

Cooling Tower Treatment

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Legionella

Legionella has been associated with cooling towers for many years

- ❑ The operating temperatures for cooling systems are ideal for the proliferation of the Legionella bacterium (35 – 45°C)
- ❑ The cooling tower is a natural air scrubber, providing nutrients for bacteria
- ❑ Biofilms, corrosion and scale deposits provide sites for Legionella bacteria to 'hide-out'

Legionella & ACoP L8

All cooling towers are governed by the Approved Code of Practice L8, Legionnaires' disease

- ❑ The control of Legionella bacteria in water systems

Statutory Instrument 1992 No. 2225

- ❑ The Notification of Cooling Towers and Evaporative Condensers Regulations 1992

All cooling towers have to be registered with the Local Authority in which they are sited – it is the law!

The Cooling Process



The purpose of cooling systems is to transfer heat from one substance to another

The substance that gives up its heat is **cooled**

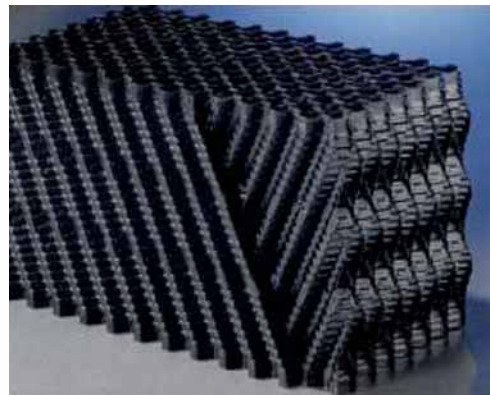
The substance that receives the heat is the **coolant**

