

treatment  
of addressing a dual challenge for  
public health and the environment  
urban  
wastewater  
& reuse

ready for the resource revolution



SUEZ

# treating wastewater to reduce the environmental impact of cities...

## 9.1

**billion inhabitants.**

This is the figure that the world population could reach in 2050  
(United Nations - WWDR4)

## 2.6

**billion people**

have no access to improved sanitation  
(United Nations - WWDR4)

## 90 %

**of wastewater**

in developing countries flows untreated into rivers, lakes and highly active coastal areas  
(United Nations - WWDR4)

## 50 %

**of the world's fresh water reserves are polluted**



**Global population growth, urbanisation and new production and consumption methods present a dual challenge in terms of public health and environmental conservation for emerging and developed countries. On a worldwide scale, the treatment of wastewater is one of the key factors in protecting water resources.**

- ▶ All the Group's brands (Degrémont, Ozonia, Aquasource, Ondeo IS, Ameriwater, Infilco, Poséidon, etc.) have been using the SUEZ single brand since March 2015. From now on, water treatment technologies and expertise of the "Treatment Infrastructure" business line will be identified by the degremont® label.

# ... a SUEZ's offer for local authorities



SUEZ's comprehensive water cycle expertise and know-how make it a key player in conserving water resources. Its water treatment experts offer local authorities latest-generation wastewater treatment plants that are adapted to local challenges, highly efficient, innovative and environmentally friendly.

## ► the SUEZ offer: four complementary areas of activity

- **Customised design & build** for new plants, extensions or rehabilitations. As both project managers and water treatment experts, SUEZ's dedicated specialist teams handle all the stages in the design and building process: from the choice of process and setting, managing purchasing, site supervision, installation of equipment and operational start-up.
- **Operation and service solutions** for daily management, facilities optimisation, preservation of assets and for "custom" services such as technical support, supply of spare parts, upgrades, training, etc.
- **"Packaged" equipment and technologies** to increase or diversify the performance of treatments or for a modular, compact and easy-to-operate design.
- **Financing in the form of a BOT (Build, Operate, Transfer) contract**, a genuine partnership in which SUEZ is fully involved right up the financing management.

## ► outstanding advantages

With 75 years of experience as a builder-operator and many references for local authorities and industry, SUEZ has been able to anchor its position as a global leader in wastewater treatment, thanks to:

- its expertise in managing the wide range of discharge collected;
- its know-how in designing and managing compact facilities;
- its know-how in odour management;
- its expertise in sludge recovery and the production of alternative energies;
- its concern for safety, which is the essence of its processes;
- its extensive past experience, which enables it to optimise the day-to-day performance of facilities;
- its preventative maintenance plans, which prolong the life of the plant and preserve assets;
- its expertise in wastewater treatment technologies, which has made it a pioneer in reusing treated wastewater.

## ► proactive R&D

SUEZ's worldwide network of researchers and experts are developing key innovations to anticipate regulation and future challenges in the field of sanitation, and to design the wastewater treatment plant of the future:

- optimisation of traditional treatments;
- development of tertiary treatments such as filtration, microfiltration, ultrafiltration, etc.;
- development of refining techniques such as ozonisation, UV disinfection, etc.;
- optimisation of energy efficiency.

SUEZ's water treatment experts are developing the best technique combinations so as to give wastewater a new lease of life by reusing it in agriculture or industry.

**2,500** wastewater treatment plants designed and built by SUEZ worldwide

**26** million people benefit from the treatment of their wastewater by SUEZ's water treatment experts

# treatment solutions that have proved their worth

Building on their experience, SUEZ's water treatment experts can respond to local challenges with the aim of conserving water resources and protecting biodiversity across the globe. If necessary, they are designing their treatment plants so that the treated water can be reused, whilst complying with the constraints of environmental and public health regulations.

## Biomaster

(pre-treatment)

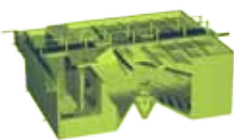


This aerobic biological degrading procedure is specifically for greasy residue from the plant's

degreasers, fat boxes from restaurants, canteens, etc. It is a compact and stand-alone system that is easy to automate and which eliminates the cost of transporting fatty waste to landfill or incineration plants.

