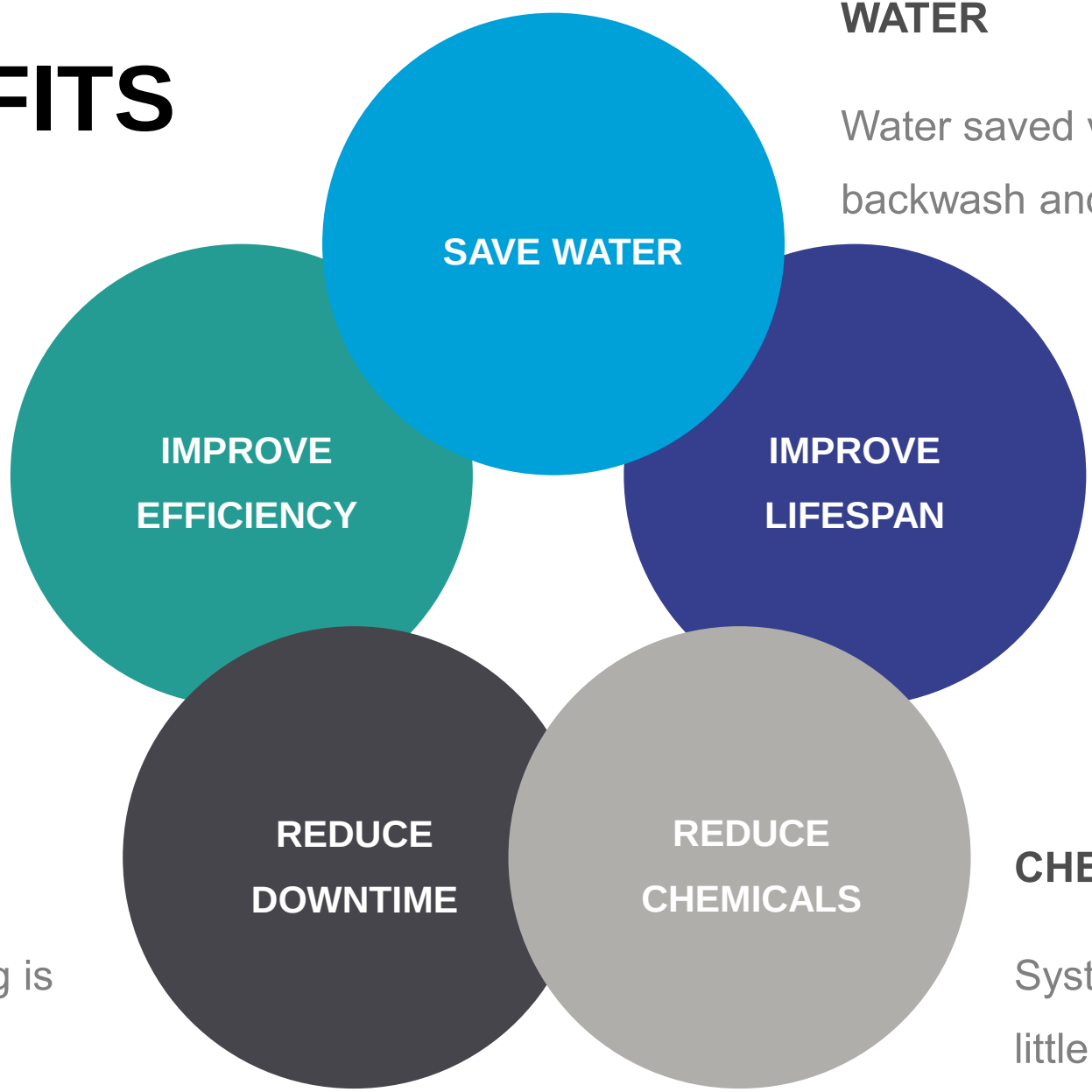
Comparing parallel centrifuges, (same torque) polymer reduction from 3.5 to 3.1 kg/ tDS

Comparing same centrifuge, (const. torque) polymer reduction from 3.6 to 3.2 kg/ tDS

Turning off Hydroflow results in visible change to samples in <25min

HydroFLOW™

KEY BENEFITS



WATER

Water saved via reduced backwash and increased cycles

EFFICIENCY

Heat transfer improves and pipelines become clearer, saving energy

EQUIPMENT LIFESPAN

Equipment works more effectively and lasts longer

DOWNTIME

Downtime for cleaning is less frequent and cleaning becomes easier

CHEMICALS

Systems are protected with little or no need for harmful chemicals

HYDROPATH