# SBR PROCESS FOR WASTEWATER TREATMENT


## IMR E&T S.r.l.

**Maria Vittoria Marra**
maria.vittoria.marra@imr.it
www.imr.it

# Purification of wastewater

A process aimed at removing organic and inorganic contaminants with the objective of producing a clarified effluent that can be released into the environment  with a concentration of contaminants lower than the values set by the law.

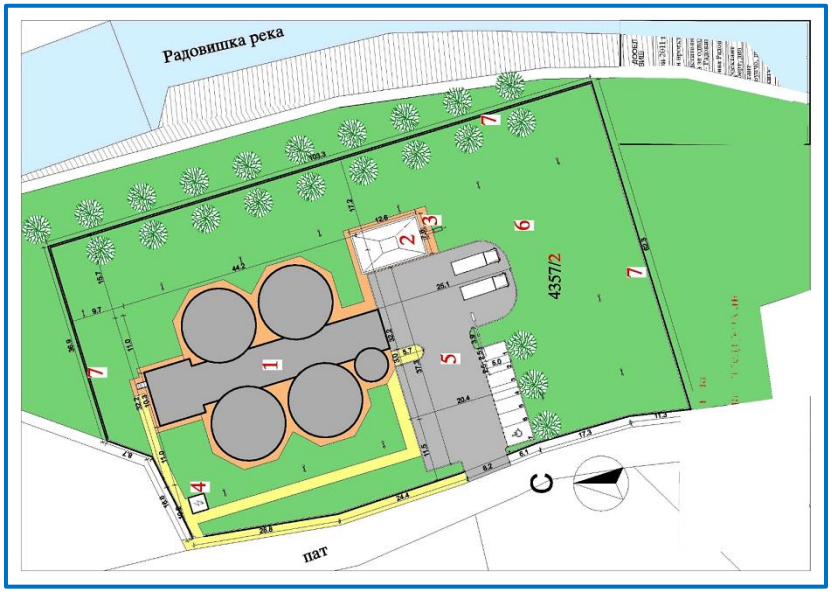
# SBR (*Sequencing Batch Reactor*)

- Since the 1920s, with the growing population in Europe, China as well as the United States, it has been necessary to use a method to treat both municipal and industrial wastewaters successfully, especially in areas characterized by low or varying flow patterns.

- Municipalities, resorts, and a number of industries, including dairy, paper, tanneries and textiles, are using SBR process as practical wastewater treatment alternatives.

# Advantages of SBR Process

Improvements in equipment and technology, especially in aeration devices and computer control systems, have made SBR an efficient solution over the conventional activated-sludge system. These plants are very practical for a number of reasons:




- In areas where there is a **limited amount of space**, treatment takes place in a single reactor instead of more basins, reducing the footprint.

- **Low total-suspended-solid** values of **less than 10 mg/L** eliminate the need for a separate clarifier.

- The treatment cycle can be adjusted to undergo aerobic, anaerobic, and anoxic conditions in order to achieve biological **nutrient removal**, including nitrification, denitrification, and some phosphorus removal.

- Biochemical oxygen demand (**BOD**) levels of **less than 5 mg/L** can be achieved consistently.

- **Total nitrogen** limits of **less than 5 mg/L** can also be achieved by aerobic conversion of ammonia to nitrates (nitrification) and anoxic conversion of nitrates to nitrogen gas (denitrification) within the same tank.

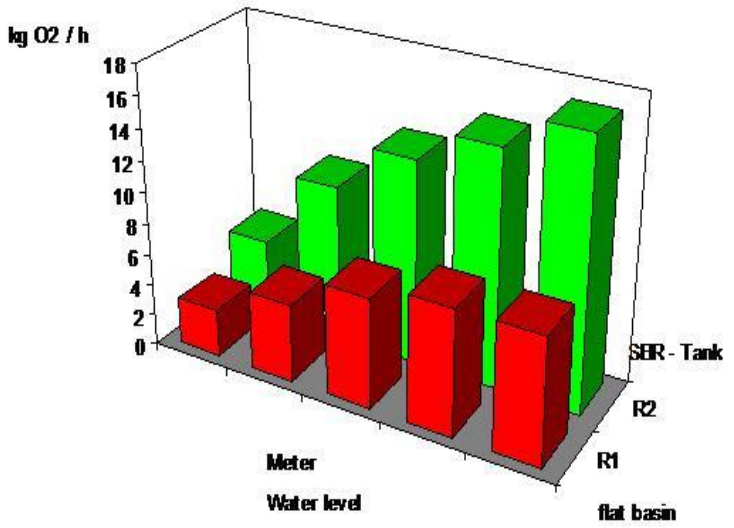
- Low phosphorus limits of less than 2 mg/L can be obtained with the treatment cycle.

