

# Sewage Treatment Plant No. 1 in Nuremberg.

## A brief description.

### Sewage Treatment Plant No. 1 is...

- a mechanical-biological-chemical\* sewage treatment plant
- designed to serve an equivalent population (EP) of 1,400,000,
- with two-stage biological purification (activation / activation),
- with nitrogen and phosphate removal,
- with wastewater filter.

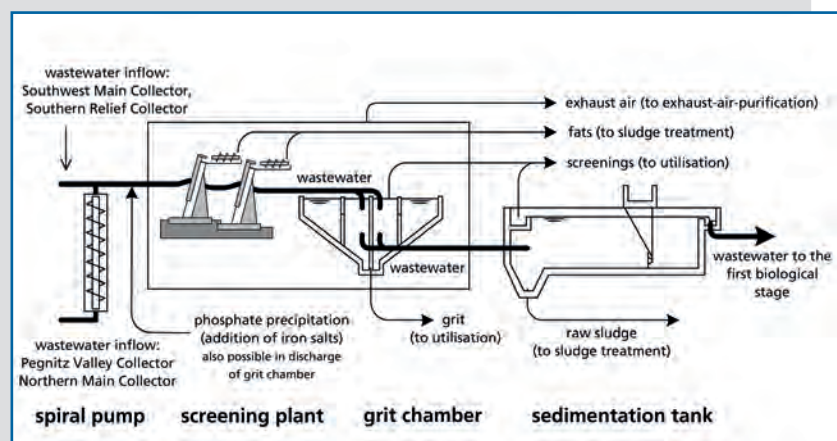
The facilities for the treatment of sludge (digestion / dewatering) are located on the site of the Sewage Treatment Plant No. 1, and operate for both large sewage treatment plants in Nuremberg (Sewage Treatment Plant No. 1 and Sewage Treatment Plant No. 2).

### The mechanical cleaning stage

The sewage from the northern main collector, from the old town and from the Pegnitztal collector is transported, by means of a **spiral pump**, to the level of the sewage treatment plant intake. The sewage from the southern urban areas (southwestern main collector and southern relief collector) flows downhill to the sewage treatment plant.

The coarse substances are removed by the **screening plant**. Two-stage screens with bar spacings of thirty millimeters (first stage) and six millimeters (second stage) are used here. This is followed by the aerated **grit chamber**. Sand and other mineral solids settle at the bottom of the grit chamber, whilst the fat carried in the wastewater floats to the surface.

The wastewater then flows into four rectangular **sedimentation tanks** (pre-treatment). There, all substances heavier than water settle as raw sludge at the bottom of the tanks. The fats which have not yet been completely removed during grit removal, float to the surface of the water.

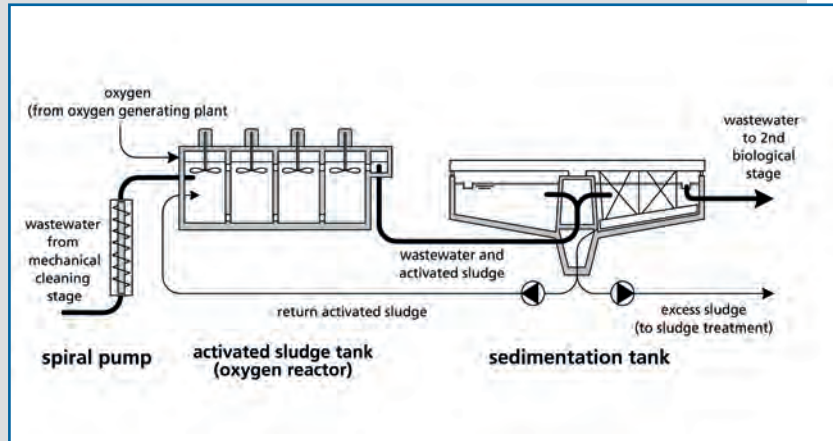


\* Chemical precipitation of phosphate in wastewater.

Mechanical cleaning stage.

## The first biological stage (high-rate activated sludge plant)

The first biological purification stage is a **high-rate activated sludge plant** operating with pure oxygen. The main process here is the removal of carbon compounds from the wastewater. The oxygen required for the plant is generated on the site of the stormwater reservoir east of Sewage Treatment Plant No. 1. The oxygen generating system is operated by an external company. The wastewater flows from the activated sludge tanks into the four **sedimentation tanks** of the first biological stage. There, the activated sludge is separated from the effluent.

