



***Environmental Non-Chemical Water  
Treatment for  
Cooling Towers & Evaporative  
Condensers***



[WWW.VRTXUK.COM](http://WWW.VRTXUK.COM)



# ***Types of Cooling used in Commercial and Industrial Buildings***

## **Air**

Naturally best for water efficiency

Size, mass / building load bear, noise, high energy consumption, excessive heat rejection requirements and capital cost are often prohibitive factors.

## **Water**

Natural high thermal capacity of water allows a more cost effective method used directly to directly or indirectly cool a process, building or specific space.

# ***Water Based Cooling***

Involves water recirculating cooling towers and evaporative condensers.

Traditional approach is the use of water treatment chemicals to control scale, corrosion, fouling and microbiological proliferation ie legionella

Industry standard is to subcontract the ownership of the water treatment to an external specialist contractor to allow the client to focus on core business

Modern developments in technology include non chemical water treatment processes which eliminate chemicals and save water

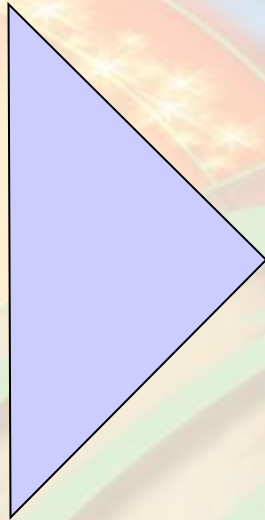
# *Problems related to Cooling Towers and Condenser Water*

## *PROBLEMS*

*Scale*

*Corrosion*

*Bacteria*



## *EFFECTS*

- *Increased maintenance cost*
- *Reduced heat transfer efficiency*
- *Increased energy cost*
- *Increased water costs*
- *Increases effluent costs*
- *Reduced plant efficiency*
- *Growth of hazardous micro organisms*

# *Chemical Treatment*



# ***VRTX Technology – The system***

***VRTX Cavitation Unit** – Cavitation chamber to produce very high energy chemical reactions in the water which convert the soluble minerals associated with scale formation into a non-sticking calcium carbonate powder and destroys bacteria*

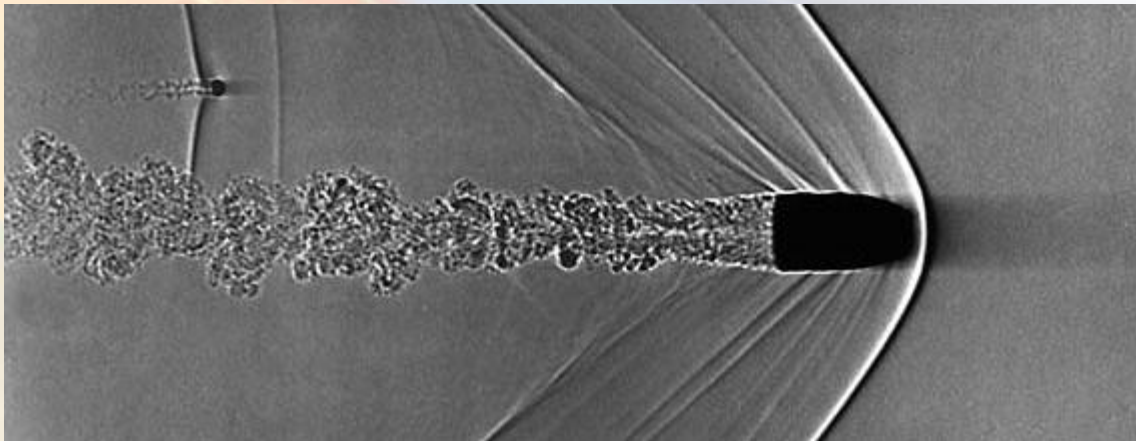
***Filtration Unit** - A highly effective side stream Automatic Self Cleaning Water Filtration System is used to filter out the particles formed by the VRTX cavitation chamber and other suspended solids, leaving the condenser water crystal clear*



# *The Technology behind VRTX*

*Originally developed in the mid 80s by Dr Cliff Ashbrook*

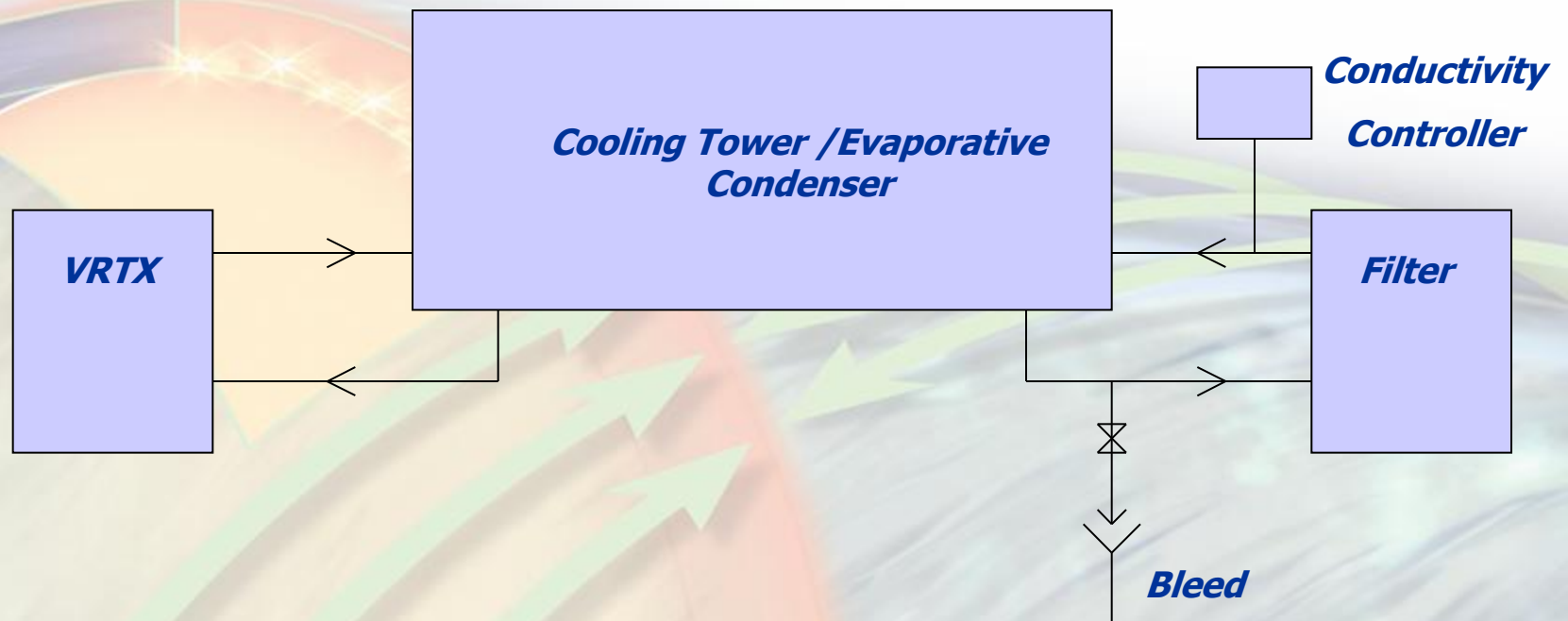
*An Engineer who determined that the low pressure cavitation zone created by a spinning bullet travelling through water caused changes in the water chemistry leading to the deposition of Calcium Carbonate.*