- Wastewater discharge permits are becoming more stringent and SBR offers a cost-effective way to achieve lower effluent values.

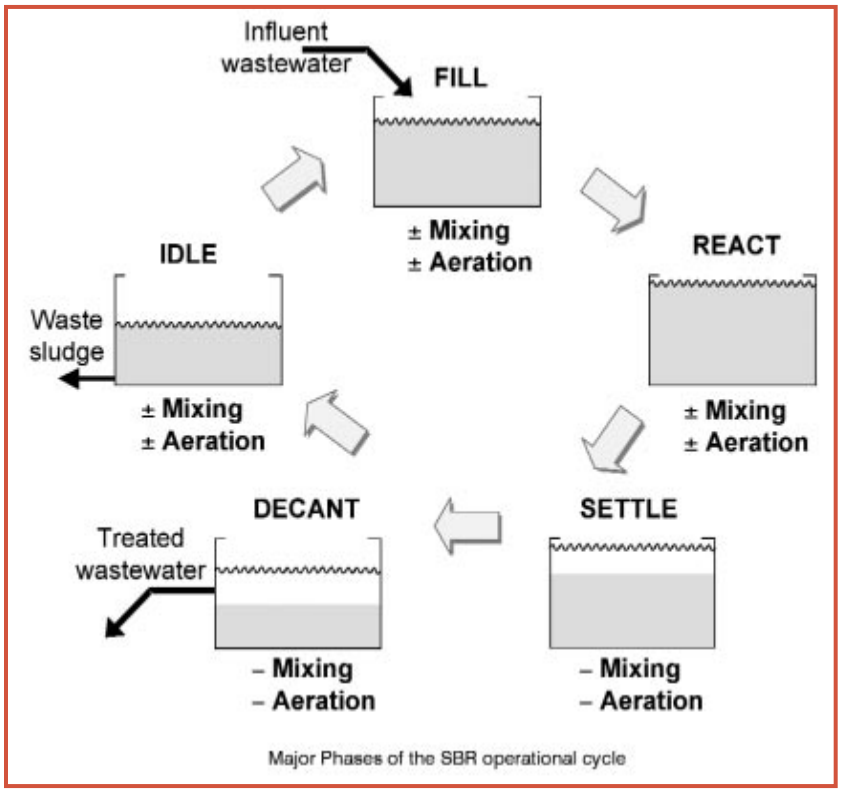
- SBR is a variation of the activated-sludge process. It differs from activated-sludge plants because it combines all of the treatment steps and processes into a single tank, whereas conventional facilities rely on multiple basins.