## Sedipac™ 3D

(primary settling)



This combined treatment process integrates three functions in one single

work: grit removal, grease removal and settling. The system works at high-speeds of treatment and without reagents. The water is clarified efficiently using lamellar modules. It can be used in any type of facility upwards of 15,000 PE.

## Densadeg®

(primary settling and tertiary treatment)



This settler using external sludge recirculation combines a rapid physical-

chemical settling (flocculation + lamellar clarification) with a sludge thickening pre-treatment in a single work. As a primary settling stage, it is used to eliminate SS<sup>1</sup> and colloids and to reduce the BOD<sup>2</sup> and the COD<sup>3</sup>. As a tertiary treatment stage, it treats phosphorus and any residual SS. Its modular and lamellar design makes it a compact unit which is suited to plants of all sizes.

## Combigreen™

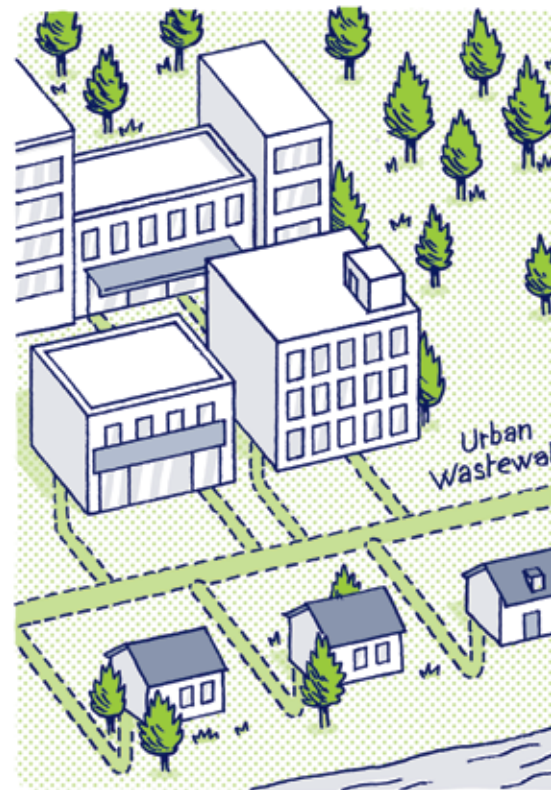
(biological treatment)



Free culture

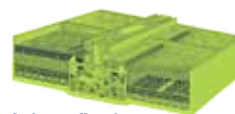
This biological process combines an annular

aeration channel with a central settling basin. The hydraulic design of the aeration channel/settling basin combination ensures savings up to 15% in the energy required to re-circulate sludge and pump raw water. Combining these two treatment phases into one process reduces the total footprint of the plant up to 25%.



## Biofor®

(biological treatment)