*This observation led to the development of nozzles to create and control cavitation.*

*It has subsequently been developed to be recognised as Award Winning and Best Available Technology*

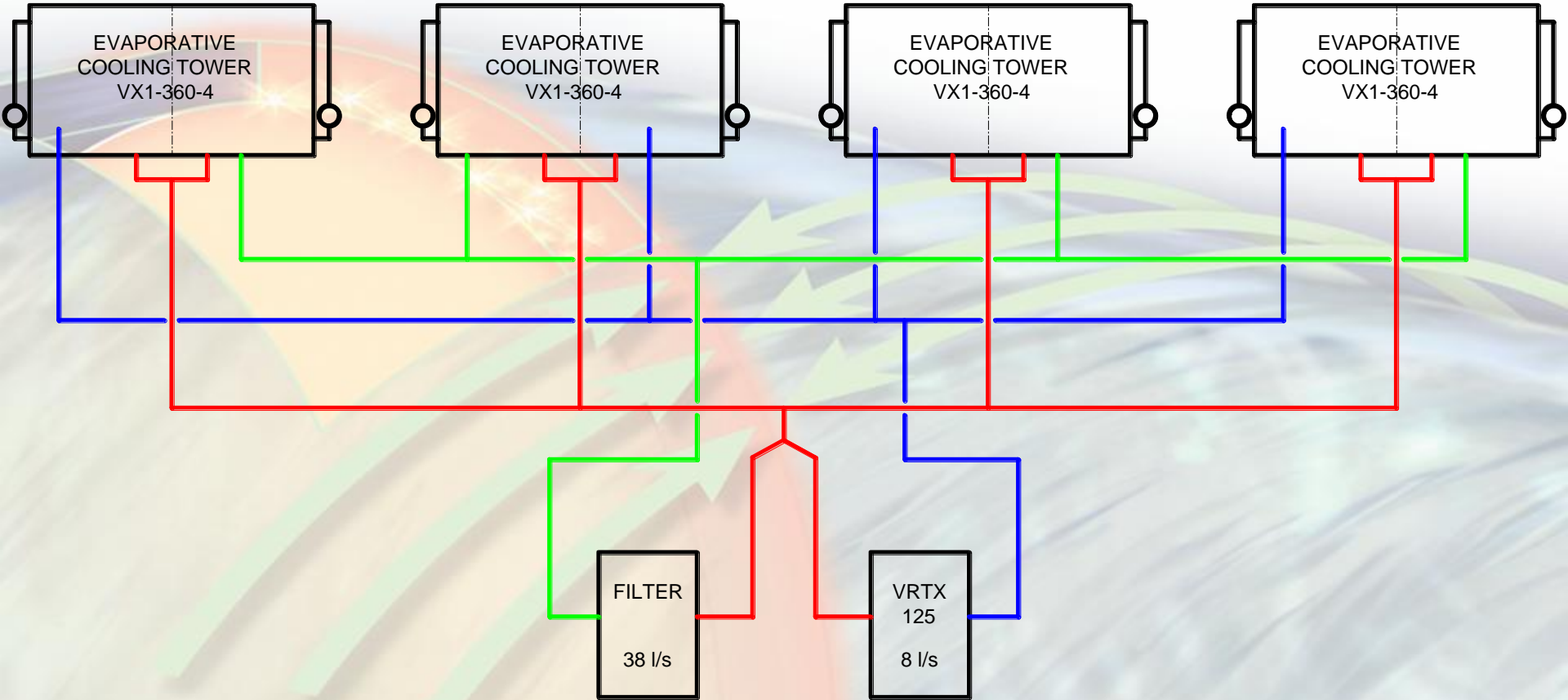
# ***VRTX - CHEMICAL FREE METHOD OF CONTROL***



*VRTX - Typical Systems Schematic*

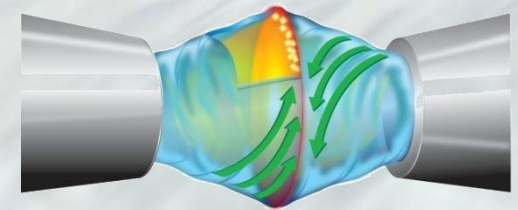
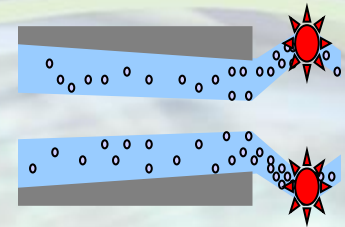
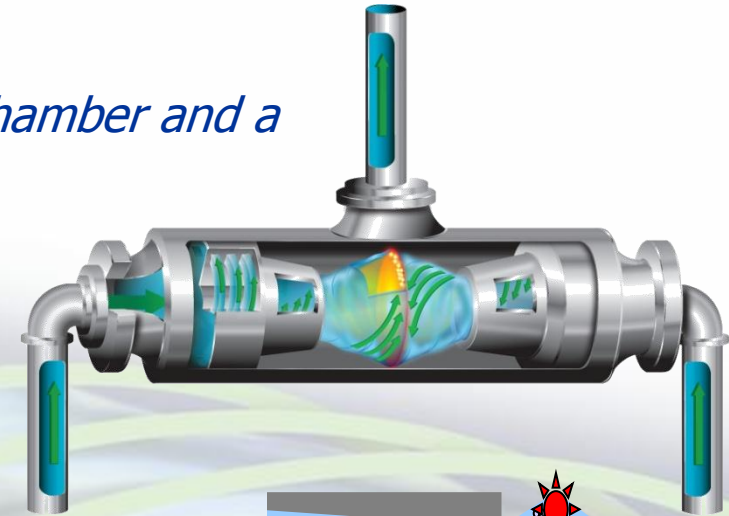