# SBR Process

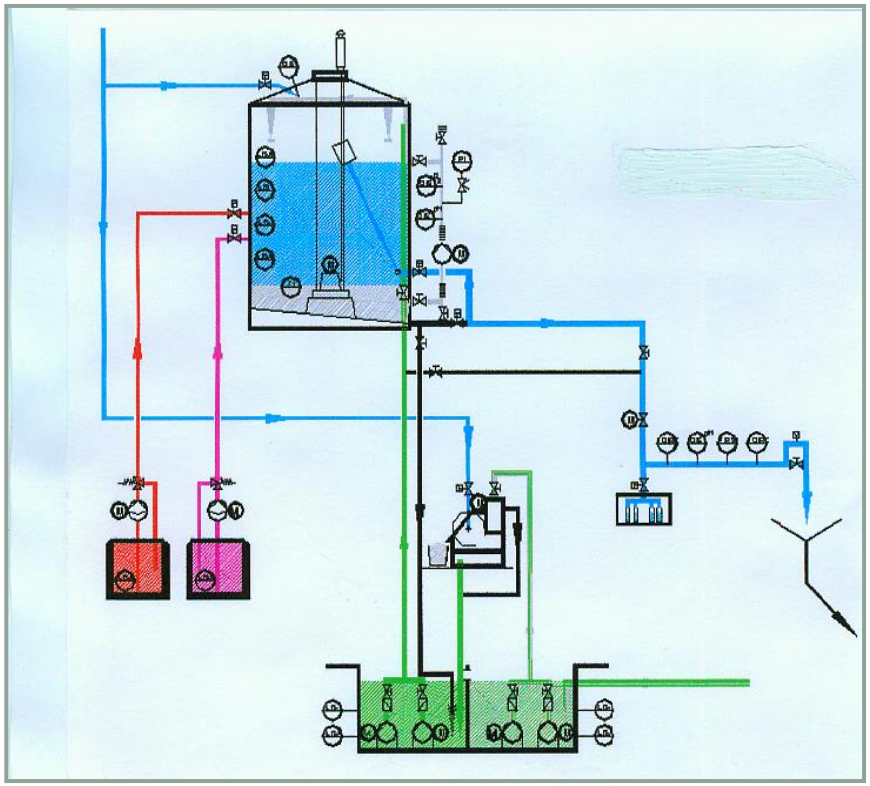
- Discontinuous flow **oxidation biological treatment** systems
- Conducted at different times, **varying the operating conditions** of the plant according to the real needs of wastewater treatment
- Works according to the time of the phases, which succeed one another **in sequence**



# SBR Process → IMR *Schwander* Technology

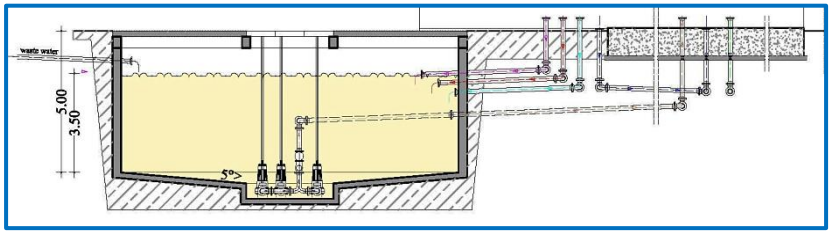


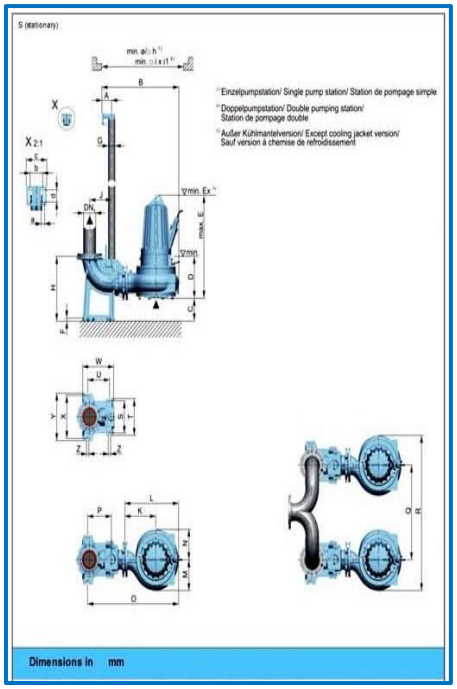
Major Phases of the SBR operational cycle



# FILL

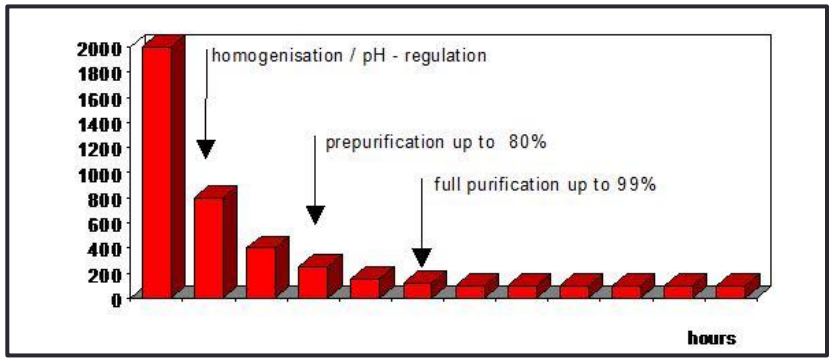
During the filling phase, the reactor receives influent wastewater, which brings food to the microorganisms in the activated sludge, creating an environment for biochemical reactions to take place.



