

# Valuable water knowledge





**AQUARIUM**  
VANDERHANDLINGSANLÆG  
LEARNING CENTER

## Water, tomorrow's most valuable natural resource

The challenge of access to clean drinking water is not restricted to Denmark, it is a global issue. At Kemic Water Technology, we constantly strive to improve and develop solutions in close collaboration with waterworks specialists and the waterworks industry.



# Valuable water knowledge

## Our know-how - your know-why

Kemic Water Technology delivers water treatment solutions based on the very latest research and technology. Danish water utilities place high demands on the quality of our drinking water, and we are prepared for the future with a whole range of new solutions. We regularly develop new, ground-breaking technologies; among others, treatment of contaminated raw water, which is an increasing problem in Denmark.

One of our priorities is sharing our expertise on water treatment with our customers, so that our KNOW-HOW becomes our customers' KNOW-WHY. This will help us meet tomorrow's challenges together.

### We build tomorrow's waterworks

Kemic Water Technology is an active partner when it comes to the design and construction of tomorrow's water treatment plants.

Aquarium is one such plant, combining the latest water treatment plant technology with an education centre.

### Technologies that ensure clean water

- Clean water tanks in stainless steel with effective CIP processes
- Chemical contamination in percolate is eliminated by vacuum
- UV treatment for elimination of bacteria growth

### New biotechnology eliminates pesticides

Bacteria that eat pesticides: it's as simple as that. But the technology is more advanced than it sounds. Kemic Water Technology is one of the partners on the 'Trojan Horse' project, the aim of which is to develop environmentally friendly and sustainable sand filter technology to deal with the increasing incidence of pesticides in our groundwater.



know  
how

*We deliver water treatment solutions for safe water supply.*

know  
why

*The world's hygiene challenges will be the next generation's reality.*





know  
how

*Security of supply depends on entirely closed systems.*

know  
why

*One of the weaknesses in the security of supply.*



# Overview

## - from idea to finished project

It does not make sense to provide standard solutions when requirements differ from waterworks to waterworks. For this very reason, the design and analysis phase is of vital importance to the details of the finished result. The right solutions are based on experience, the latest technology and expertise. We pass this understanding and reasoning on to our customers so that our **know-how** becomes their **know-why**.

### **Balancing expectations in clear agreements**

It is important that we fully discuss and reach agreement on all of the customer's project requirements and expectations before the project begins. A supplier agreement with Kemic Water Technology is based on a close dialogue to promote understanding of the project's specific content requirements.

Kemic Water Technology is an order-producing company, and our own experienced fitters handle installation, commissioning and service. All of our skilled installation and service engineers have completed the legally required operational and hygiene courses.

- Design and analysis
- Installation and commissioning
- Service and maintenance



*Haarby waterworks  
- from idea to finished project.*



*Ry waterworks*

know  
how

*Water is pumped to the treatment plant.*



know  
why

*Collective supply agreements.*



*Filtration plant in stainless steel  
Bøgebjerg waterworks.*

# Renovate or build from scratch?

## Investment in the future requires thought

If it is regularly maintained and optimised, a water treatment plant is often fully functional for 20 to 30 years. It is then time to give careful consideration to the options: renovation or a new plant. Kemic Water Technology has many years of experience in both solutions, and both are viable options - the investment merely requires some thought.

## 5 good reasons

### Renovation:

- Good potential for risk protection and gearing existing buildings for the future
- Potential for renovating in stages
- Acute need for renovation but insufficient funds for a new building
- The building is functional but does not have sufficient space
- Building conservation

### New building:

- The entire waterworks is run-down
- New waterworks will not require maintenance for many years
- Optimal potential for meeting new demands, such as requirements for hygiene zones
- Long-term economic profit
- Potential for relocating the waterworks





*Filter capacity 400 m<sup>3</sup> per hour  
Aquatarium, Ringkøbing-Skjern Forsyning*



# Aquatarium

## Tomorrow's water treatment plant is already up and running

Architecturally and technologically, Aquatarium is a modern waterworks, consolidating expertise and technology in one location. With its new water treatment plant and knowledge centre, Ringkøbing-Skjern Forsyning has taken yet another step towards creating an international showcase. Kemic Water Technology was an active partner in the design and analysis of the water treatment process and the integration of new technologies. Technical specialists and researchers specialized in water technology, both from Denmark and abroad, regularly participate in development projects aimed at optimising global water treatment in the long term.

### Open to the public

Aquatarium supplies 22,000 consumers in the municipality of Ringkøbing-Skjern with water but is also a knowledge centre and demonstration facility. In addition to the extensive collaboration on further development and studies, the waterworks is also intended to be a learning center to teach about water and water treatment. Consequently, Aquatarium is open to the public. With the Aquatarium project, Kemic Water Technology proves that we, and Denmark, are at the very forefront of water technology.