Culture fixed

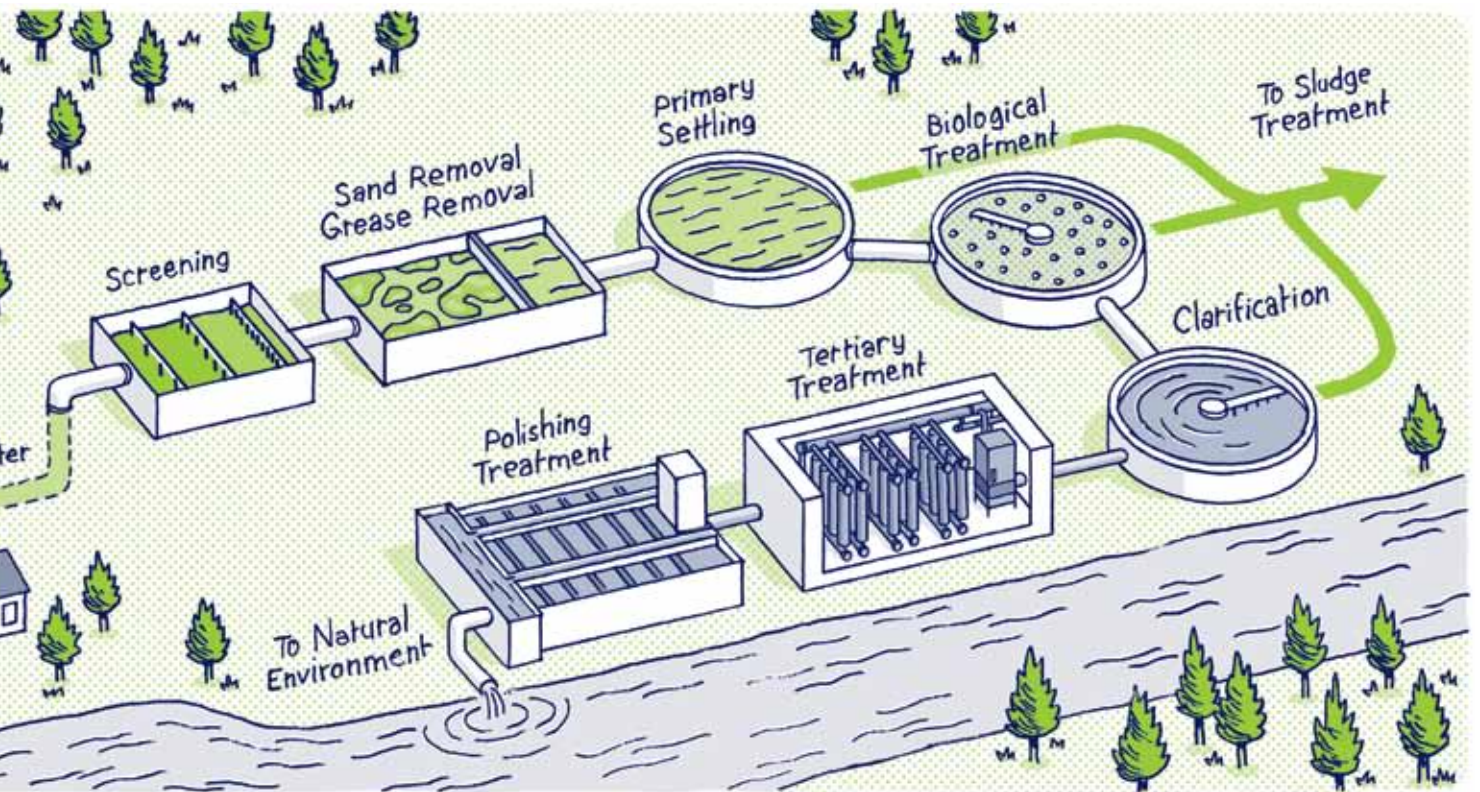
This biofiltration solution combines filtration with intensive biological treatment. The natural mineral filter media retains any suspended solids. Carbonaceous and/or nitrogenous pollution is eliminated through the development of natural bacteria in the form of bio-film (purifying biomass) that attaches on the filter media.

The performance of this treatment meets the standards for all types of effluent (low temperature, large variations in flow and/or load, diluted, etc.). This compact and modular solution is suited to space and architectural constraints.

<sup>1</sup> SS = suspended solids

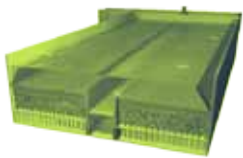
<sup>2</sup> BOD = biological oxygen demand

<sup>3</sup> COD = chemical oxygen demand



### Aquazur™ V

(tertiary treatment)



This downflow open sand filter retains SS and their associated pollutants. It

enables filtration at high speeds of filtration. Whether or not it follows on from a settling basin, it helps to retain micropollutants associated with SS and to obtain high quality filtered water.

### Filtrazur™

(tertiary treatment)

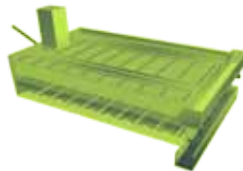


This Mediaflo floating material open filter operates with an

ascending flow. The Mediaflo ensures that residual polluting particles are captured. It makes it easier to capture nitrifying bacteria, thus ensuring that ammonium is further eliminated on the basis of the rate of dissolved oxygen.

### Pulsagreen™

(tertiary treatment)



This lamellar settler clarifier uses a powdered activated carbon (PAC) pulsed

blanket to reduce the majority of micropollutants. It is even more effective on adsorbable compounds such as pesticides and alkylphenols. The pulsations optimise the contact of the dissolved organic matter and the micropollutants with the activated carbon, encouraging their adsorption, then their removal during the lamellar settling.