# REACT

During this phase, no wastewater enters the reactor and the mechanical mixing and aeration units are on. Because there are no additional volume or organic loadings, the rate of organic removal increases dramatically.




The continuous BOD decrease in time

The **microorganisms**:

- Convert the colloidal and dissolved materials to gas and other cellular material
- Feed and reproduce by means of organic substances contained in the sewage
- Perform the biological neutralization



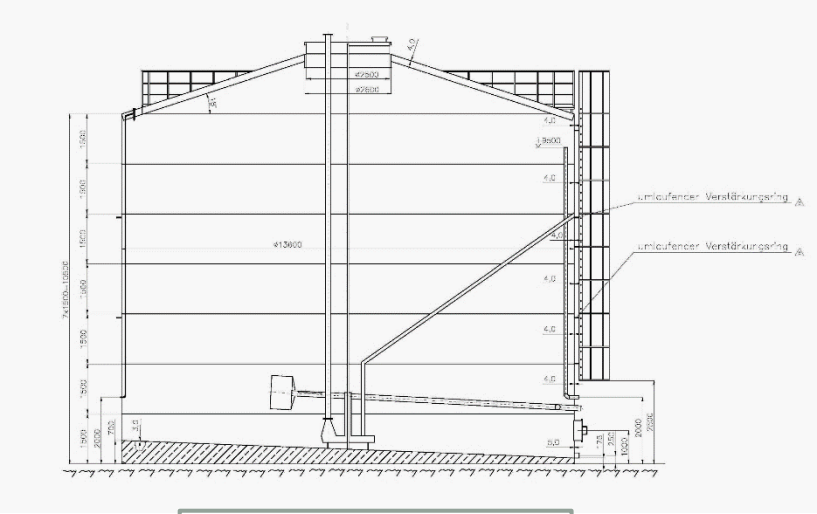
Microorganisms + Substrate → Water + Gas + New biomass

# SETTLE

- During this phase aeration and mixing are turned off and the activated sludge settles.
- The activated sludge settles as a flocculent mass, forming a interface with the clear supernatant.
- Usually this is the critical part of the cycle, because if the solids do not settle rapidly, some sludge can be drawn off during the subsequent decant phase and thereby degrade the effluent quality.
- With the IMR technology, due to the vertical development of the reactor and the presence of the shower system the sedimentation is optimized

# DECANT

During this phase, a decanter is used to remove the clear supernatant effluent. Once the settle phase is complete, a signal is sent to the decanter to start the opening of the effluent-discharge valve.

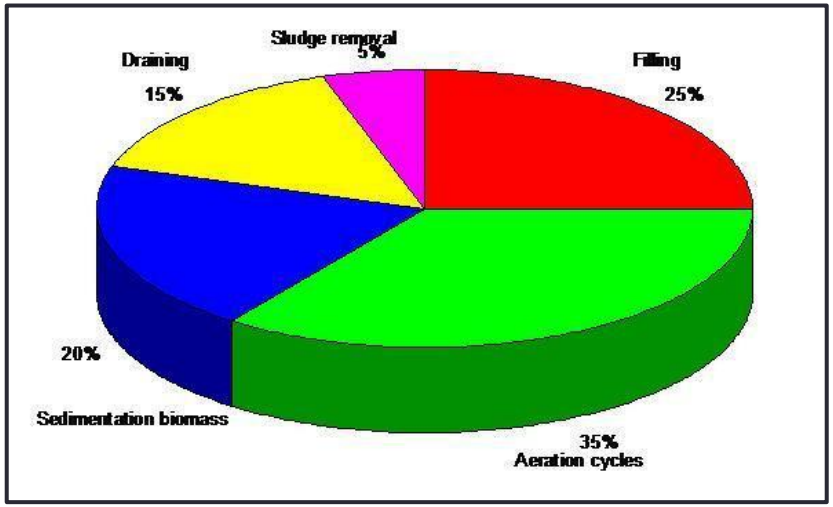


It is optimal that the decanted volume is the same as the volume that enters the reactor during the filling phase. It is also important that no surface foam is decanted.

# IDLE

This step occurs between the decant and the fill phases. The time varies, based on the influent flow rate and the operating strategy.