### Research and international focus

Aquatarium is one of the front-runners and is participating in the FutureWater research project together with Aarhus University and the Danish Ministry of the Environment. The aim is to gather and make use of knowledge, **know-why**, and experience, **know-how**, to improve tomorrow's water supply.

During this close collaboration, Kemic Water Technology supplied the technical element of the project on account of our many years of expertise and experience in water supply.



*Aquatarium produces 2,000,000 m<sup>3</sup> of water to consumers in Ringkøbing-Skjern's Municipality. In addition, it also acts as a learning and research center.*



*Love-Knudstrup waterworks*

know  
how

*Stainless steel clean water tanks are part of the solution for a safe water supply for consumers.*

know  
why

*Drinking water in rustproof containers.*



*Horizontal, stainless steel clean water tanks  
Love-Knudstrup waterworks*

# The tank that matters

## Stainless steel tanks meet tomorrow's requirements

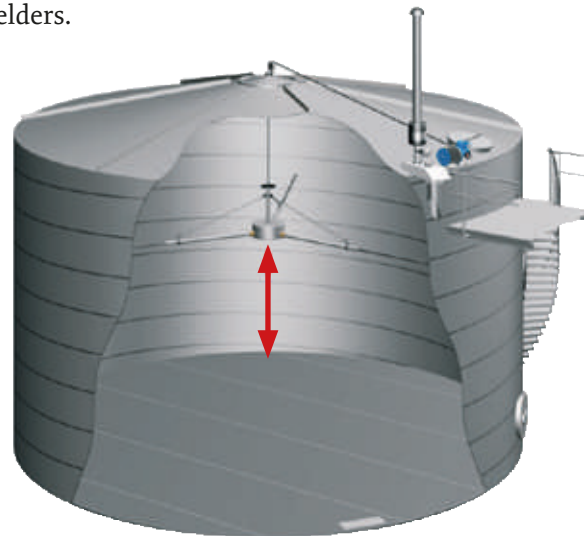
Drinking water hygiene is receiving increasing attention, as are the solutions that will gear our water utilities for the future. One of these solutions is stainless steel clean water tanks, which minimise the risk of bacteria growth.

### Welding methods and design

There are clean water tank solutions in stainless steel, of varying quality and price, for both large and small waterworks. Kemic Water Technology supplies clean water tanks in grade 316L/1.4404 stainless steel. Welding and construction are adapted to prevent unnecessary deposits in the tanks. The tanks can either be delivered ready-made or be welded up on site by certified welders.

### The CIP cleaning process - new but recognised technology

In the future, waterworks will benefit greatly from using the CIP process to clean stainless steel tanks (see illustration). CIP is an abbreviation of Clean In Place and uses cleaning fluids and high-pressure water blasting for the cleaning process. The technology is already well established in the food industry.



