



Elsinore Municipality

Waste Water Treatment

Denmark

Aquatic environment in Elsinore

Elsinore is located in the North of Zealand on the tip of the Eastern and Northern coastline. The sea has always been an important factor in the region. Trade in the port of Elsinore, the shipyard and fishing used to be the key income sources, whereas tourism and outdoor life are central today where the region experiences a considerable inflow of new inhabitants. The environmental issues have a very high priority in the region. The municipal environmental department of the keeps an eye on waste water, water supply, air and noise pollution and refuse.

During the last five to ten years, the three purification plants in the region have been rebuilt to make sure that they live up to the Aquatic Environment Plan. In 1997, the rebuilding of the central purification plant near the city of Elsinore was finished and all the plants now live up to the stringent demands in the plan.

Concurrently, most of the sewer system has been renovated and the overflow systems will be furnished with basins, primarily to protect lakes and beaches in the area.



Elsinore Municipality has about 59,000 inhabitants distributed on 25,800 households and the three purification plants have a capacity of 108,300 person equivalents (PE), including the industrial waste water. A PE is used to express the average production of waste water of one person per day.

History

Purification of waste water in Elsinore Municipality started back in 1938 on the Nordkysten Renseanlæg in Hornbæk in the north part of the region. At the end of the 60s, the Sydøstøst Renseanlæg was put into service and the central plant, Helsingør Renseanlæg, was started in 1977. The picture below shows the locations of these three plants in the region.

CUSTOMER CASE

Why waste water must be purified

When organic material ends in the sea, the lakes or the waterstreams, an oxygen-demanding biological degrading process is started which leads to a lack of oxygen in the water. This, in turn, provides bad living conditions for the fish, mussels and other bottom fauna.

At the same time, the two nutrient salts, nitrogen and phosphorus are formed and they contribute to the imbalance. Unfortunately, algae thrive in this kind of environment and further worsen the living conditions for animals.

The Aquatic Environment Plan demands that the purification plants clean the waste water for nitrogen and phosphorus.

How is the waste water purified ?

The waste water is purified biologically using microorganisms that live in the water. They transform and degrade the polluting salts, nitrogen and phosphorus. At the same time, the process is regulated to provide the optimal living conditions for these microorganisms.

Types of microorganisms

Two types of microorganisms are used to remove nitrogen from waste water:

- **Nitrifying bacteria** transform ammonia-nitrogen, which is found in uncleaned waste water, into nitrate-nitrogen. This process is applied under oxygen-rich (aerobe) conditions. This type of bacteria grows relatively slowly and needs a fairly long period for its process.
- **De-nitrifying bacteria** transform the nitrate, which the nitrifying bacteria formed, to nitrogen. The bacteria transform the organic material when they use the bound oxygen which is a part of the nitrate (anoxic process). Thus, clean nitrogen is formed which disappears in the atmosphere which consists of 80 % nitrogen.

Facts about the sewage system in Elsinore

The sewage system consists of 450 km of pipes, 100 pumping stations, 50 overflow systems, 60 basins and three purification plants. This system takes care of the transportation of both sewage water and rain water which in most cases run in separate pipes.

The three purification plants in Elsinore Municipality

Helsingør Renseanlæg

This purification plant was rebuilt in 1997 to fulfill the requirements in the Aquatic Environment Plan. In practice, this means that it can now remove nitrogen and phosphorus from the waste water. The plant has a capacity of 72,500 PE where 34,000 PE come from private households. Leading architects and artists were involved in this latest rebuilding of the plant to make sure that it falls naturally into the surroundings. The plant is located just outside the city centre near the big ferry port where there is only a 25-minute trip to the Swedish city, Helsingborg.



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Much of the waste water has come from the brewery Wiibroe which is located just outside Elsinore, but this company has now sadly been closed. When the brewery was still in operation, it contributed with 40 % of the industrial waste water to the purification plant. This huge amount of waste water did not represent a problem; on the contrary, the residue was used to optimise the biological degrading of nitrogen in the plant.

When the cleaning process is finished, the sludge is mixed with calcium and then used as fertilizer on the agricultural soil in the region.



Sydkysten Renseanlæg

The Sydkysten Renseanlæg is located south of Elsinore and is servicing about 13,000 inhabitants. The plant has a capacity of 17,500 PE.

The area is very attractive for many sailors and windsurfers and they demand a clean sea which is why Elsinore Municipality has invested in the highly advanced regulation system, STAR (Superior Tuning And Regulation system). The system ensures that the waste water is effectively purified so that all phosphorus and nitrogen is removed, before the water is led into the sea (Øresund). By using STAR,

the plant has achieved a significant reduction in operating costs and a much better quality in the effluent because of the improved overview of the biological processes.

The STAR system has been developed by the Danish engineering company, Krüger A/S, in co-operation with Seven Technologies. The system is designed specifically for purification plants and is a regulation system that builds on process-technical experiences and online measurements of ammonia, nitrate and phosphorus. Some plants have achieved a 50 % increase in capacity, because STAR automatically ensures that the biological/chemical process is optimised.

STAR controls, for example, the oxygen concentration in the aeration tank, the recirculation and the dosing of chemicals. The system regulates the process around the clock by monitoring the actual and calculated conditions in the inlet which enables it to predict the quality of the effluent.

The system regulates the process as long as the predefined value limits are not exceeded. If they are exceeded, the system is disabled and the plant will be manually controlled. When the values are inside the accepted range again, STAR is automatically enabled.

The nitrogen is removed using the recirculation principle and the phosphorus is removed by adding iron salts that degrade the phosphorus through chemical precipitation.

Nordkysten Renseanlæg

This plant is located in Hornbæk on the north coast of Zealand which is a very popular seaside resort with nice beaches and a little fishing port. Nordkysten Renseanlæg is an active sludge plant which uses the patented BIO-DENIPHO process to biologically remove nitrogen and phosphorus from the waste water, before it is led into the sea (Kattegat). Of course, the inhabitants and tourists expect clean water and this is ensured by this modern purification plant.



CUSTOMER CASE

The plant is servicing about 12,000 inhabitants and has a capacity of 18,300 PE. After passing the sand and grease trap, large amounts of oxygen-consuming organic material still exists in the waste water. The amount of this harmful material is reduced by leading the water through the biological process and applying chemical precipitation.

The grease from the mechanical purification is transported to the Sydkysten Renseanlæg where it goes into the energy production process. Calcium is added to the sludge and is then used as fertilizer on the agricultural land in the area.

System Integrator

Krüger A/S.

System Integrator

Høier & Vendelo A/S