### Ultrablue™

(tertiary treatment)



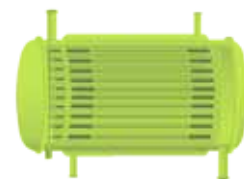
These ultrafiltration membranes let small molecules (water and salts) through, but block molecules with a

high molar mass (polymers, proteins and colloids). These treatment

systems are chosen for their efficiency in SS reduction, disinfection, and removal of the micropollutants attached to the retained particulate matter.

### Ozoneur

(tertiary treatment)



The ozone ( $O_3$ ) has a very substantial oxidising capacity. When it oxidises organic

substances, the ozone destroys a number of micropollutants (or makes them more easily biodegradable) and pathogenic organisms (viruses and bacteria). It degrades a broad spectrum of persistent organic micropollutants in the effluent. It also acts on colour and organic macropollution.

# cutting-edge solutions

to guarantee the future of our resources

Their familiarity with local problems across the globe, combined with their expertise, mean that SUEZ's water treatment specialists are able to anticipate changes in this field and develop their own technology, using it to create their own treatment combinations.

In order to support the development of local authorities, depending on the quality of the effluent for decontamination and the sensitivity of the receiving environment, they design treatment lines of various degrees of complexity, optimising the balance between quality, price, operating costs, energy efficiency and environmental footprint.

## Meteor®

(biological treatment)

This range of biological reactors, in which bacteria are trapped in the form of biofilm on mobile media, is dedicated to carbon and/or nitrogen removal. They are suited to variations in load, flow or temperature.

There are 2 products in the range:

### • Meteor® MBBR

(Moving Bed Biofilm Reactor)



This is a fluidised attached

growth reactor which is used, as a preference, for treating carbon only, or for partial treatment of nitrogen;

### • Meteor® IFAS

(Integrated Fixed film Activated Sludge)

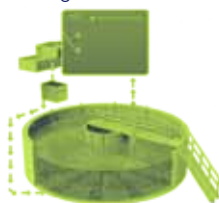


This hybrid growth reactor

(fluidised attached growth and suspended growth) is used, as a preference, for the total nitrogen allowance and the biological treatment of phosphorus.

## Greenbass™

(biological treatment)

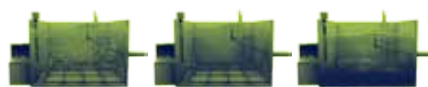


This regulation solution of sequenced aeration for activated sludge reduces energy consumption by up to 15%. The

system uses both concentrations of ammonia nitrogen ( $N-NH_4^+$ ) and nitric nitrogen ( $N-NO_3^-$ ) for more precise control of the process of nitrification/denitrification, therefore avoiding excessive aeration by adjusting air flow to the exact air requirements of the bacteria in the aeration tanks.

## Cleargreen™

(biological treatment)



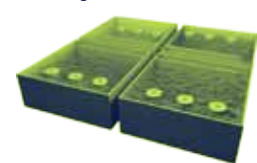
This biological treatment solution is for effluents with high concentrations of ammonia. Implementation of deammonification in a sequenced Cyclor™ reactor allows the treatment of effluents from sludge anaerobic digestion returning to the head of

water treatment line. This limits the impact of digestion on the water treatment line.

Cleargreen™ uses less energy than a conventional treatment.

## Cyclor™

(biological treatment and purification)

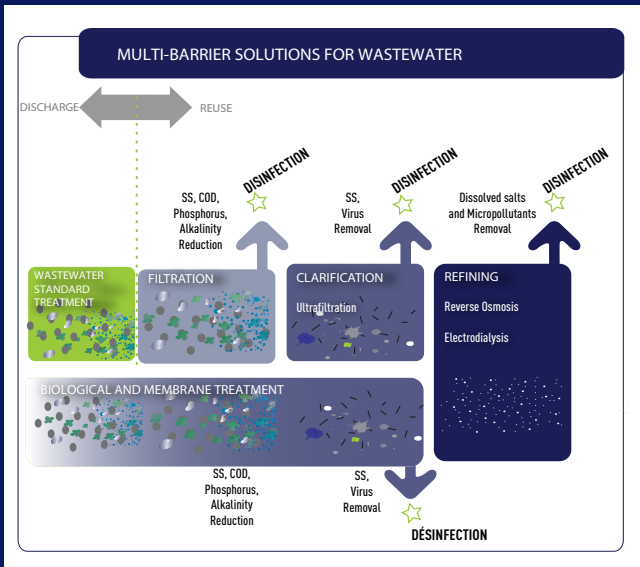


This sequenced biological reactor is made up of cells that carry out all the

treatment steps (aeration, settling, draining).