*Two 1,000 m<sup>3</sup> clean water tanks  
Aquarium*



know  
how

*Water sampling is an important tool for ensuring water quality.*

# When vacuum cleans

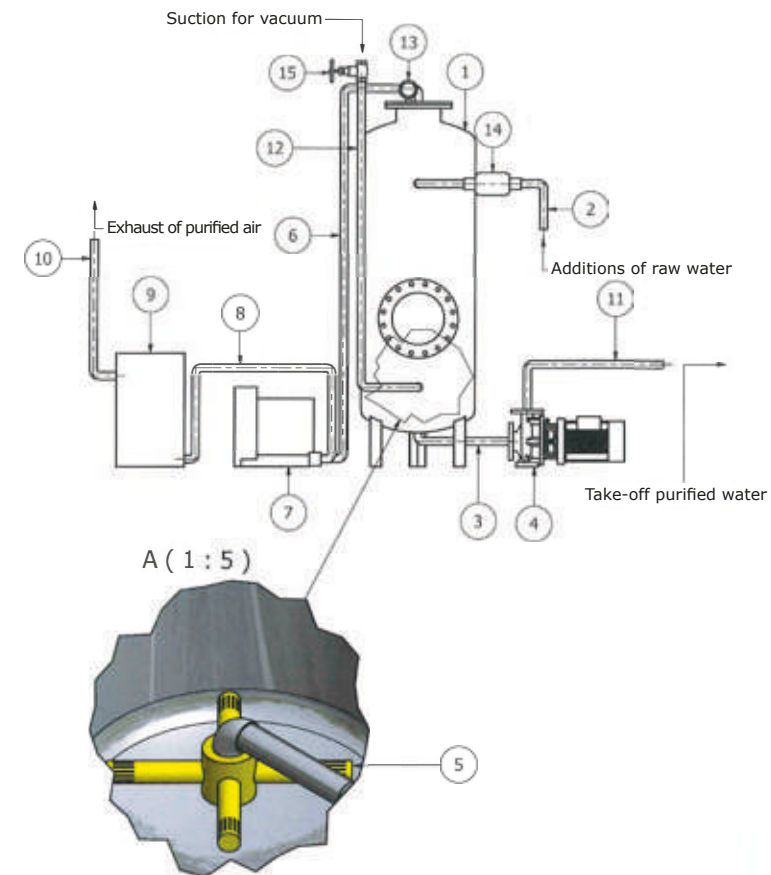
## Solvents are eliminated

### Vacuum systems

We see an increased number of boreholes that contain raw water contaminated with solvents and petrol and oil components. Remediation is required to avoid the spread of contamination. Percolate pumped up from boreholes can be effectively purified in Kemic Water Technology' vacuum extraction plant before the water is piped to the recipient.

### Environmentally friendly treatment of percolate

The purification method used in vacuum extraction consists of several processes: Contaminated particles are gasified by piping the water through a filter, which operates by negative air pressure (vacuum). The resulting quality of the clean, treated water fully complies with all threshold values for treated water for discharge. During the vacuum process, contamination is gasified. Contamination is then piped through a carbon filter and out of the plant as clean air.



### Mobile system with no major installation costs

Kemic Water Technology has a mobile vacuum extraction system which can be set up wherever a remediation system may be needed.

*The quality of the water greatly depends on how well the source is protected.*

know  
why



**Tabel 3.1: Minimum og maksimum indhold af klorerede opløsningsmidler samt BTEX'er ved indløb til rensningsanlæg ved 10 testrensninger (µg/l)**

Lokalitet	Raaco Nykøbing F.		SP Karise		MGKK
	Min. konc.	Max. konc.	Min. konc.	Max konc.	
TCE	400	1000	56	110	1
VC	8,1	18	0,15	0,25	0,2
1,1-DCE	0,55	1,3	<0,020	0,077	1

**Tabel 4.1: 1. Testrensning af klorerede kulbrinter i Karise med undertryk på 0,2bar**

Klorerede alifater	Kolonne 1					Kolonne 1 % fjernelse				
	Råvand	2 min.	3 min.	5 min.	10 min.	2 min.	3 min.	5 min.	10 min.	
TCE	1000	410	190	110	45	59,0	81,0	89,0	95,5	
VC	18	2,3	0,48	0,21	0,024	87,2	97,3	97,8	99,9	
1,1 DCE	1,3	0,32	0,052	0,039	<0,020	75,4	96,0	97,0	#	
Trans-1,2DCE	17	6,3	2,8	1,7	0,64	62,9	83,5	90,0	96,2	
Cis-1,2 DCE	280	160	100	70	42	42,9	64,3	75,0	85,0	

**Tabel 4.2: 2. Testrensning af klorerede kulbrinter i Karise med undertryk på ca. 0,2bar**

Klorerede alifater	Kolonne 1			Kolonne 1 % fjernelse			
	Råvand	4 min.	7 min.	10 min.	4 min.	7 min.	10 min.
TCE	470	45	22	10	90,4	95,3	97,9
VC	18	0,15	<0,02	<0,02	99,2	#	#
1,1 DCE	2,1	<0,02	<0,02	<0,02	#	#	#
Trans-1,2DCE	18	1,3	0,75	<0,02	92,8	95,8	#
Cis-1,2 DCE	160	33	22	16	79,4	86,3	90,0

**Tabel 4.3: 3. Testrensning af klorerede kulbrinter i Karise med undertryk på ca. 0,15bar**

Klorerede alifater	Kolonne 1 (nye bunddysser)			Kolonne 1 % fjernelse			
	Råvand	7 min.	10 min.	13 min.	7 min.	10 min.	13 min.
TCE	880	26	11	9,1	97,0	98,8	99,0
VC	18	<0,02	<0,02	<0,02	#	#	#
1,1 DCE	1,4	<0,02	<0,02	<0,02	98,6	#	#
Trans-1,2DCE	18	0,53	0,13	<0,02	97,1	99,3	#

**Tabel 4.5: 5. Testrensning af klorerede kulbrinter i Karise med undertryk på 0,15bar**

Klorerede Alifater	Kolonne 1			Kolonne 1 % fjernelse			
	Råvand	10 min.	13 min.	16 min.	10 min.	13 min.	16 min.
TCE	820	21	2,8	0,89	97,4	99,9	>99,9
VC	12	<0,020	<0,020	<0,020	#	#	#
1,1 DCE	1,1	<0,020	<0,020	<0,020	#	#	#
Trans-1,2DCE	14	<0,020	<0,020	<0,020	#	#	#
Cis-1,2 DCE	260	26	7,4	2,6	90,0	97,2	99,0