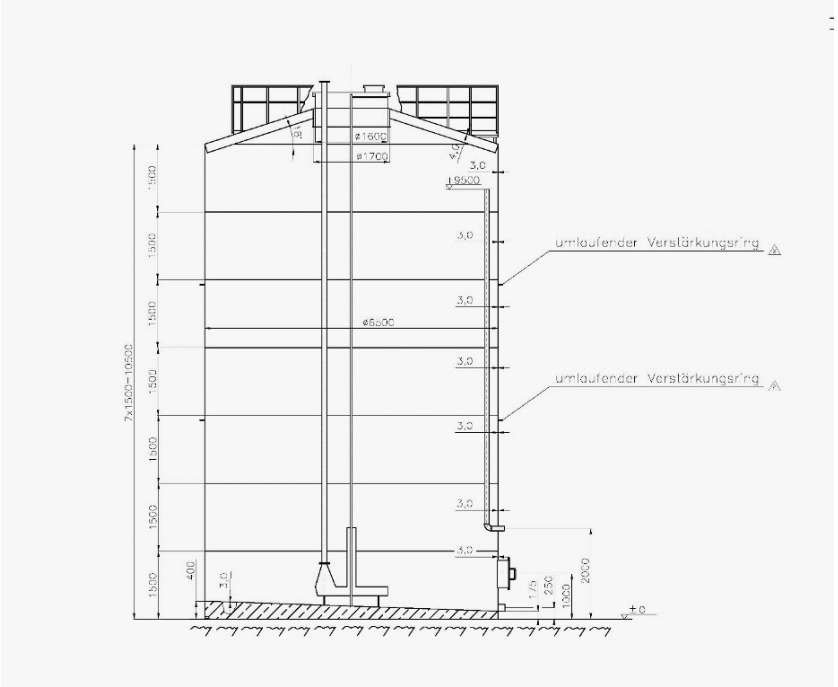
During this phase, a small amount of activated sludge at the bottom of the SBR basin is pumped out.