# Multiple Evaporative Cooling Towers – VRTX Solution



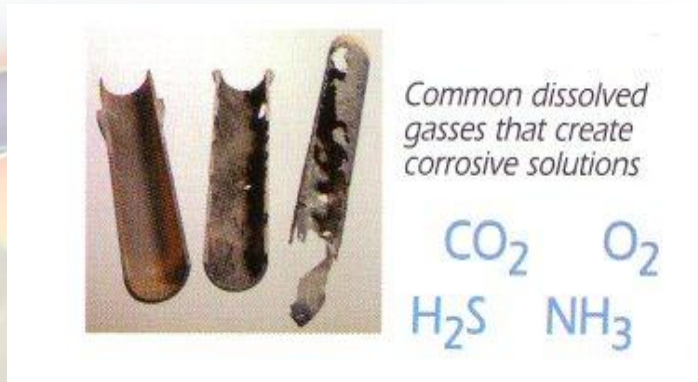
# How the VRTX Cavitation Chamber Works

- VRTX chamber consists of a pressure equalizing chamber and a cavitation chamber
- Water is pumped at approx 7 bar into pressure equalizing chamber, then channeled into the cavitation chamber where it is forced to rotate at high velocity
- Two opposing streams collide at the mid-point of the chamber
- Rotating water streams create strong vacuum
- Micro bubbles form and grow in the Vacuum zone
- The bubbles collapse catastrophically when streams collide

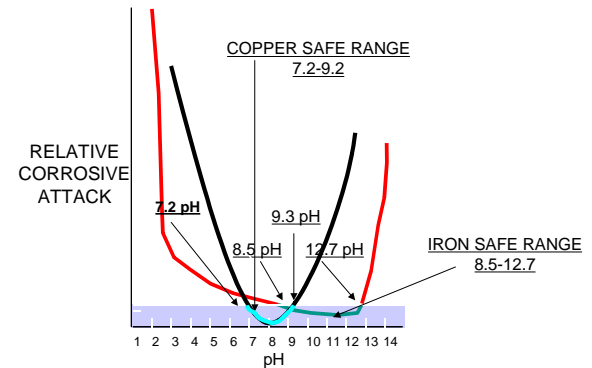


# ***VRTX Technology Corrosion Control***

*VRTX Cavitation degases water, removing dissolved gasses that create corrosive solutions*



**COPPER AND IRON CORROSION AS A FUNCTION OF pH  
(8.5 - 9.2 SAFE FOR BOTH)**



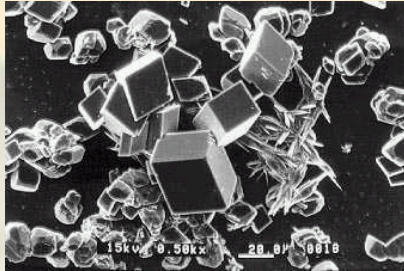
*Maintains water levels at stable elevated Levels (pH > 8.5)*

*Removes the requirement for using aggressively corrosive halogen based biocides*

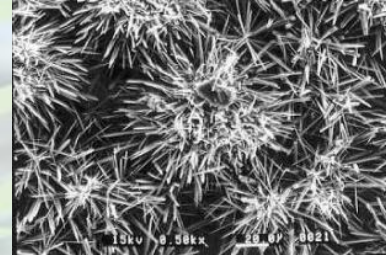
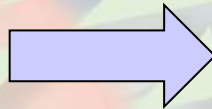
*Utilises the natural reserves of Bicarbonate in the water as an effective Cathodic Corrosion Inhibitor*

# ***VRTX Technology Scale Control***

*VRTX uses the kinetic energy released when the streams collide to form solid particles of calcium carbonate from solution to form non sticky  $\text{CaCO}_3$  colloids called Aragonite. Aragonite colloids are then removed by filtration, this allows the system to run at higher cycles of concentration.*



***Calcite***



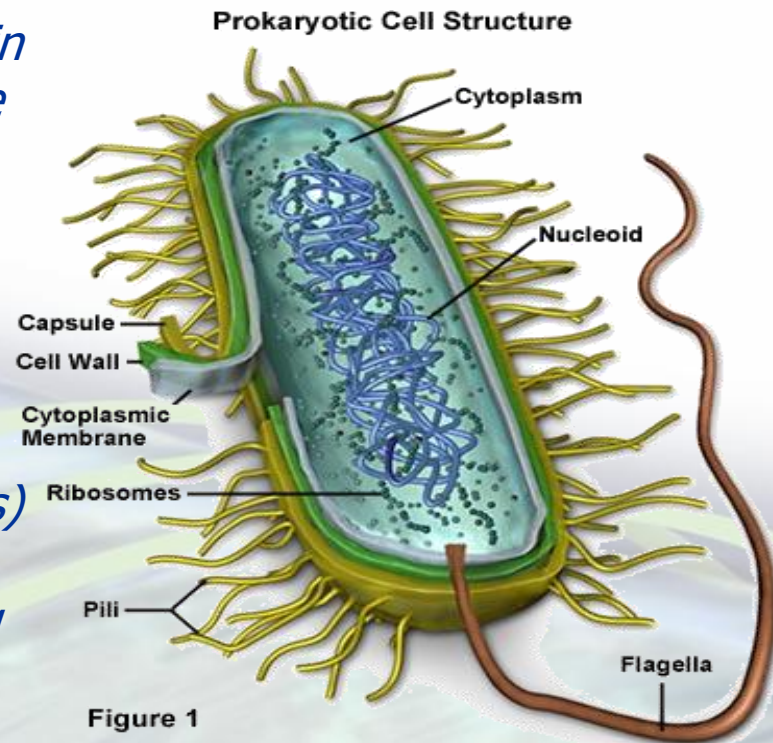
***Aragonite***

*The VRTX Technology prevents the formation of new scale and by conditioning the water in this way and will also scavenge any existing scale thus improving heat transfer.*

# ***VRTX Technology Bacteria Control***

*The VRTX Cavitation chamber destroys bacteria in a combination of ways all resulting in the rupture of the micro organism's cell membrane*

- Extreme Pressure Changes*
- Microscopic extremes of temperature*
- Kinetic impact of opposing water streams*
- Hydrodynamic cavitation sonic waves (Micro jets) caused when micro size bubbles collapse near a bacteria cell it implodes asymmetrically rupturing the cell membrane*
- Production of Hydrogen Peroxide (active biocide)*



# ***VRTX Technology***

***Atmospheric pressure in sump***



***Pump pressure (~100 psi – 7 bar)***



***Near vacuum condition inside of cavitation chamber (-27.5" Hg)***



***High pressure and shear created by the collision of water streams at 450 mph at the mid-point of chamber***




***Discharge pressure (2 - 4 psi)***



***Atmospheric pressure in sump***

# ***VRTX Technology – Comparison to Traditional Water Treatment*** *Author – Alan Edwards*

<b>POTENTIAL PROBLEM AREAS</b>	<b>CAUSES</b>	<b>PREVENTED BY</b>	
		<b>CHEMICAL APPROACH</b>	
Scale Deposition	Calcium bicarbonate ↓ Crystalline calcium carbonate	Sequestrant – calcium carbonate is precipitated in amorphous Aragonite form	Calcium Carbonate is precipitated in amorphous Aragonite form
Corrosion	Metal Electrolyte Oxygen	Inhibitor film e.g Calcium Carbonate	Inhibitor film (Calcium Carbonate)
Sedimentation	Suspended solids accumulation	Dispersant and / or side stream filtration	Side stream Filtration
Bio fouling Legionella	Bacterial proliferation (Biofilm)	Chemical Biocide – oxidising & non oxidising	Physical Biocide & Oxidising agents produced in Cavitation chamber
Algae	Sunlight / Damp	Exclude Sunlight or use Algaecide periodically	Exclude Sunlight or use Algaecide periodically