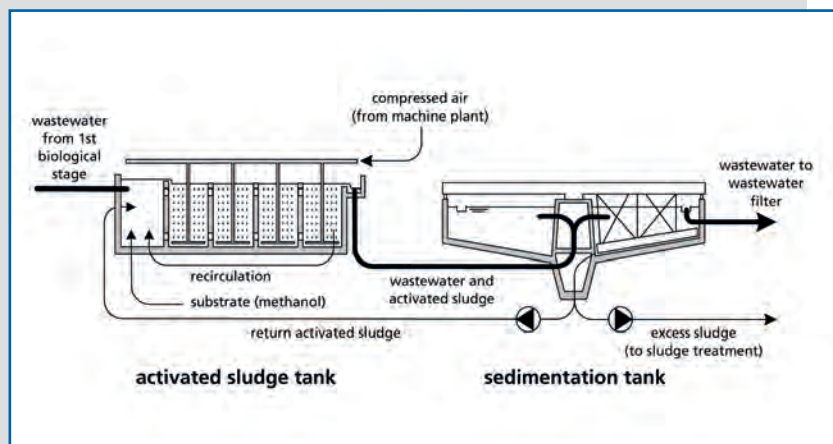


First biological stage.

## The second biological stage (low-rate activated sludge plant)

The wastewater then flows to the **low-rate activated sludge plant** (second biological cleaning stage). There, ammonium is converted into nitrate (nitrification). Then, the nitrate is converted into nitrogen (denitrification) in the non-aerated sections of the aeration tanks. If the necessary supply of carbon compounds is not sufficient, an external substrate can be added.

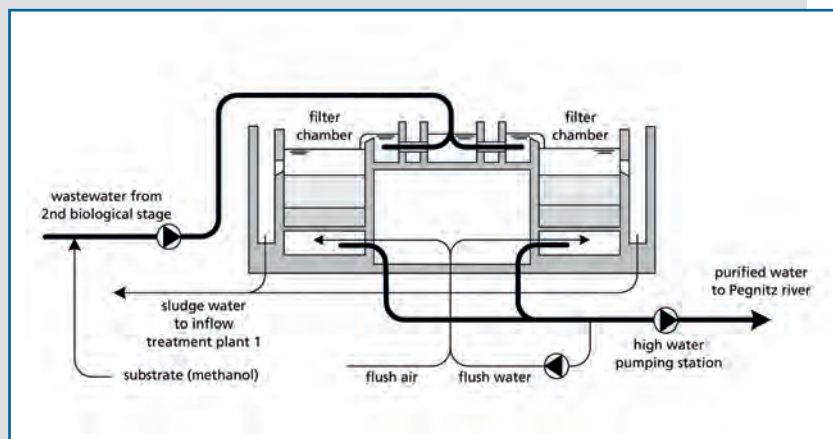
The wastewater then enters the second-biological-stage **sedimentation tanks** from the aeration tank. There, the activated sludge is separated from the effluent. Iron chloride (or equivalent substances) are added to these tanks, as well as after the grit removal process, to remove phosphate.



Second biological stage.

## The wastewater filter

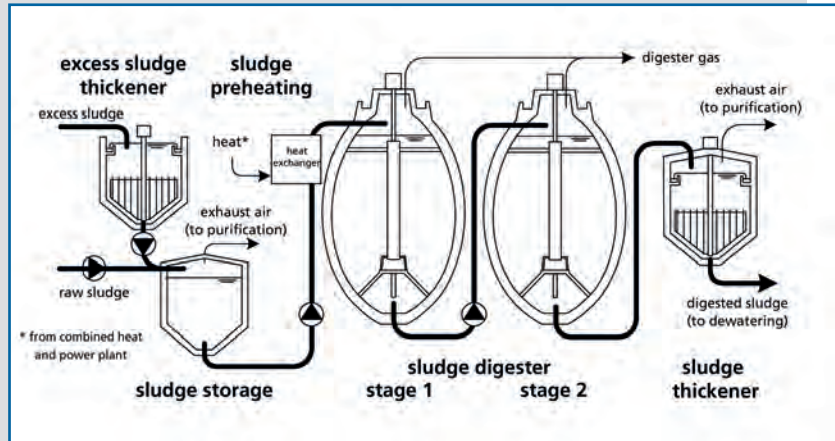
A **wastewater filter** is the final stage of wastewater treatment. There, the wastewater flows from top to bottom through a filter bed, in which the finest of suspended matter is retained. The purified wastewater flows into the **Pegnitz** river.



Wastewater filter.

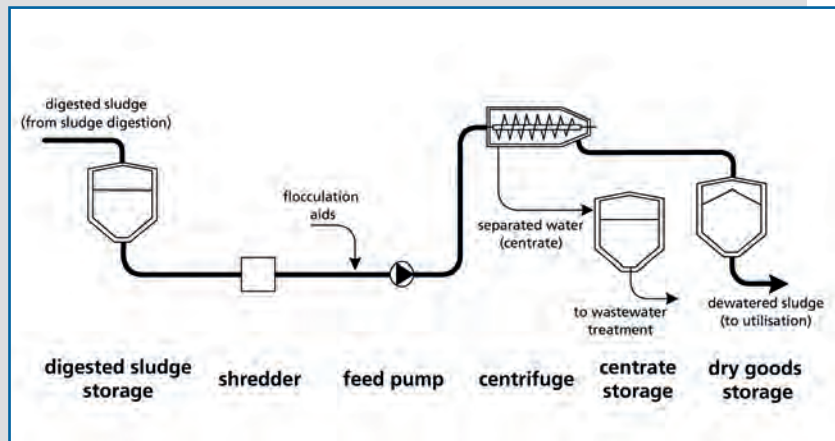
## Sludge treatment

The treatment of the sludge ensures a biological stabilisation of the sewage sludge to prevent uncontrolled digestion – which would lead to significant odour. Prior to digestion, the excess sludge from the biological purification stages is thickened (in the **excess sludge thickener**) and then intermediately stored in **sludge storage** tanks. In the **sludge digesters**, about half of the organic substance (about one third of the solid content) in the sludge is converted into digester gas under exclusion of oxygen (anaerobically).