Working structure within 24 hours

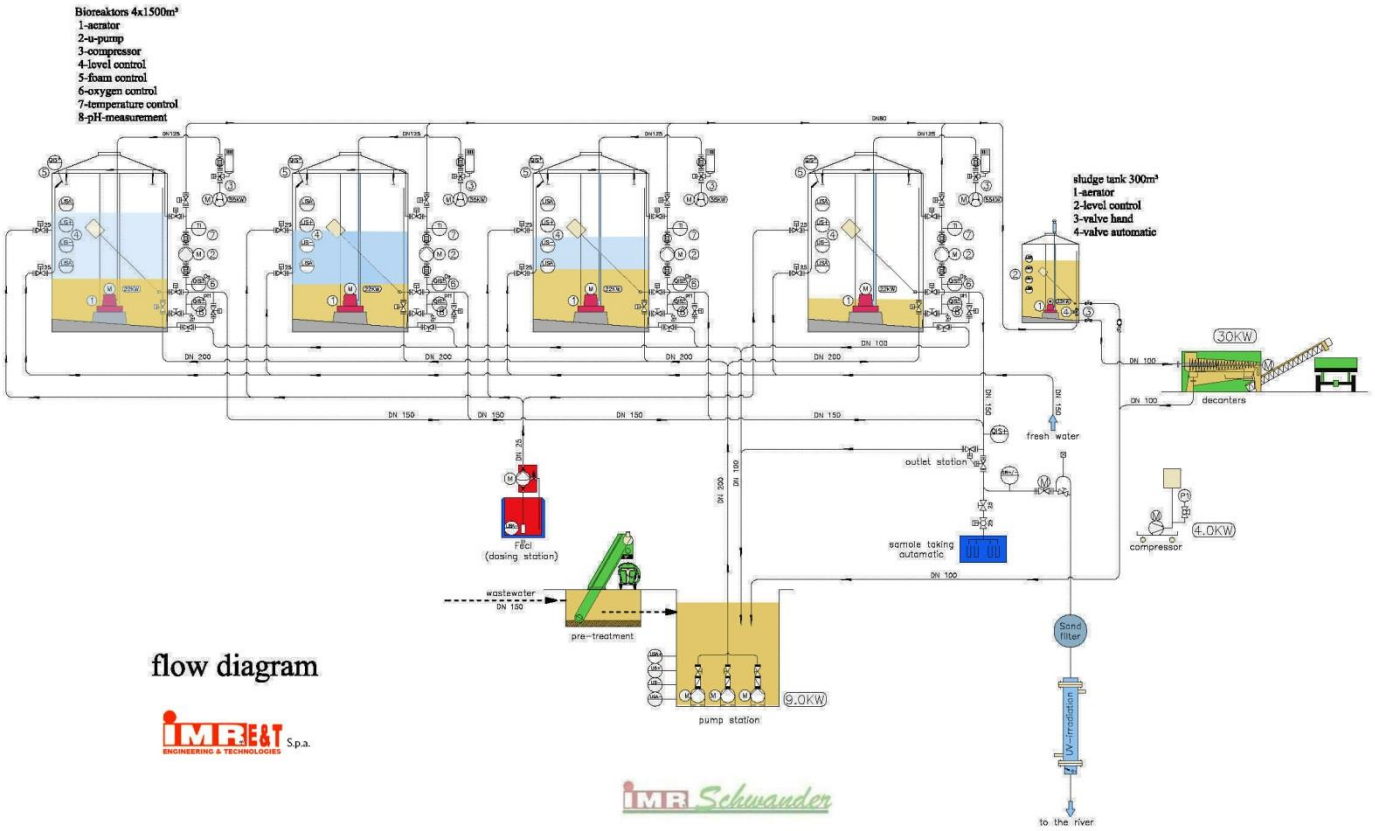
# Possible sludge destinations

- Utilization as compost
- Production of biogas
- Oxidation
- Exsiccation




The bioreactor for treatment sludge

# Layout of the 4 tanks plant

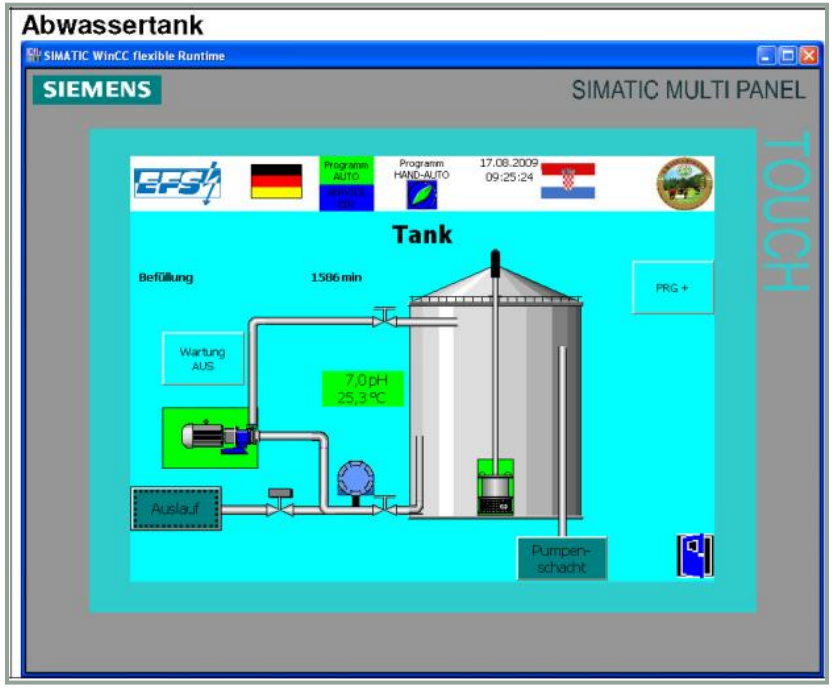


# Operational considerations

**Intelligent Software**

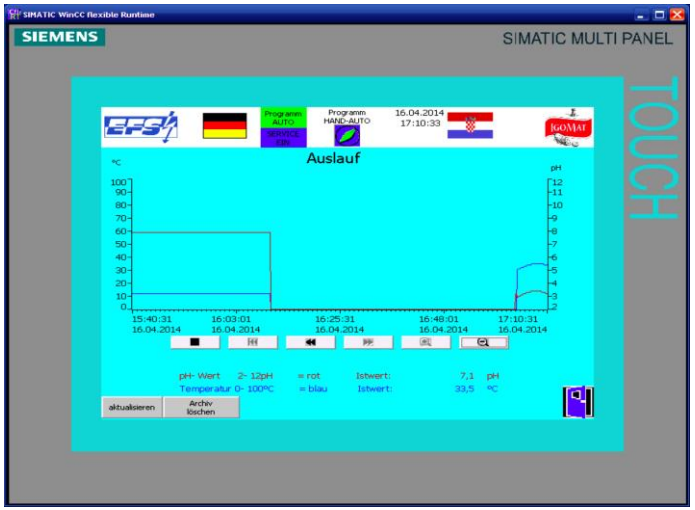
**Real-Time Control Levels:**

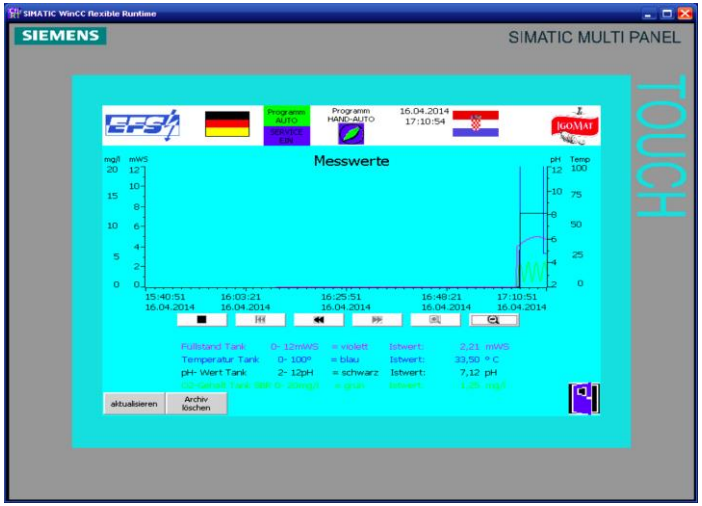
SCADA is a computer-monitored alarm, response, control, and data acquisition system used by operators to monitor and adjust treatment processes and facilities, also from a remote control.



Real-time control improves the operation of the flow regulation devices by way of automation. Real-time control maximizes the storage and treatment capacities available in wastewater systems in order to:

- reduce overflows
- save energy costs
- reduce the risk of flooding