# ***Recognition Awards & Independent Evaluations***

- *February 1999* -*Plant Engineering Product of the Year 1999*
- *December 2001* *The Strategic Enviro-technology Partnership  
Green Book Technology Summary Report*
- ***October 2002*** -***Minnesota State Governor's Award (General Mills Inc.)***
- *October 2005* -*National Registry of Environmental Professionals  
2005 Award (Tropicana).*
- *December 2005* -*American Society of Heating, Refrigeration and Air  
Conditioning (ASHRAE) 2006 Innovative  
Award*
- *July 2007* -*Alan Edwards & Mercian Science Independent  
Legionella Testing*
- *2007* -*WCEC VRTX one of fourteen affiliate companies of  
the Western Cooling Efficiency Centre,  
California*
- *2008* -*US Green Building Council's LEED(New Construction)  
Innovation and Design Credit 1.1 and 1.2*

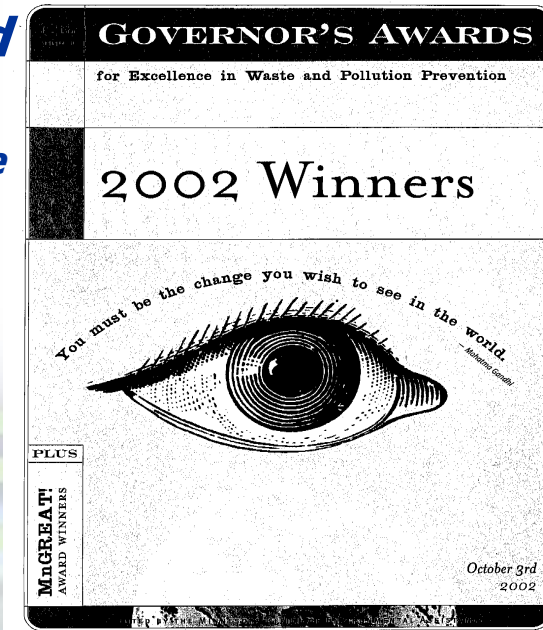


# ***Case Study*** ***General Mills, Inc., Chanhassen Facility -*** ***Minnesota State Governors Environmental Award***

***Ammonia refrigeration with two evaporative condensers***  
***1999 installed VRTX on 1 condenser and evaluated performance***  
***Compared with chemical treatment.***

- 1. "Elimination of toxic & hazardous chemicals"***
- 2. Improved work environment for employees***
- 3. "40% reduction in water usage***
- 4. " An estimated 10% increase in efficiency was achieved resulting in a 1.8million kWh decrease in energy usage and it's related emissions."***
- 5. "Installation of 21 additional systems across the General Mills Plants , resulting in improved environmental conditions in the USA"***

JAN-06-2004 TUE 11:03 AM VRTX TECHNOLOGIES LLC FAX NO. 8661489 P. 01



# *Chemical Free Cooling Water Treatment*

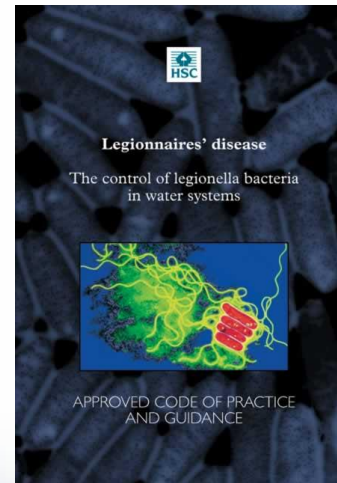
*VRTX is the only tested & proven totally chemical free water treatment system commercially available.*

*Environmentally Friendly Control of Scale , Corrosion, and Bacteria*

*VRTX Technologies offers enhanced Environmental and Performance savings*

*Full ACOP L8 Compliance*





***“It is therefore perfectly acceptable to use an alternative technology to treat water systems providing they comply with the provisions of the ACOP. Under Water Treatment the ACOP says that the risk from Legionella should be prevented or controlled; precautions should include the use of water treatment techniques”.***

***“I believe paragraph 121 of the ACOP recognises the potential benefits of alternatives to chemical biocides but importantly implies that other water treatment techniques should only be used if they are capable of achieving at least the equivalent biocidal effect to those of traditional methods”.***

**Steven Copping  
HM Specialist Inspector  
Biological Agents Unit  
July 11<sup>th</sup> 2005**



# ***Independent Legionella Testing***

*Independent Legionella analysis was conducted on the VRTX Cavitation chamber by UKAS Accredited Laboratory Mercian Science and Principle Consultant Alan Edwards of Alan Edwards and Partners, (who acted in consultation with the HSE in the production of the ACOP L8 document) .*