Cooling Towers

Forced Draught Cooling Towers

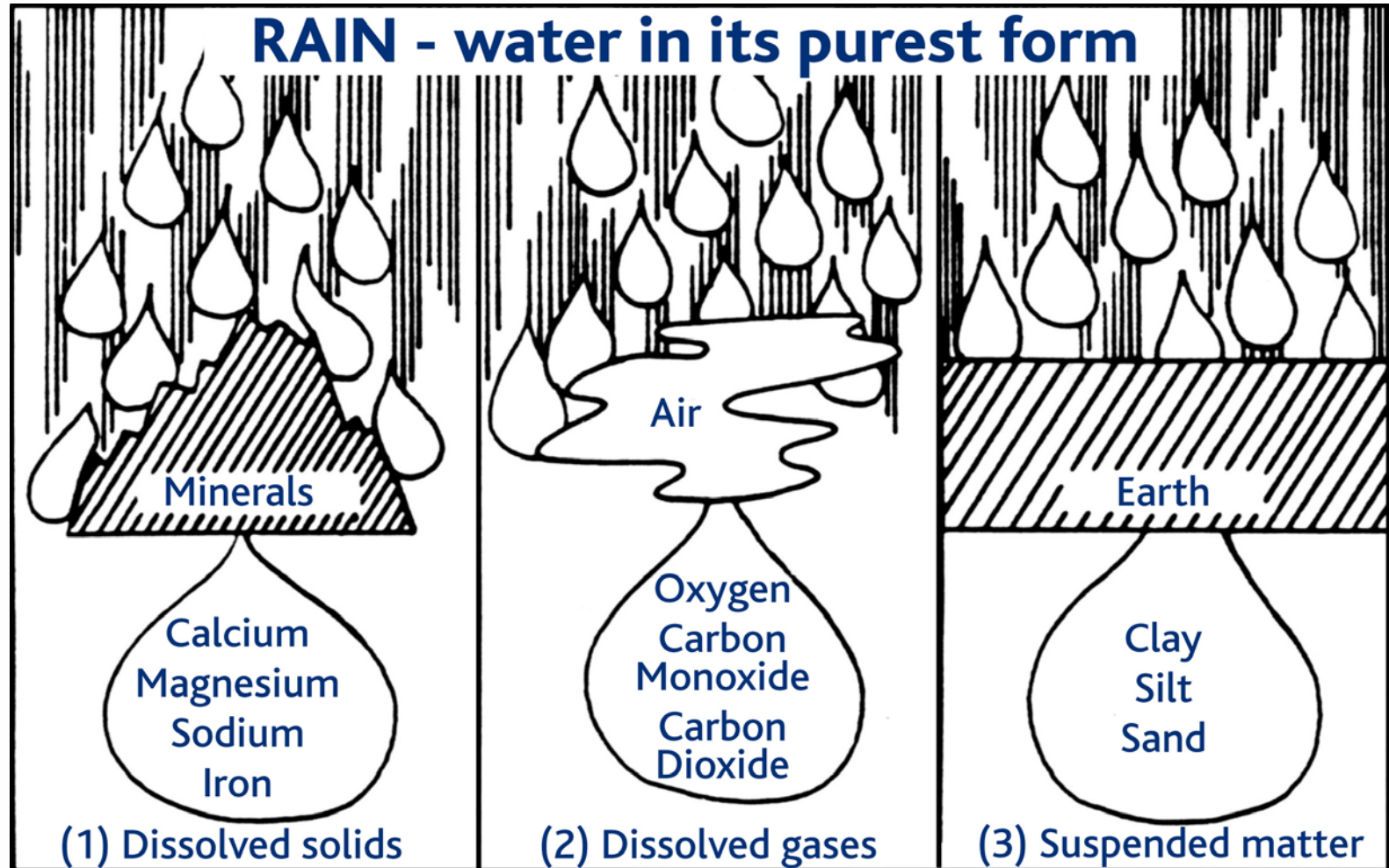


Tower Fill Pack

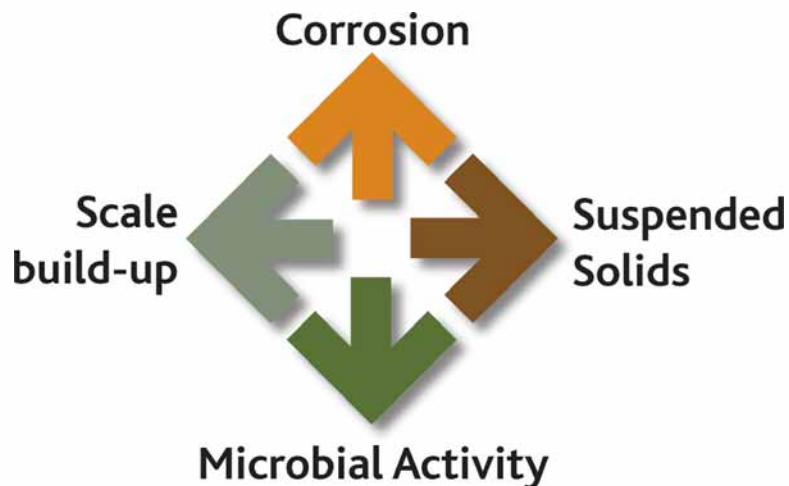


- ❑ Increases contact between air & water
- ❑ Breaks water into small drops or a film as it cascades through the tower
- ❑ Two types of fill

Water contains 3 types of impurities



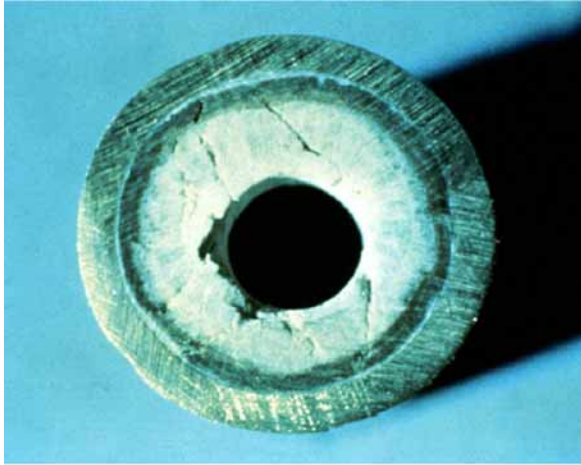
Cooling System Problems



Left unchecked these problems cause:

- ❑ Loss of heat transfer
- ❑ Reduced equipment life
- ❑ Equipment failures
- ❑ Lost production
- ❑ Lost profits
- ❑ Increased maintenance costs
- ❑ Plant shutdown

Mineral Scale



Cooling water contains many different dissolved minerals

When minerals come out of solution they form a hard, dense **SCALE**

Common Scales

- ❑ Calcium Carbonate
- ❑ Magnesium Silicate
- ❑ Calcium Phosphate
- ❑ Calcium Sulphate
- ❑ Iron Oxide
- ❑ Iron Phosphate
- ❑ Others...