**Tabel 5.1: 6. Testrensning af klorerede kulbrinter på Platanvej med undertryk på 0,2 bar**

Klorerede Alifater	Kolonne 1			Kolonne 1 % fjernelse			
	Råvand	10 min.	13 min.	16 min.	10 min.	13 min.	16 min.
TCE	56	1,6	0,81	0,43	97,1	98,6	99,2
VC	0,20	<0,020	<0,020	<0,020	#	#	#
1,1 DCE	<0,02	<0,020	<0,020	<0,020	#	#	#
Trans-1,2DCE	0,18	0,034	0,024	<0,020	#	#	#
Cis-1,2 DCE	20	2,2	1,4	0,94	89	93	95,3

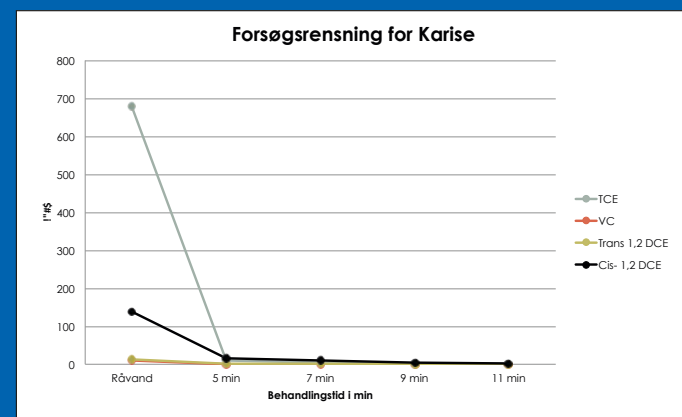
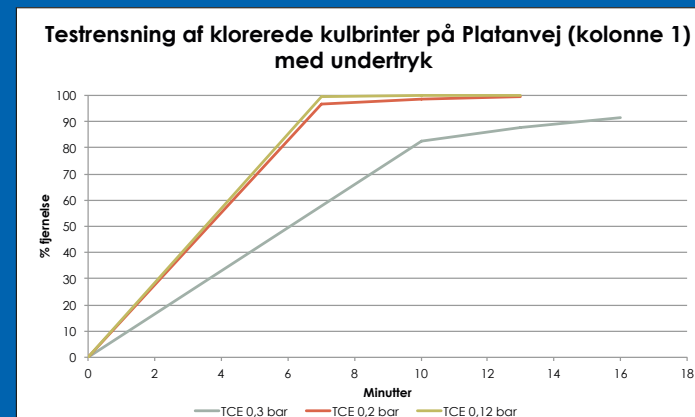
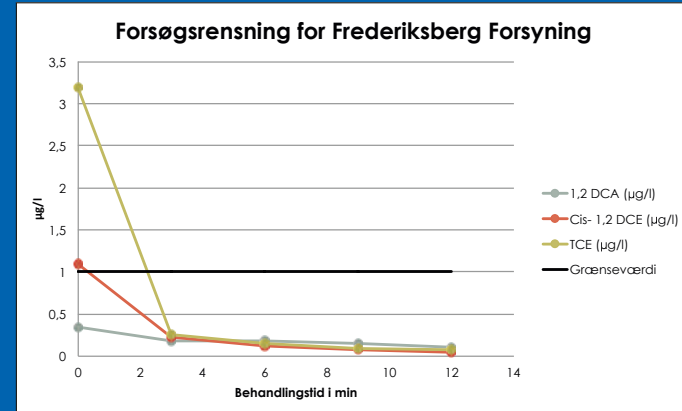
**Tabel 5.2 A: 7. Testrensning af klorerede kulbrinter på Platanvej med undertryk på 0,2bar**

Klorerede Alifater	Kolonne 1			Kolonne 1 % fjernelse			
	Råvand	7 min.	10 min.	13 min.	7 min.	10 min.	13 min.
TCE	80	14	10	6,8	82,5	87,5	91,5
VC	0,24	<0,020	<0,020	<0,020	#	#	#
1,1 DCE	0,10	<0,020	<0,020	<0,020	#	#	#
Trans-1,2DCE	0,27	0,038	<0,020	<0,020	85,9	#	#
Cis-1,2 DCE	28	9,9	8,0	6,3	64,6	71,4	77,5