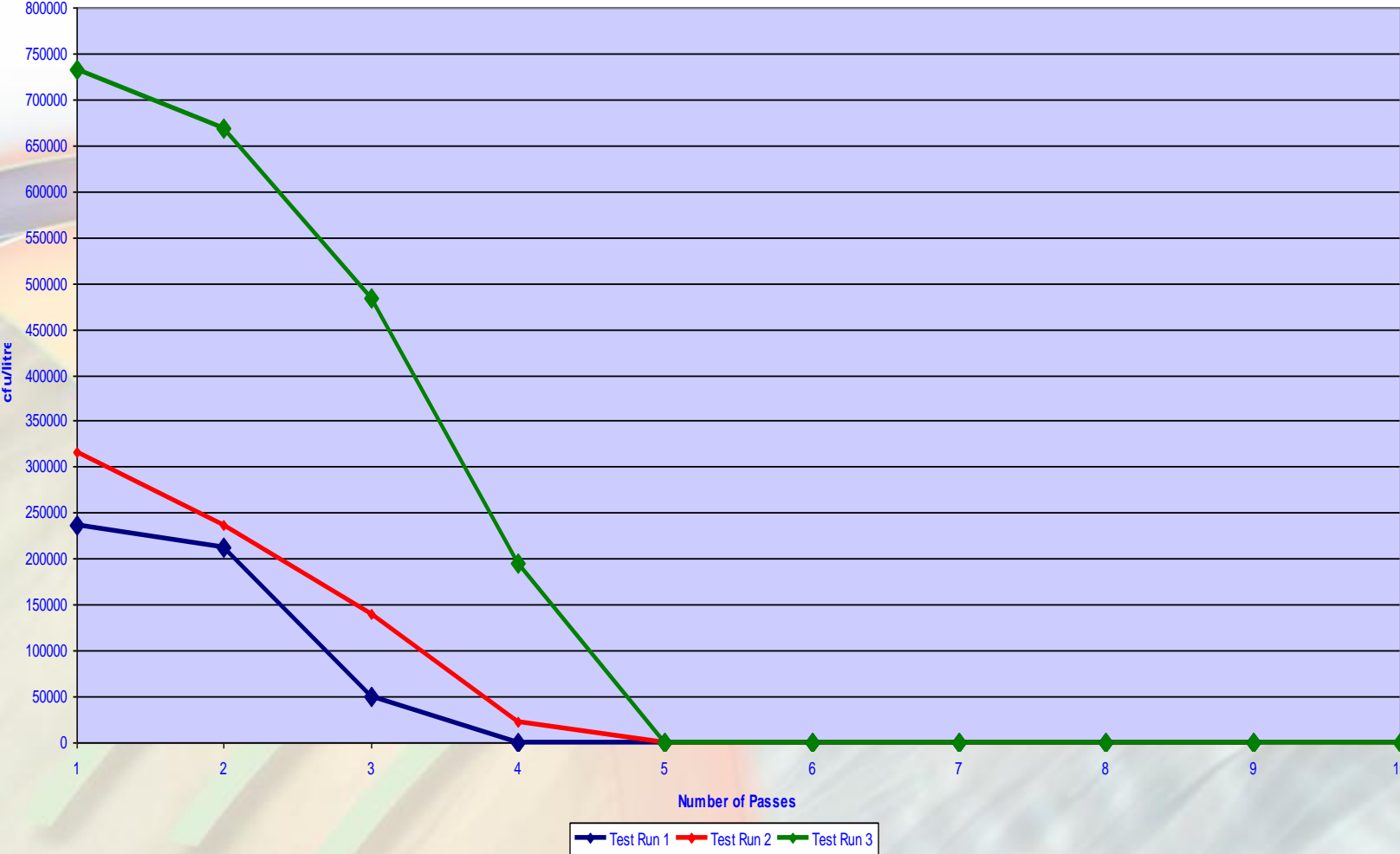
*The graphical representation of the results show conclusively that the VRTX has the ability to reduce the number of Legionella Pneumophila Serogroup 1 from concentrations of  $1 \times 10^7$  cfu/Litre (10,000,000) to 0 cfu/Litre within 5 passes of the cavitation chamber*



**Alan Edwards & Partners**

# VRTX Technology Bacteria Control

Effect of VRTX on Numbers of Legionella Pneumophila sgr 1 (1 Pass takes 75 secs)





The following companies have trusted VRTX with their water treatment needs...



Life is our life's work



- Seminole Community College
- Sugar Creek Baptist Church
- Cloverleaf Cold Storage
- Richmond Cold Storage
- Appleton Med Center
- Pomeroado Hospital
- Preferred Freezer
- Tri-North Builders
- U.S. Cold Storage

2005  
Award



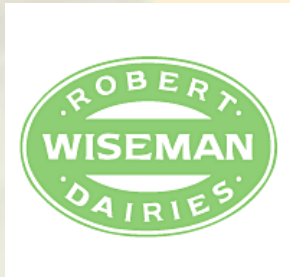
Water, Waste Water,  
Storm Water

## USA INSTALLATIONS

*1,500 + Cooling Towers & Evaporative Condensers Being treated using VRTX Technology throughout the USA*



# UK INSTALLATIONS



***35 VRTX Systems Treating 95 Towers  
over 100 years operating time in the  
UK***

# ***VRTX Treatment***



***Non Chemical***

***Fully Integrated with BMS Systems***

***Monitored and alarmed to ensure correct treatment.***





## ***BPS Projects are a Category 1 member of the Legionella Control Association Service Provider Code of Conduct Directory***

***All registered companies are committed to have correct management practices and procedures in place to conform with the registration documents, and the management requirements of ACOP L8***

***Reference to the Code can be found in the document "Legionnaires' disease - The control of legionella bacteria in water systems - Approved Code of Practice and Guidance L8 " released by the HSE in January 2001.***