This type of reactor optimises denitrification and biological phosphate removal reactions and improves the settleability of the sludge.

# REUSE... specific solutions to go further



In order to assist local authorities with their resource management policies, SUEZ's water treatment experts offer numerous technical solutions for reusing purified wastewater.

Avoiding discharges whilst increasing available resources at a lower cost is one of the key advantages of wastewater reuse. Furthermore, access to an alternative reliable quality resource in sufficient quantities contributes to the sustainable development of regions affected by water shortages and drought.

These days, the preservation of water resources is widely recognised as a requirement arising from three factors: human, environmental and economic.

SUEZ designs solutions that meet the agricultural, urban or industrial needs and that enable to replenish natural water reserves.

## Ultrafor™ / Ultragreen™

(biological treatment, clarification and tertiary treatment)



These two membrane bioreactors (MBR) combine biological degradation of contaminants

with advanced clarification by ultrafiltration membranes (hollow fibre membranes for the former and flat sheet membranes for the latter). The resulting effluent complies with discharge standards for even the most sensitive environments and is suitable for reuse. These MBRs are more efficient (according to the results of the AMPERES project) on 20% of the micropollutants which are only partly removed by traditional activated sludge systems or which are adsorbable.

## Greendaf™

(clarification and tertiary treatment)



This range of dissolved air flotation systems capitalise on

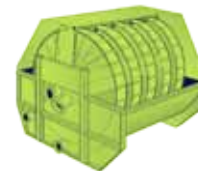
the fact that certain solid or liquid particles are able to cling to air bubbles to form a blanket less dense than water. These blankets are then collected as a foam (floating sludge) on the surface of the machine.

The range comprises 3 products:

- **Greendaf™ MW**  
(Meteor Water) for separating biological sludge generated by attached growth processes such as Meteor™ MBBR;
- **Greendaf™ BWW**  
(Biofilter WashWater) to reduce or eliminate biofilter washwater effluents returning to the head of water treatment line of in order to avoid over-sizing the upstream treatment line;
- **Greendaf™ TW**  
(Tertiary Water) to remove phosphates from treated water.

## Compakblue™

(tertiary treatment)



This type of immersed disk filter is recommended for removing suspended solids and the associated

pollutants, such as micropollutants. This solution is an alternative to traditional filtration on granular media and is particularly suitable for discharge in sensitive areas and offers identical performance for a footprint area four times smaller.

# a few flagship projects

## CONSTRUCTION/OPERATION



### **CANNES** (France)

300,000 PE

The Aquaviva plant in Cannes is the first carbon-neutral wastewater treatment plant in the world.



### **LE CAIRE** (Egypt)

2,300,000 PE

Its 3 stages make Gabal El Asfar the largest wastewater treatment plant on the east bank of the Nile.



### **PANAMA City** (Panama)

1,000,000 PE

The largest wastewater treatment plant in the country, a benchmark in the region in terms of sanitation and environmental preservation.



### **PARIS Seine amont** (France)

3,500,000 PE

The first wastewater treatment plant in France serving more than 100,000 residents to be granted ISO 50001 certification.



### **LA FEYSSINE** (France)

300,000 PE

This plant consumes very little external energy, drawing on its own energy resources.



### **MAPOCHO** (Chile)

4,000,000 PE

The rehabilitation of this plant doubled its capacity, enabling it to treat 760,000 m<sup>3</sup>/day. Cogeneration from the biogas produced by the sludge digestion provides 60% of the electricity required by the plant and the heat required by the digestion process.



## REUSE



### MEDIOUNA (Morocco)

40,000 PE (extendable to 80,000 PE)

On the outskirts of Casablanca, this is the first wastewater treatment plant in Morocco and in North Africa to use an ultrafiltration membrane process. The treated water can be reused for agricultural irrigation.



### DOHA WEST (Qatar)

1,040,000 PE

The plant recycles nearly 85% of its treated water, which is used to irrigate green spaces or vegetable plots, or to replenish the water table. Any surplus is stored in lagoons, where flora and fauna develop.