Klorerede Alifater	Kolonne 2			Kolonne 2 % fjernelse			
	Råvand	7 min.	10 min.	13 min.	7 min.	10 min.	13 min.
TCE	80	15	12	8,4	81,3	85,0	89,5
VC	0,24	<0,020	<0,020	<0,020	#	#	#
1,1 DCE	0,10	<0,020	<0,020	<0,020	#	#	#
Trans-1,2DCE	0,27	0,042	0,025	<0,020	81,1	84,4	90,7
Cis-1,2 DCE	28	9,4	8,3	6,9	64,3	70,4	75,4

# = mindre end detektionsniveauet

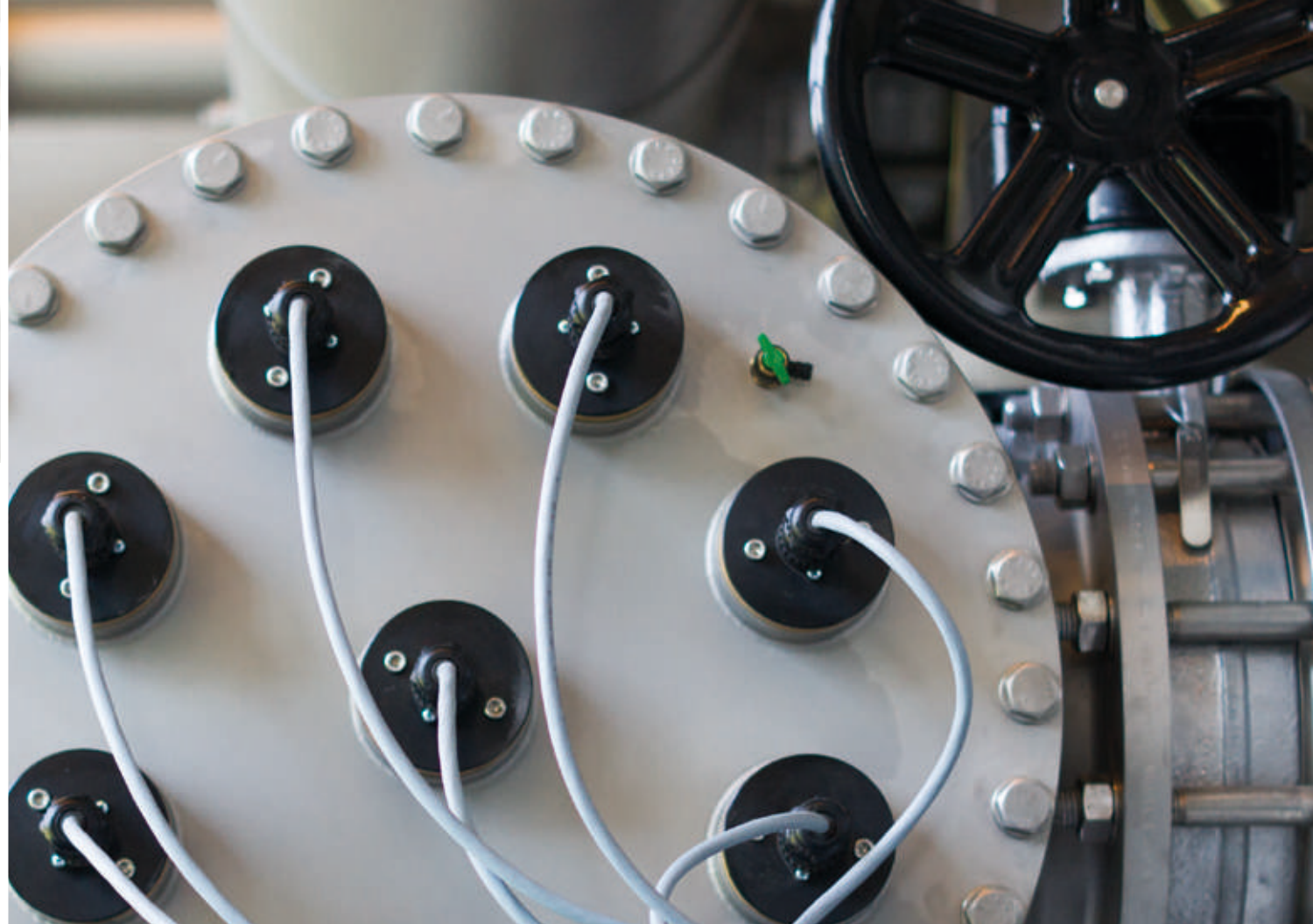


The vacuum system has been tested on a number of boreholes in collaboration with MOE A/S and Region Zealand with excellent results, and we would be happy to provide more information.