# ***VRTX Treatment***



***Non Chemical***

***Fully Integrated with BMS System***

***Monitored and alarmed to ensure correct treatment.***

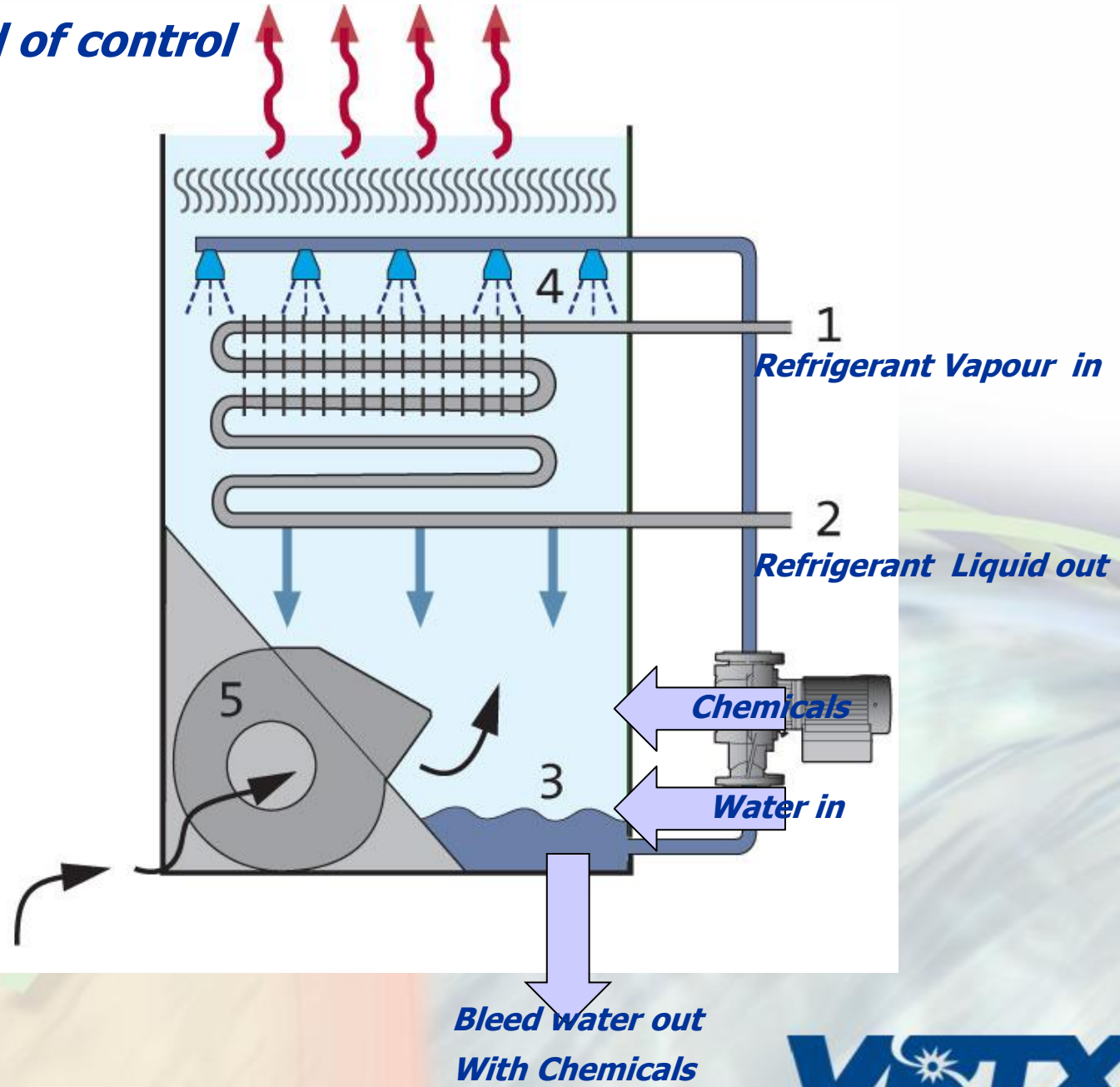


***VRTX Water Quality***

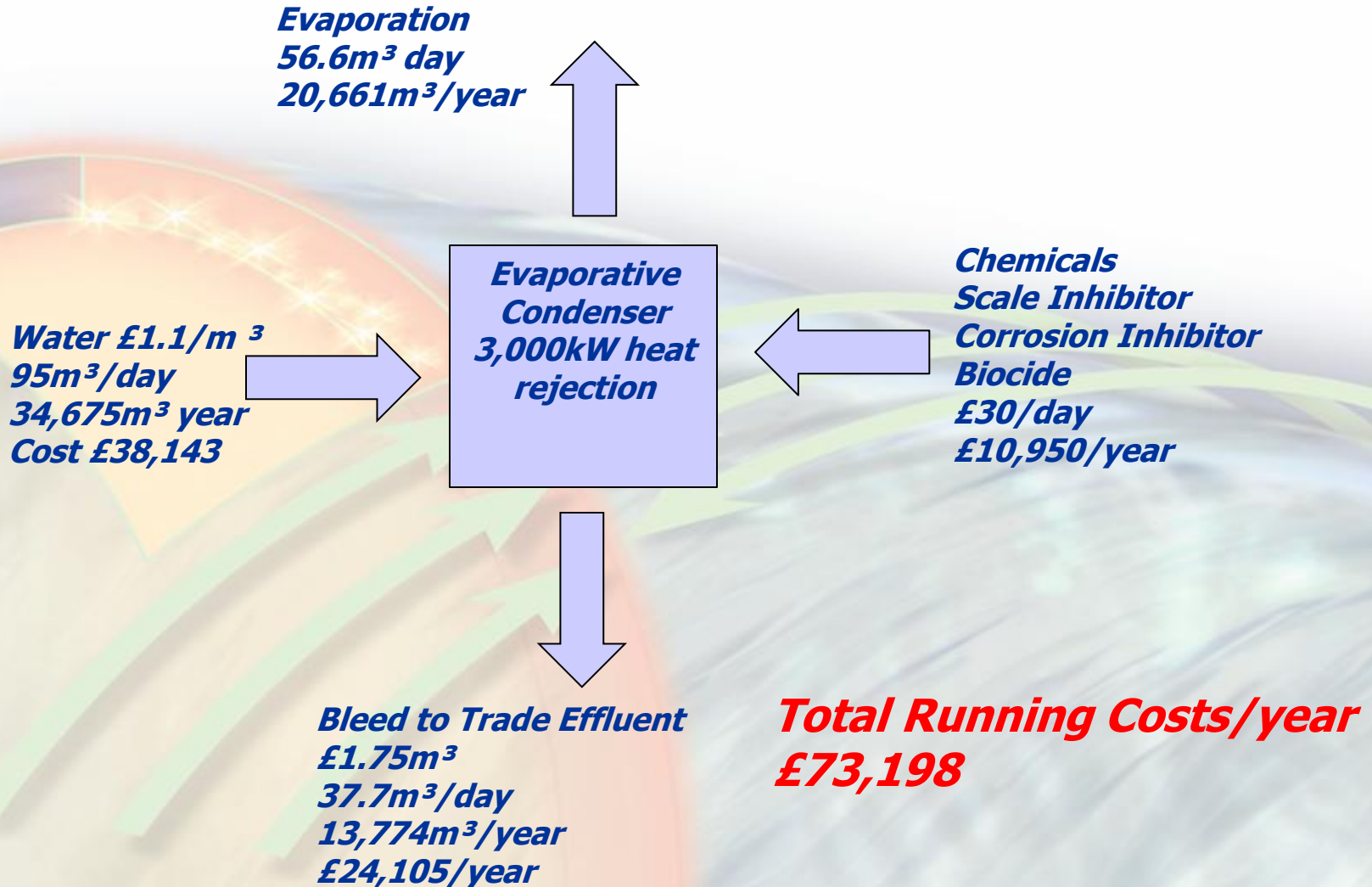


**Traditional method of control**

**H<sub>2</sub>O**



**Evaporative Condenser 3000kW Heat Rejection operating on chemical water treatment with 2.5 cycles of concentration and 50% utilisation**



