



Proces Water for Dow Deutschland,
Werk Stade (Hamburg)
Production of demi water from Elbe water

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History

The 16 Dow Deutschland factories in Stade, near Hamburg in Germany, produce a total of approximately three million tonnes of base and specialty chemicals a year.

For this, Dow needs process and demi water. By expanding production capacity in 2003, water use on location increased sharply in a short period of time.

Moreover, the ion exchangers in the existing demi installation gave problems since it was fed with water from the nearby river Elbe, which has a high salt content. This often made it necessary to add drinking water as raw material.

Since water treatment is not one of Dow's core activities, it was decided to outsource this activity to Evides Stade Wasserbetrieb GmbH (ESW), a participation of Evides Industriewater. This choice resulted from Evides' ongoing collaboration with the Dow facility in Terneuzen. Here Evides supplies various categories of process water from a number of sources, using different techniques.

Evides therefore built a water treatment plant in Terneuzen, in which large-scale membrane filtration was used for the first time to desalinate seawater. This installation has been running since 2007, using the effluent from the sewage purification plant of the municipality of Terneuzen.

After an extensive comparison of a number of concepts and technologies, Evides Industriewater conducted a study using a pilot installation at the Dow location in Stade. On the basis of the results obtained, a choice was made for a robust, reliable solution using proven technology, coagulation, sedimentation and filtration. After the study was finished Evides Industriewater built a new demi water installation and also adapted and modernised the existing installation. The process was based on exchange. In addition, Evides Industriewater realised a new installation for the treatment of process water. This was designed, financed and built on the basis of the concept of 'Design, Build, Finance and Operate'. The construction was completed in 2002. The production capacity is five million m³ of demi water and 1.75 million m³ of process water annually (800 and 200 m³/hour). The process water is partly delivered straight to Dow but also feeds the demi installation.

The outcome of the partnership between one of the world's main players in chemicals, Dow, and the specialist in industrial water, Evides, means reliability and a guarantee of supply. Evides' expertise in the field of water treatment allows Dow to concentrate on its core activities. This mutual dependence therefore leads to shared advantages.