### MILAN San Rocco (Italy)

1,050,000 PE

Ultraviolet disinfection at the end of the treatment cycle enables water to be reused for agricultural irrigation at a flow rate of 14,400 m<sup>3</sup>/h in dry periods.

## BOT



### MARIBOR (Slovenia)

195,000 PE

Working in partnership under this 20-year BOT contract made it possible to lower tariffs initially by 15% and to improve operating performance, releasing new financial resources.



### AS SAMRA (Jordan)

3,300,000 PE

This 25-year BOT contract to extend the plant (from 2,270,000 to 3,300,000 PE) has created added value in economic, environmental and social terms with an affordable tariff for the local community. This is the first project of this size in which MCC\* has been involved.



### CIUDAD JUÁREZ (Mexico)

310,000 m<sup>3</sup>/day

This 15-year BOT contract to finance and build an extension (from 225,000 to 310,000 m<sup>3</sup>/day) of two existing urban wastewater treatment plants and then to operate them, makes it possible for the city to reuse the treated water to irrigate nearby agricultural areas, thereby freeing up a large volume of potable water to ensure that the city can be self-sufficient in water for the next 30 years.

\*Millennium Challenge Corporation, a US Government development institution

# a partnership strategy and a proximity commitment

**to consolidate and enhance the added value of its offers,** SUEZ is committed to genuine partnerships and maintains constant dialogue with customers

## **technological cooperation creates value and differentiation**

With its expertise in water treatment and experience acquired at numerous plants, SUEZ teams up with appropriate equipment manufacturers to develop and optimise new treatment solutions, new energy recovery systems and new sources of alternative energy.

In addition, by calling on partners to contribute on know-how outside its own areas of expertise, SUEZ has extended its scope and competitiveness (selling price, deadline, quality, technological differentiation...).

## **programmes with local authorities**

SUEZ develops partnerships with some of its major customers, especially through research programmes and in the field of social and environmental responsibility. This approach helps SUEZ to understand the challenges they face.



## **customised associations**

SUEZ is committed to Alliance contracts with some of its clients, especially for a joint management of water and wastewater services, with the aim of optimising costs and delivering environmentally friendly performance, including energy efficiency.

## **constantly listening to clients**

Understanding their stakes, anticipating their needs, innovating and controlling costs... by being always in tune with its clients, SUEZ offers treatment solutions which match their objectives and address the challenges that water represents for them. In this way, local authorities:

- can treat wastewater of the population in accordance with local health, safety and environmental standards;
- can preserve water resources by extending the use of water thanks to the treated wastewater reuse for agricultural purpose, street cleaning or water table replenishing.



# a culture of **innovation** and **industrial** **excellence**



**SUEZ's water treatment experts are developing the best technological, commercial, logistical, financial and contractual solutions to respond to the needs of their customers**

## **customers are the source of anticipation and innovation**

SUEZ's global reach enables it to anticipate and detect early indications of major changes that will affect all the water treatment players. For the water treatment specialists of SUEZ, innovating means putting customers and their needs at the heart of the process. SUEZ's teams are perfectly positioned to analyse evolving requirements, devise tomorrow's solutions and adapt to local conditions. This approach is conducive to generating original solutions – not only from a technological, but also a financial, contractual and logistical standpoint – that best respond to global or local needs.

## **dedicated specialist teams**

Having experts in design, build, equipment and operation, SUEZ is able to draw on the particular skills of its employees for each project to create a response that meets the specific needs of its customers. The commitment and motivation of its teams enable SUEZ to deliver high performance, energy-efficient and reliable plants to its customers, within short timescales and at an optimal capital and operating cost, and to guarantee the quality of water required by the natural receiving environment or the objective for which the water is reused.

## **responsible involvement at all stages of the project**

For example, by signing a BOT (Build, Operate, Transfer) contract, SUEZ is committed:

- over the long-term, from the design to the transfer of the plant, through its operation;
- to integrating responsibility for raising the necessary finance;
- to establishing the legal framework for the project;
- to securing completion of the project by involving selected partners to contribute added technical or financial value, specific know-how and local knowledge.

A BOT contract involves SUEZ in long-term commitment and service to the customer, guaranteeing the performance of the plant in terms of volume and quality of the treated water.

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ready for the resource revolution