## *Environmental Effect – Chemical Treatment*

**Greenhouse Gasses  
44.82 Tonnes CO<sup>2</sup>e**

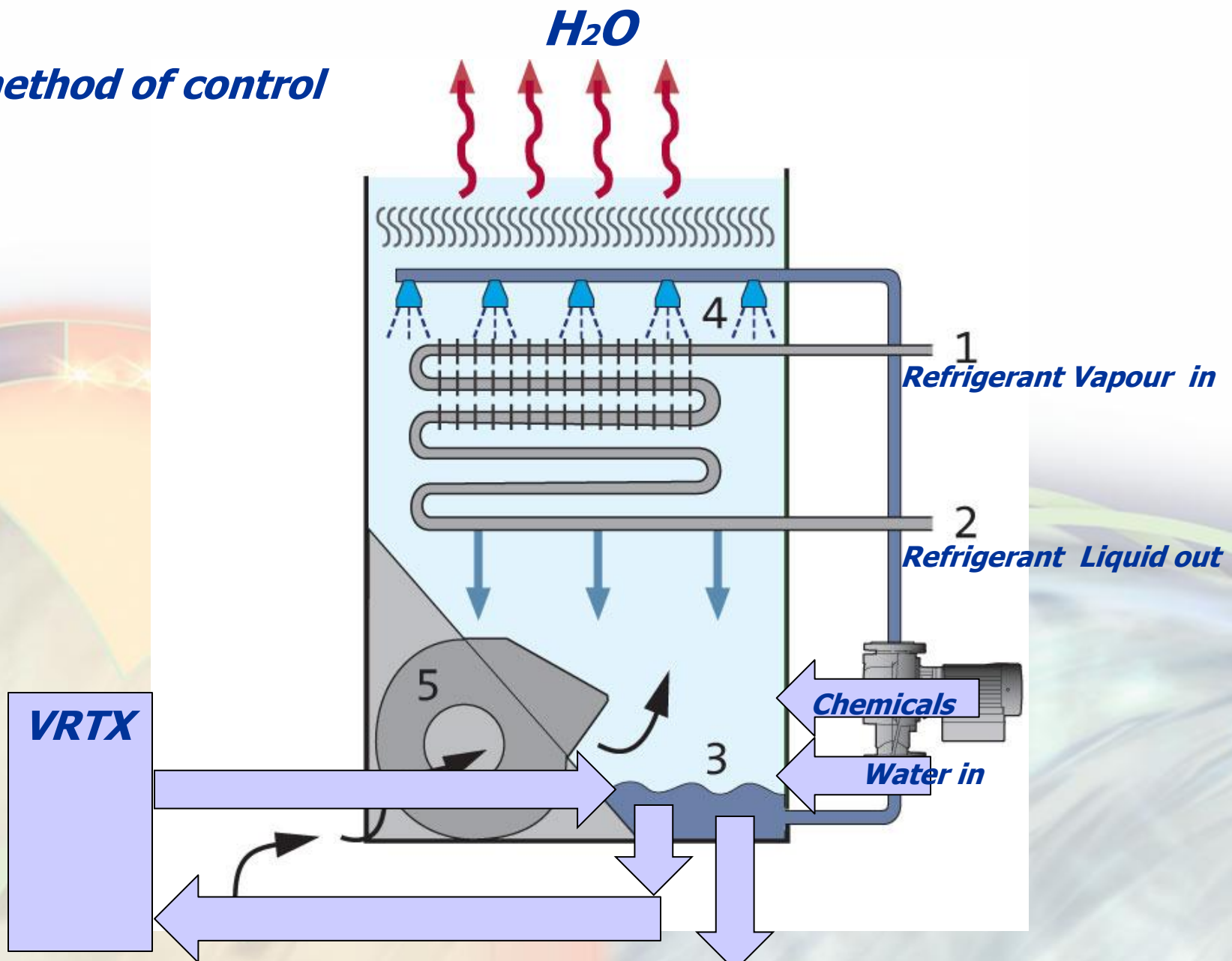
**Water 34,675m<sup>3</sup>**

**Chemicals  
2.3 Tonnes**

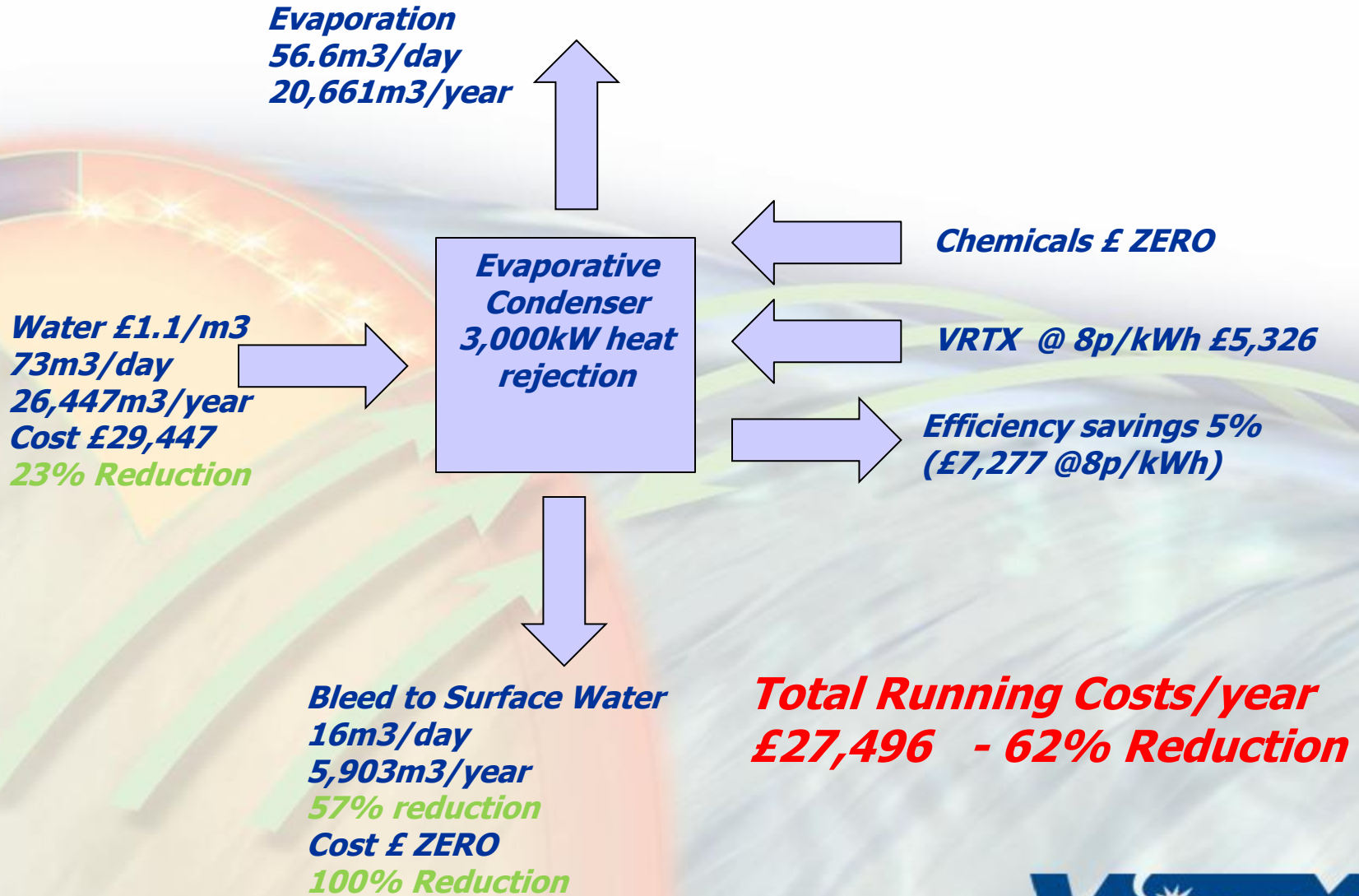
**Effluent  
13,774m<sup>3</sup>**

**Including 2.3 tonnes of  
Chemicals**

# VRTX method of control

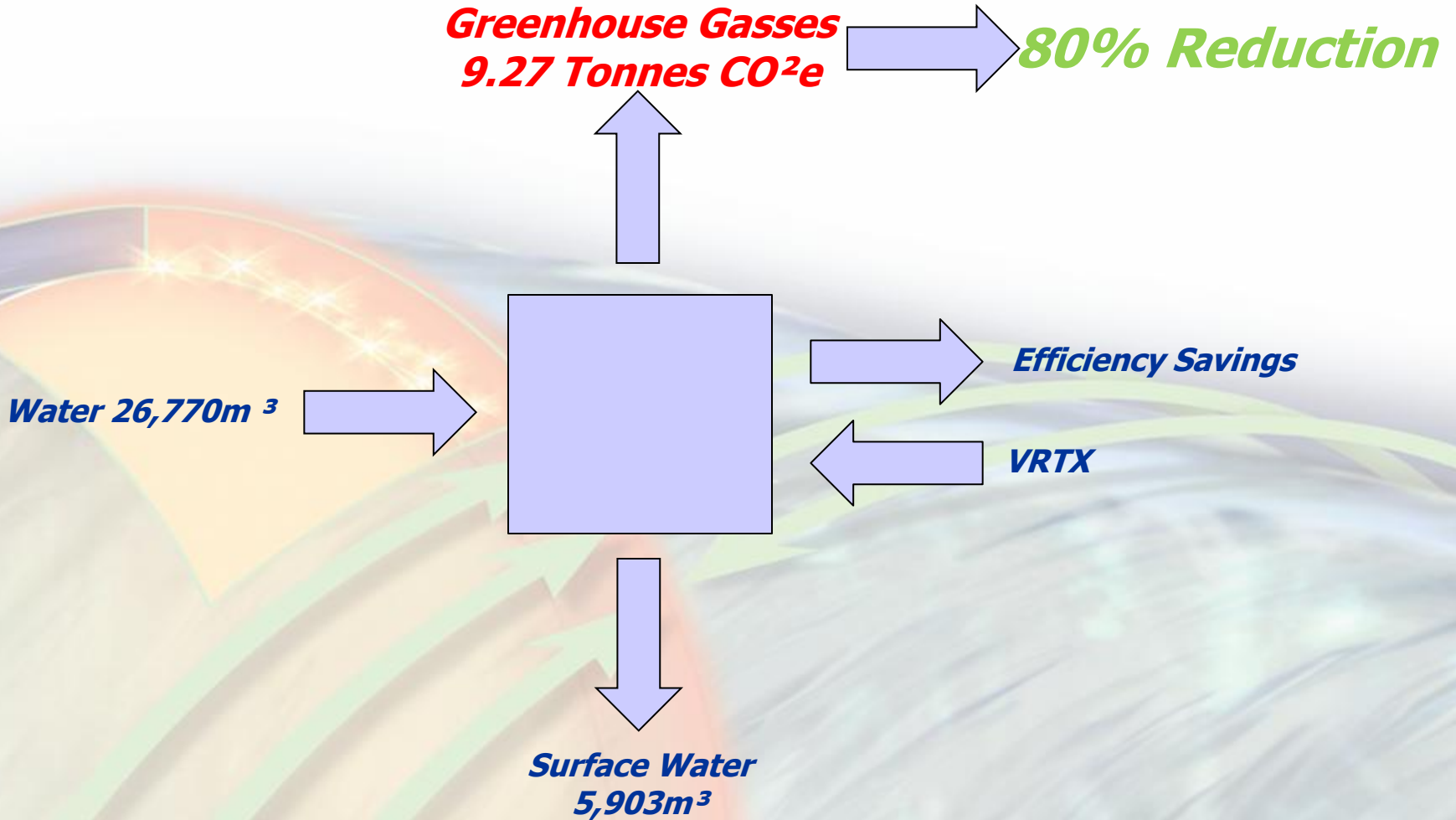


# Evaporative Condenser 3000kW Heat Rejection operating on 4.5 cycles of concentration and 50% utilisation with VRTX Treatment





## *Environmental Effect – VRTX Treatment*



**Comparison of Chemical Treatment V's VRTX Non Chemical Treatment  
Evaporative Condenser 3000KW Heat Rejection**

	<b>Cost</b>	
	<i>Chemical</i>	<i>VRTX</i>
<i>Make Up Water</i>	<i>38,143</i>	<i>29,447</i>
<i>Effluent</i>	<i>24,105</i>	<i>Zero</i>
<i>Chemicals</i>	<i>10,950</i>	<i>Zero</i>
<i>VRTX Running Cost</i>	<i>-</i>	<i>5,326</i>
<i>Efficiency Savings 5%</i>	<i>-</i>	<i>(7,277)</i>
<i>Total Cost / Annum</i>	<b><i>73,198</i></b>	<b><i>27,496</i></b>

***Saving £45,702 or 62% of costs***  
***80% Reduction of Greenhouse Gases***

# ***Case Study ASDA CDC – Lutterworth***

***Commissioned November 2006***

***NO LP Positives or Dip Slides outside of L8***

***Cycles from 2.5 to 4***

- ***Chemical Saving £8,000/annum***
- ***Water & Effluent Savings £8,000/annum***
- ***Water consumption reduced by 4,000m<sup>3</sup> /annum***
  - ***Greenhouse gases reduced by 7.2 tonnes***
  - ***Energy savings 10.6Mw***
  - ***Chemical savings 1 tonne***