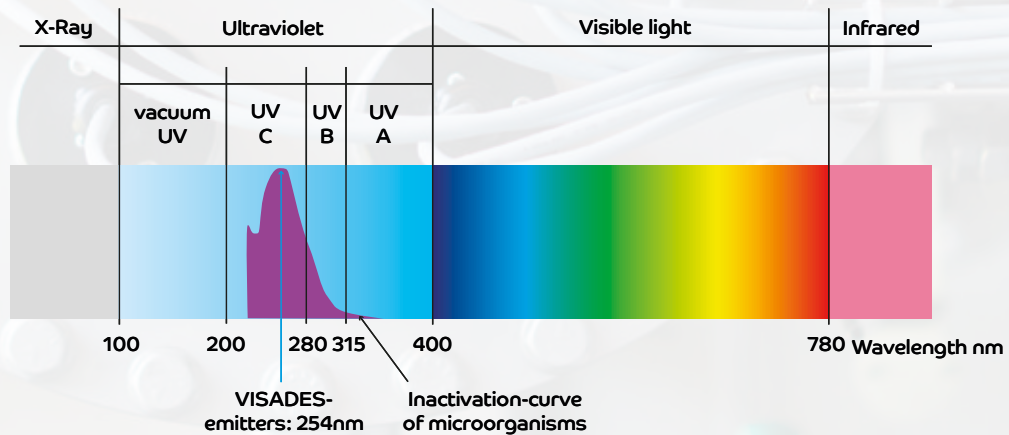
know  
how

UV-lamps irradiate the water with ultraviolet light.



Quite by chance, African teacher Mammasang discovered that placing bottles of water in the sun before drinking the water prevented diarrhoea. The sun's UV radiation killed the bacteria in the water.

know  
why



# Light versus bacteria

## UV disinfection systems

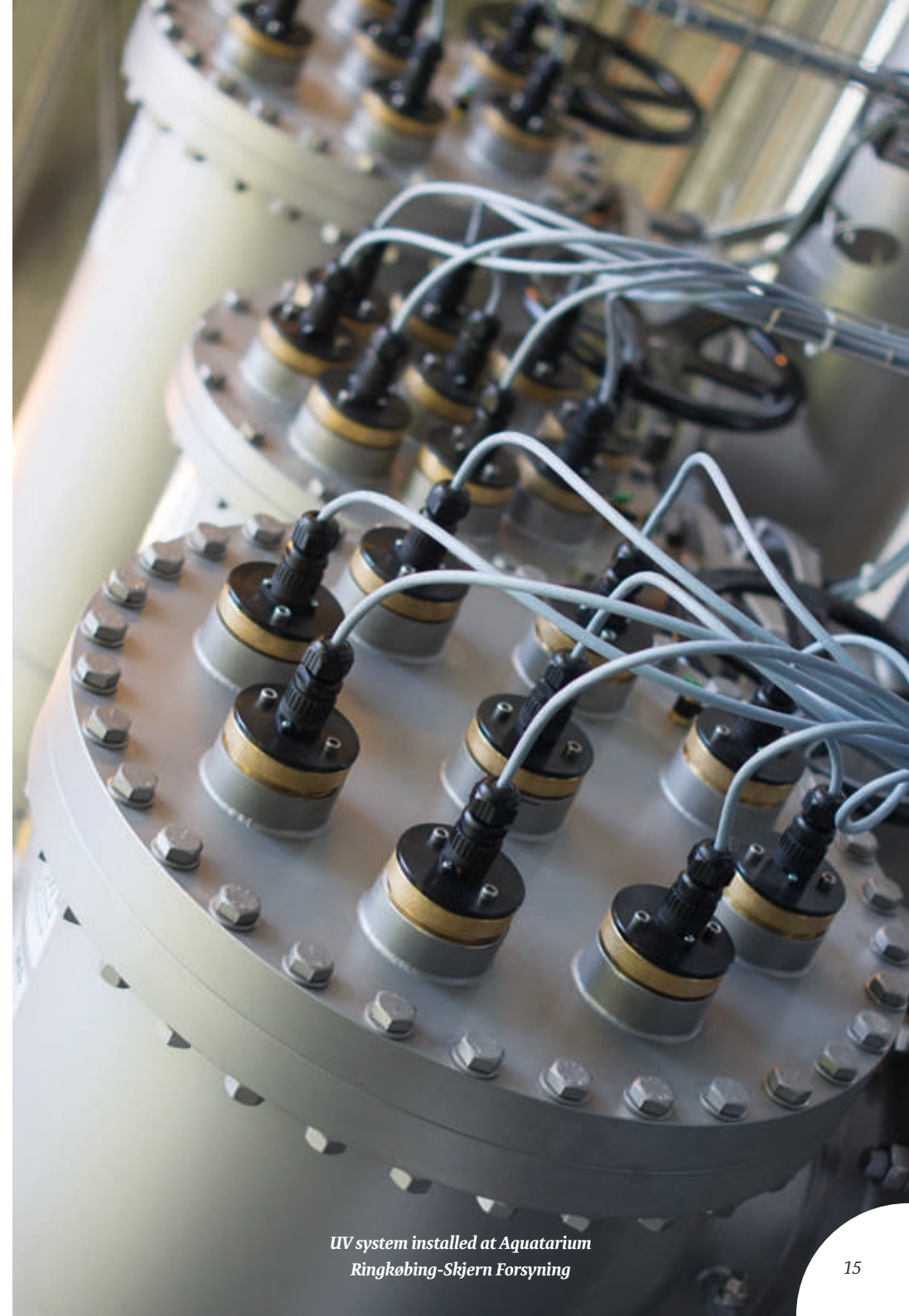
UV treatment of drinking water is a high-tech water treatment that kills germs and bacteria. Ultraviolet irradiation of the water is a well recognised disinfection method, and a legal requirement in several countries. The water is piped through a UV system with built-in UV-lamps where the water is irradiated with ultraviolet light. Irradiation with UV light creates a safety barrier that captures harmful germs, bacteria and other undesirable microorganisms.