Sludge digestion.

The steps after the sludge digestion are used to separate the water from sewage sludge. **Sludge dewatering** in centrifuges is the final step in this process. The dewatered sewage sludge is currently used in coal-fired power plants. The future perspective is the recovery of the phosphorus contained in the sewage sludge as a fertilizer and raw material.

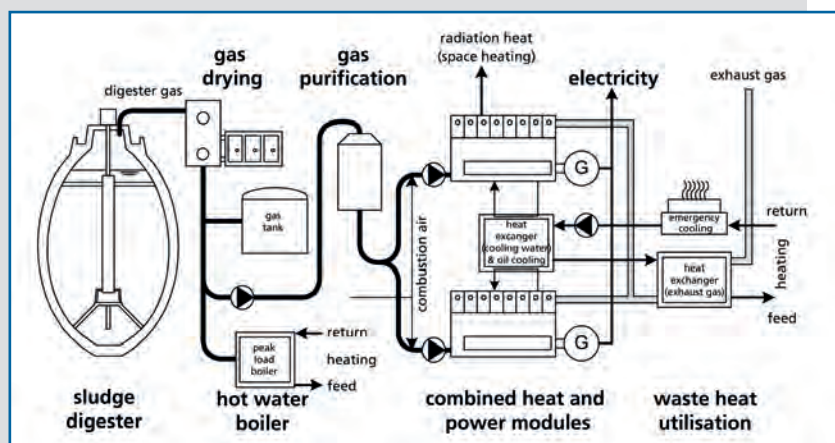


Sludge dewatering.

## Sewage gas utilisation in combined heat and power plants

The digester gas, which is generated during the sludge digestion, is collected and used. Two gas tanks serve to compensate for fluctuations in digester gas production and consumption.

The digester gas is used in combined heat and power plants. There, four gas motors generate both electricity and heat. Almost all of the required heat and about 60 percent of the electricity consumed in the two sewage treatment plants in Nuremberg can be covered by own digester gas.



Sewage gas utilisation.

# The history of Sewage Treatment Plant No. 1

|             |   |
|-------------|---|
| <b>1908</b> | Plans for a central sewage treatment plant for Nuremberg at the site of today's Sewage Treatment Plant No. 1 at Doos. The project is not pursued because of the very high costs.  |
| <b>1917</b> | As part of a plan for the expansion of sewage disposal in Nuremberg, the construction of a central biological sewage treatment plant at the Doos site is suggested once again.  |
| <b>1929</b> | Start of construction for the sewage treatment plant at the Doos site. It is named Kläranlage Nord [Sewage Treatment Plant North] (corresponding to its drainage area).   |
| <b>1931</b> | Completion of the sewage treatment plant. It consists of screening plant, four sedimentation tanks, eight sludge digesters and five sludge-drying beds with an area of 3000 square metres. The grit chamber is completed in 1932. |
| <b>1956</b> | Introduction of biological wastewater treatment: four trickle filters are put into operation.   |
| <b>1962</b> | Kläranlage Nord is renamed Klärwerk 1 [Sewage Treatment Plant No. 1] (as it is the larger of the two Nuremberg sewage treatment plants).  |
| <b>1967</b> | Completion of the first large digester of 10,800 cubic metres in volume. Until 1989 four more digesters were built.   |
| <b>1975</b> | The second biological stage (sludge activation plant) with three sedimentation tanks (diameter 70 m) is put into operation.   |
| <b>1989</b> | Extension of the second biological stage:<br>Two new activated sludge tanks and a fourth sedimentation tank (70 m).   |
| <b>1993</b> | The new intake area (spiral lift, screening plant, aerated grit chamber) is put into operation.   |
| <b>1994</b> | The wastewater filter is put into operation.  |
| <b>1995</b> | Measures for nitrogen reduction (denitrification at the second biological stage) are put into operation.  |
| <b>2002</b> | The high-rate activated sludge plant (as the first biological stage) goes into operation. It replaces the existing trickle systems.   |
| <b>2011</b> | Renewal of the sludge dewatering plant: drainage in centrifuges.<br>Expansion of the combined heat and power plants.  |
| <b>2013</b> | The renewed sedimentation tanks of the second biological stage are put into operation.  |
| <b>2015</b> | The renewal of sludge treatment plants begins.  |
| <b>2019</b> | The renovation of the first digester built in 1967 has been completed.  |



Sewage Treatment Plant No. 1: Sedimentation tanks, first biological stage, sludge digester. Photo: Susanne Vogel (SUN).