# ***1,200kW condensers with V40 system***

***COC from 4 to 7***

***Eliminating Chemicals***

***Saving Water & Effluent***



***Commissioned August 2010***

***Average Cycles of Concentration 6.95***

***Average TVC (Dip Slide) <1000cfu/ml***

***All Legionella Test Results Negative***

***Annual Savings £19,000***

# GSK



***Commissioned April 2010***

***Bacteria results typically < 1,000cfu/ml  
ALL within L8 specification***

***Monthly Legionella sampling  
– NO Positives.***

# ***VRTX Environmental Performance Savings***

## *ISO 14001 compliance*

- By allowing system to run at higher cycles of concentration it allows customers to make **best use of their water resources.***
- Because the amount and chemical contamination of the Cooling tower bleed off is eliminated it helps to **reduce the customer's negative impact on the Environment and reduce pollution to a minimum.***
- Shows continuous improvement as customer's **chemical & carbon foot print is reduced** by utilising "Green Technology"*

## *COSSH*

*As **VRTX is totally chemical free**, the H&S and management burden are virtually eliminated, allow best use of labour resources*



# ***Summary & Typical Cost savings***

*-Fully Automatic , monitored & alarmed*

*-Saves Water By Running Higher Cycles*

*-No Chemical dosing*

*-Reduce Energy Consumption By Operating Cleaner System*

**-Water Savings - 25%**

**-Effluent Savings – up to 100% (50%)**

**-Improved Heat Transfer**

**-Eliminates Chemical Footprint**

**-Reduces Carbon Footprint**

**-Reduces Water Footprint**





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