AquaCare Scale Control

Pre-Treatment Plant

- ❑ Water Softening Plant
- ❑ De-Mineralisation Plant
- ❑ Reverse Osmosis Plant
- ❑ Supply of new units and servicing of existing plant

Scale inhibitors

- ❑ Crystal Modifiers
- ❑ Sequestrants
- ❑ Dispersants

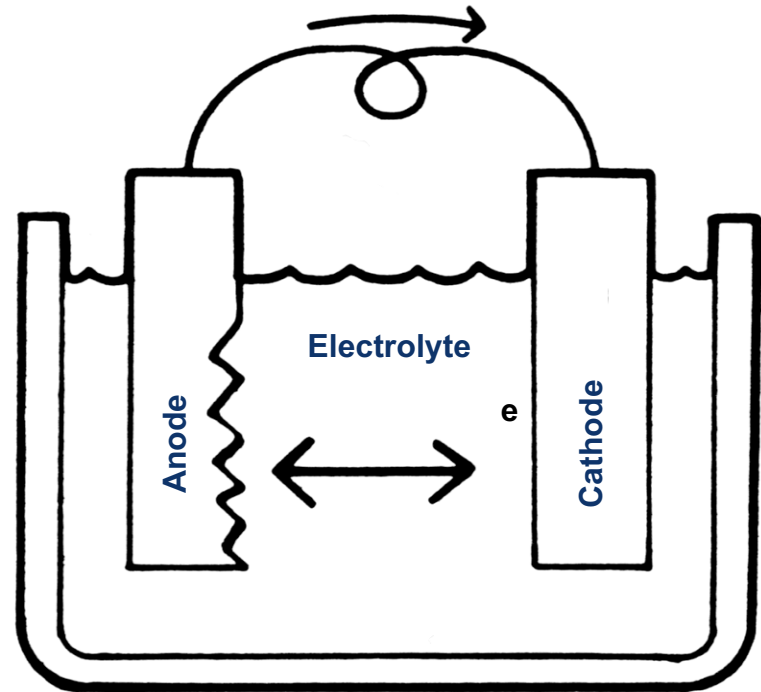


CORROSION

Corrosion is the mechanism by which metals are reverted back to their natural “oxidized” state

Battery Analogy

- ❑ Anode
- ❑ Cathode
- ❑ Electrical Circuit
- ❑ Metal lost at anode



AquaCare Corrosion Inhibitors

Anodic Inhibitors

- ❑ Stop corrosion cell by blocking the anodic site
- ❑ Chromates, Nitrites, Orthophosphates, Silicates, Molybdates

Cathodic Inhibitors

- ❑ Stop corrosion cell by blocking the electrochemical reaction at the cathode
- ❑ Bicarbonates, Polyphosphates, Polysilicates, Zinc

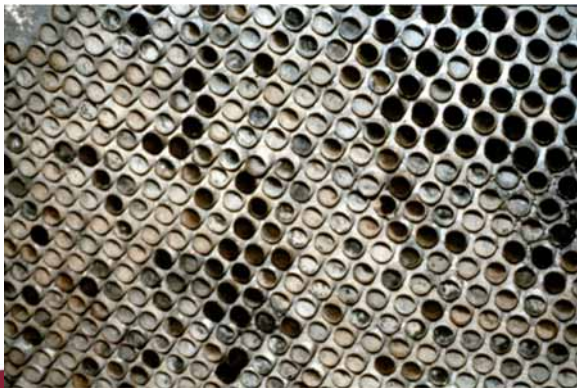
General Corrosion Inhibitors

- ❑ Protect metal by filming all surfaces whether they are anodic or cathodic
- ❑ Soluble Oils, Tolyltriazoles, Benzotriazoles

Fouling

The accumulation of solid material – other than scale – that hampers equipment operation:

- ❑ Silt, Sand, Mud and Iron
- ❑ Dirt & Dust
- ❑ Contaminants, e.g. Oils
- ❑ Corrosion Products
- ❑ Microbiological growth



Solutions

- ❑ Increase Flow Rate
- ❑ Control Temperature
- ❑ Control Microbiological Growth – Biocides
- ❑ Control Corrosion – Inhibitors
- ❑ Filtration
- ❑ Wetting Agents – Surfactants
- ❑ Polymers

Microbiological Growth

Three kinds of troublesome micro-organisms in cooling water:

- ❑ Algae
- ❑ Fungi
- ❑ Bacteria

The microbial fouling process is:-

- ❑ The most complex
- ❑ The least understood
- ❑ The hardest to measure and monitor
- ❑ Controlled using the least desirable, most expensive, & potentially hazardous products

Microbiological Growth

Algae

- ❑ Require sunlight to grow
- ❑ Found on tower decks & exposed areas
- ❑ Form “algae mats”
- ❑ Plug distribution holes on tower decks
- ❑ Plug screens/foul equipment
- ❑ Consume oxidants
- ❑ Provide food for other organisms

Fungi

- ❑ Use carbon in wood fibre for food
- ❑ Destroy tower timbers by either surface or internal rotting (deep rot)
- ❑ Loss of structural integrity of tower