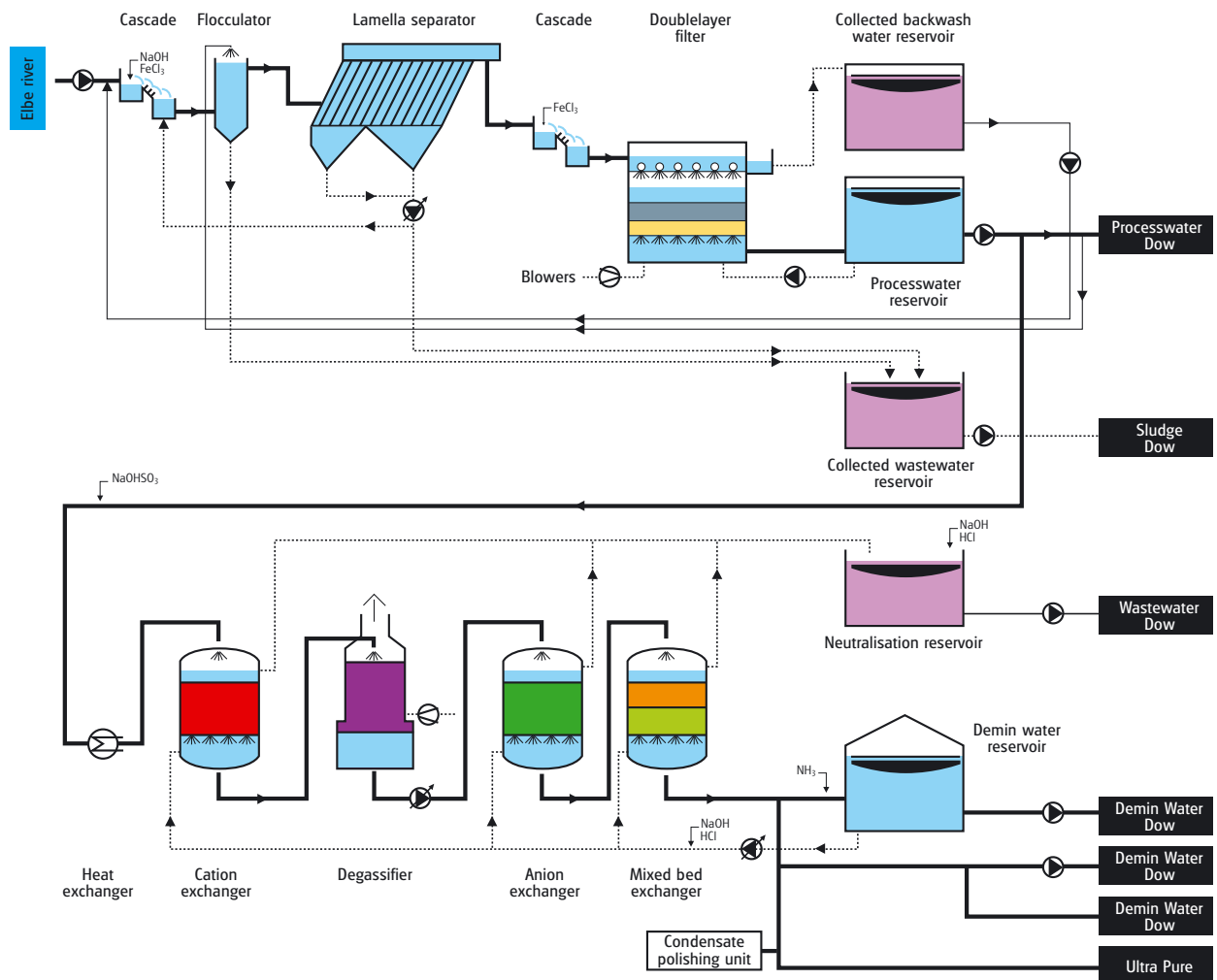
Realisation and management

The process water and demi water are produced in Pre-treatment, a purification installation, that consists of a pre-purification/pre-treatment and desalination.

Pre-treatment

The basic material for the pre-treatment is raw surface water from the nearby river Elbe. The intake point in the Elbe, just north of Stade, is in the tidal area of the North Sea. This causes continuous fluctuation in the quality of the raw water, depending on the tides and the flow rate of the Elbe.

Process diagram





Also due to these factors, the edge of the brackish water is shifting in the area of Stade. The deepening of the Elbe also added to the fact that the edge of the brackish water is shifting upstream. This leads to an increase in the pressure on the demi-installation. This was taken into consideration as much as possible in the design.

If this is necessary for purification, the raw water taken in is heated to the required temperature.

The pre-treatment of the water is a continuous process in which the production is adjustable (based on demand). The desalination consists of batch processes.

The parameters by which quality is determined are measured continuously. A process automation system translates the quality measurements to the operation of the demi installation and to the choices to be made, based on the required flows and the quality measured.

Parts of the process:

Coagulation and flocculation

In order to purify the water from colloidal and organic substances, chemicals are added to the water using a cascade. Under the influence of these chemicals the sludge present and the colloidal and organic substances will flocculate (or coagulate). Due to the accretion of these flocks, sufficiently large flocks will form in order to settle and be separated from the water.

Lamella separation

The lamella separation consists of vertical plate packs with oblique plates. The water is fed through the separators whereby the suspended solids are carried off via the lamellas. The collected sludge is partly recycled and partly removed.

Double layer filtration

The remaining substances that can be filtered are removed using double layered filters. The filters are cleaned regularly using water and air. The scouring water flows back to the start of the purification process for reuse.

Process water storage

After pre-treatment, the water is stored in two process water reservoirs. From here, part of the water is destined for direct use by Dow as process water in the production of chemicals. By far the largest part is treated further by way of desalination into demi water.

Desalination: The demi installation

Process water is the basic raw material for the production of demi water in the desalination installation. In addition, condensate is processed into demi water. Only in the event of emergencies is drinking water used as a basic raw material. Part of the demi water produced is treated further into ultra pure quality.