- better balance flows at the wastewater treatment plant
- improve the management of wastewater systems.

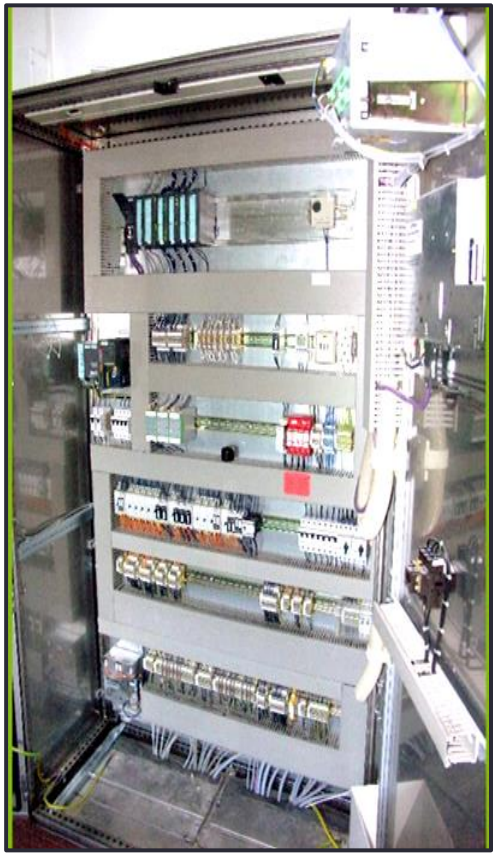


Parameters for management:


- Oxigen control
- Temperature control
- pH measurement
- Foam control
- Controlling the amount of ww
- Level control

The control cabinet



# Regulations

- We design and supply plants complying with ATV norms.
- ATV is an association, the largest in Europe, that develops the rules governing design and good practice in the construction of plants for waters and waste water treatment.
- These rules are the base of the current laws in this field

**TECHNICAL CALCULATION FOR PURIFING WASTE WATER FOR A SBR WASTE WATER TREATMENT PLANT**

**Content:**

1. Calculation of SBR - volume
2. Rating of reactors
3. BOD5 - calculation of load
4. BOD5 - calculation of sludge
5. Calculation of aeration
6. Calculation of sludge quantities

# IMR Technology

**Marra Maria Vittoria**
maria.vittoria.marra@imr.it