### **UV treatment defeats bacteria**

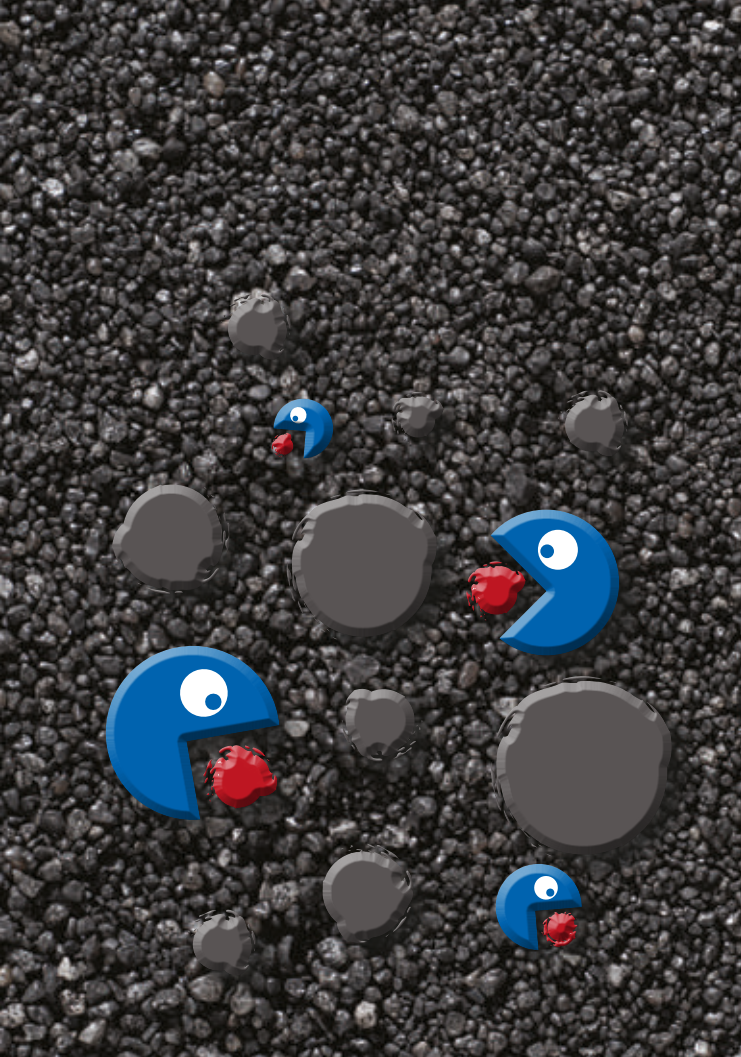
The UV systems supplied by Kemic Water Technology are fully automatic with optional connection to the waterworks' SCADA system. The design of a UV system is based on capacity and the UV transmittance of the water. This ensures the perfect transillumination. The ultraviolet light from the UV system breaks down the bacteria in less than a second. When a UV system is installed on the discharge pipe of the water treatment plant, a hygienic safety barrier is established which protects consumers against contamination.

### **Fast reaction once the damage is done**

If the water is already contaminated, UV treatment with one of Kemic Water Technology' mobile systems can be a good solution. However, special approval is required on a case-by-case basis. All of Kemic Water Technology' UV systems have the necessary European licences.



*UV system installed at Aqatarium  
Ringkøbing-Skjern Forsyning*



Properties concealed in the genes of bacterial cells break down pesticides. The bacteria with these properties are transferred to an existing bacteria population in a new sand filter, based on the 'Trojan Horse' principle.