Parts of the process:

Ion exchangers and gas removal

Where necessary the process water is heated further and then fed into cation exchangers. A cation exchanger consists of a steel vat filled with resins able to exchange cations (positive ions) for H^+ ions, bonded to the resins. As a result of the exchange process, H^+ ions are added to the water thereby reducing the pH. During the pH reduction, the anion (negative ion) HCO_3 is partly converted into CO_2 thus reducing the anion content. In the gas removal installation the CO_2 generated is removed using air. After gas removal the acidic water is fed through an anion exchanger. The resin in these exchangers is able to exchange anions for OH^- .



Results

By releasing OH^- , the acidic water is neutralised. After this treatment, the water is drastically desalinated and is neutral. In addition, on the (strong) anion resin, silicate is converted into silicate-ion, which is separated.

Mixed bed ion exchangers

The water from the anion exchanger is fed over a mixed bed. This is filled with a mixture of cation and anion resins. These resins exchange the remnant of ions against H^+ and OH^- ions. The remaining salts are removed, so the end product meets the required drinking water standard.

Regeneration/neutralisation

If the exchange capacity of the resins is depleted, these must be regenerated using chemicals. The charge on the resins is restored with a surplus of H^+ and OH^- ions. The regeneration water contains the waste cations and anions and the required surplus chemicals. The regeneration water is fed into neutralisation section, after which it is discharged.

Conditioning

A large part of the demi water must have a pH value of 9.5. In order to attain this level of acidity, ammonia is added

Demi water storage

After desalination and conditioning, the water is stored in three demi water reservoirs. From here delivery to Dow takes place.

Evides Industriewater process technologists and process technicians are responsible for the management and optimisation, at all times ensuring the quality of the process and the performance of the installation according to the values agreed in the contract. Careful tuning and consultation between Evides and Dow are the guarantee for optimum utilisation of the installation. Because Evides Industriewater expanded and adapted the existing demi water installation to the customer's needs and designed and constructed a new installation for process water purification, Dow has the right quality and quantity of water at its disposal. The new installation means savings of 90 per cent on the use of drinking water and energy savings of 114,000 MWh. Finally, the use of chemicals has been drastically reduced. This results not just in cost savings but also in a reduced burden on the environment.

The new installation has been designed in such a way that the varying composition of the raw Elbe water can be treated within a broad area. Only in extreme circumstances is it necessary to add in drinking water to the process water for the demi water installation. The amount of chemicals used depends on the conductivity and the turbidity of the raw Elbe water. The Elbe is being deepened to make it suitable for shipping with an even greater draught. The deepening will increase the conductivity of the water even further. Evides Industriewater is deploying all available knowledge and technology to adequately address these circumstances.

Evides Industriewater: the water chain approach for the industry

Evides Industriewater B.V. is a subsidiary of Evides NV, which supplies drinking water in Zeeland, the south-western part of Zuid-Holland and the Brabantse Wal and is the second largest water producing company in the Netherlands.

As the largest provider of water services to the industrial sector in the Netherlands, Evides Industriewater is responsible for the production and distribution of industrial water, demineralised and distilled water, agricultural water and process water. The total volume amounts to approximately 110 million m³ per annum. What is more, Evides owns and manages various industrial and household waste water treatment installations.

Evides also supplies various categories of water to another Dow facility (in Terneuzen). Here, the waste water from the Terneuzen municipality is reprocessed by Evides into demineralised water for Dow. Moreover, Evides supplies demi water to DuPont de Nemours in Dordrecht. In the The Hague region, Evides is part of a joint venture with Veolia, which is responsible for the (operational) management of the 1.7 million inhabitant-equivalent waste water treatment plants of Harnaschpolder and Houtrust. Evides Industriewater also manages the waste water treatment plants at Schiphol airport and of an industrial estate in Vlissingen-Oost.

Waste water treatment is an important link in the water chain. The effluent from a waste water treatment plant can serve as a raw material from which process water is produced.

Source of
Knowledge

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