Two Classifications of Bacteria

Planktonic:

- ❑ Free-floating bacteria in bulk water

Sessile:

- ❑ Bacteria attached to surfaces
- ❑ Over 95% of bacteria in a cooling system are sessile and live in **BIOFILMS**

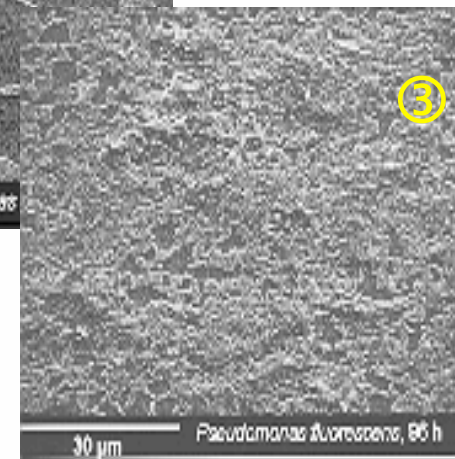
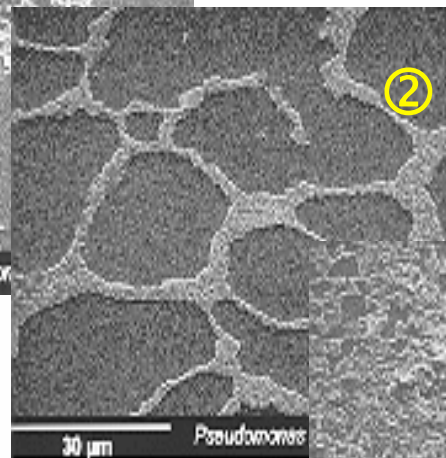
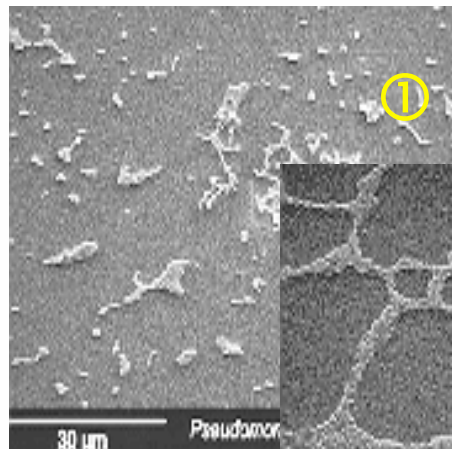
Biofilms can generally be described as a physically coordinated community of bacteria and other microorganisms, embedded in a protective glycocaylx with entrained organic and inorganic debris attached to a surface.

- (Glycocaylx derived from the Greek – glukus – sweet or sugary and kalux – covering)

Biofilms

Contribute to **all** cooling water problems:

- ❑ Under-deposit corrosion
- ❑ Trap silt & debris that foul heat exchangers and tower fill
- ❑ Provide nucleation sites for scale formation



Biofilm Formation

AquaCare Microbiological Control

Treatment With Biocides:-

- ❑ Oxidizing Biocides
 - Chlorine, Bromine, Chlorine Dioxide, Ozone, Silver Peroxide, etc
- ❑ Non-oxidizing Biocides
 - Organic chemical compounds
- ❑ Biodispersants
 - Surfactants

AquaCare Microbiological Control

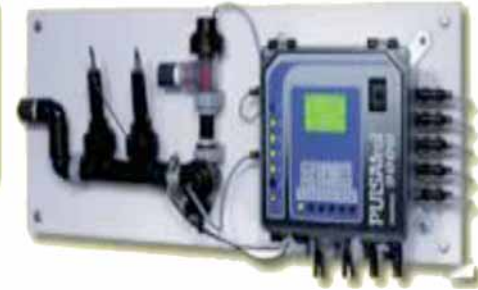
Dosage and Control Equipment

- ❑ The dosage of treatment chemicals is paramount in ensuring the control of:
 - Scale
 - Corrosion
 - Suspended Solids
 - Microbiological Fouling
- ❑ The equipment ensures system parameters are maintained and chemical dosage is correct

AquaCare equipment includes:

- ❑ Diaphragm metering pumps, solenoid actuated metering pumps
- ❑ Control modules for cooling tower systems & boilers
- ❑ Chemical storage tanks & bunds
- ❑ Brominators, water meters, bleed valves etc.

Dosage & Control Equipment



AquaCare Cooling Tower Treatment

Water Treatment

- ❑ Scale & Corrosion Inhibitors
- ❑ Fouling control
- ❑ Biocides
- ❑ Legionella Compliance

Dosage & Control Equipment

Pre-treatment Plant

Technical Service & Support