- The secret lies in the filter material





# Sand filter bacteria 'eat' pesticides

## The Trojan Horse

We have already been given forewarning of the great challenge we are facing when it comes to purifying water. Over 100 boreholes have to be closed each year because they are contaminated by pesticides. Pesticides are moving slowly but surely down to groundwater repositories, and it is only a question of time before the problem becomes large-scale.

### **The solution is on its way**

Kemic Water Technology is developing the solution in collaboration with the Danish Technological Institute in Aarhus, the Technical University of Denmark and the University of Copenhagen. This visionary project is known as 'The Trojan Horse'.

It was not until recently that bacteria and organisms with very special properties were discovered in sand filters. There are up to a billion bacteria in a mere gram of sand, and some of these bacteria are able to eliminate pesticides and, consequently, purify the water naturally.

### **Visionary research paves the way**

The aim of the project is to identify a method that enables exploitation of these pesticide-degrading properties by adding them to new or existing sand filter systems. Kemic Water Technology and the research team are working intently on developing a method for cultivating bacteria in an existing sand filter that will 'eat' the pesticides.

- Danish and international research creates a basis for new, ground-breaking biotechnology for eliminating pesticides.
- Environmentally friendly, sustainable sand filter technology for elimination of pesticides from drinking water.



know  
how

*Even the smallest details of a service can make the biggest difference to the daily operation of your waterworks.*



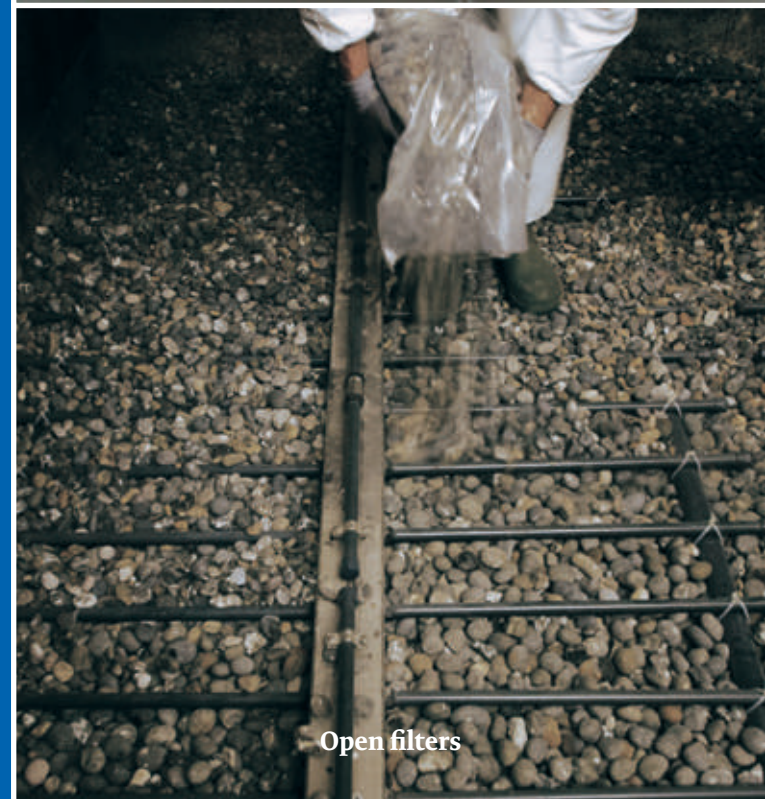
know  
why

*Lack of oxygen can 'suffocate' a water treatment plant.*

- It is all-important that customers are satisfied with their service visit!



Closed filters



Open filters

# Oxygen breathes life into waterworks

## Service improves safety

Oxygen is vital - to waterworks, too. With a service and maintenance agreement with Kemic Water Technology you are in good hands.

### Satisfaction is all-important

Kemic Water Technology' service agreements are not purely based on government orders. We take into account the customer's requirements and expectations as well as satisfaction with the service visit.

### Service visits

- Service visits are planned according to the customer's requirements, once or several times a year.
- We discuss the service with the customer before the visit to ensure that we make optimal use of the time.
- During the visit, and in close collaboration with the customer, we replace worn-out parts to ensure best possible operation of systems.
- Clean water tanks are inspected based on established standards and agreements with the customer.
- The pressure tank is inspected according to the Danish Working Environment Authority's Executive Order no. 694, and inspection is performed in close collaboration with the customer at the legally required intervals.

An electronic service report is completed and sent to the customer immediately after the visit to the waterworks. The service report is actively used during dialogue with the customer to prevent any problems and ensure the waterworks' operations. It may also contain recommendations for operational improvements.



# Collaboration promotes understanding

Our know-how - your know-why

