GMVA

Thermal Treatment for a Clean Environment

gmva.de

The GMVA Oberhausen is a Public Private Partnership between the cities of Oberhausen and Duisburg and the environmental service company, REMONDIS

Safety for people and the environment

The GMVA waste incineration plant treats waste from the cities of Oberhausen and Duisburg as well as further amounts from the districts of Kleve, Steinfurt and Coesfeld using environmentally friendly methods. In addition to this, the plant also incinerates pre-treated commercial waste delivered mainly by the company REMONDIS. The technological concept implemented at the GMVA ensures that the plant achieves a consistent level of efficiency and safety without harming the environment.

The heat energy generated by the incineration process is transformed into electrical energy and thermal energy (district heat supply) using a combined heat and power process

Thermal treatment has many advantages

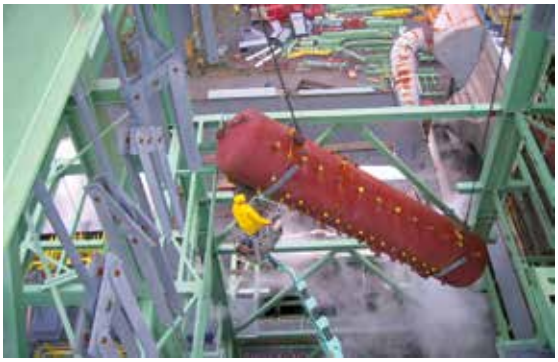
Modern thermal waste treatment plants in Germany are among the safest and cleanest industrial plants in the country. They are subject to the strict 17th Ordinance of the Federal Emissions Control Act which prescribes extremely low emission limits. The design of the GMVA plant guarantees that any harmful substances are removed before the emissions are released into the atmosphere. Other advantages include:

- Waste material is sent to us for incineration which is unable to be recycled sensibly but which often contains a large amount of energy. We convert this energy and make use of it.
- The way we incinerate the waste helps to conserve natural resources – in three different ways. Firstly, making use of energy in waste means a reduction in the need for primary energy sources, such as coal, gas and oil. Secondly, the slag resulting from the incineration process is treated in such a manner that it can be used as a construction material. And thirdly, other residual materials, such as fly ash, brine and gypsum, which are by-products of the flue gas cleaning processes, can often be used for other purposes – for example as a construction material for filling mines.

Last but by no means least, our incineration processes lead to a sustainable improvement of the climate as we reduce carbon dioxide emissions. Whereas 100 % of fossil fuel has an effect on the climate, up to 70 % of the waste incinerated contains raw materials such as wood or paper, which naturally store carbon dioxide during their creation or growth periods and so do not put an extra burden onto the atmosphere. Besides this, methane gas, which is released by waste in landfills, is thirty times more harmful for the atmosphere than the amounts of carbon dioxide released through incineration. The GMVA, therefore, guarantees that the waste from the region is managed in a reliable manner and makes an important contribution towards the sustainable conservation of our environment.

Electricity and heat for the region

The energy released by the incineration process is transformed into electricity and district heat. The amount of electricity generated is enough to cover the needs of 100,000 households in the City of Oberhausen. The district heat is delivered by the GMVA to many households using the combined heat and power process. The amount of heat generated each year alone substitutes between 5 and 15 million litres of heating oil depending on the demand.



Comprehensive modernisation and extension measures were undertaken between 2003 and 2006

A long history in just a few words

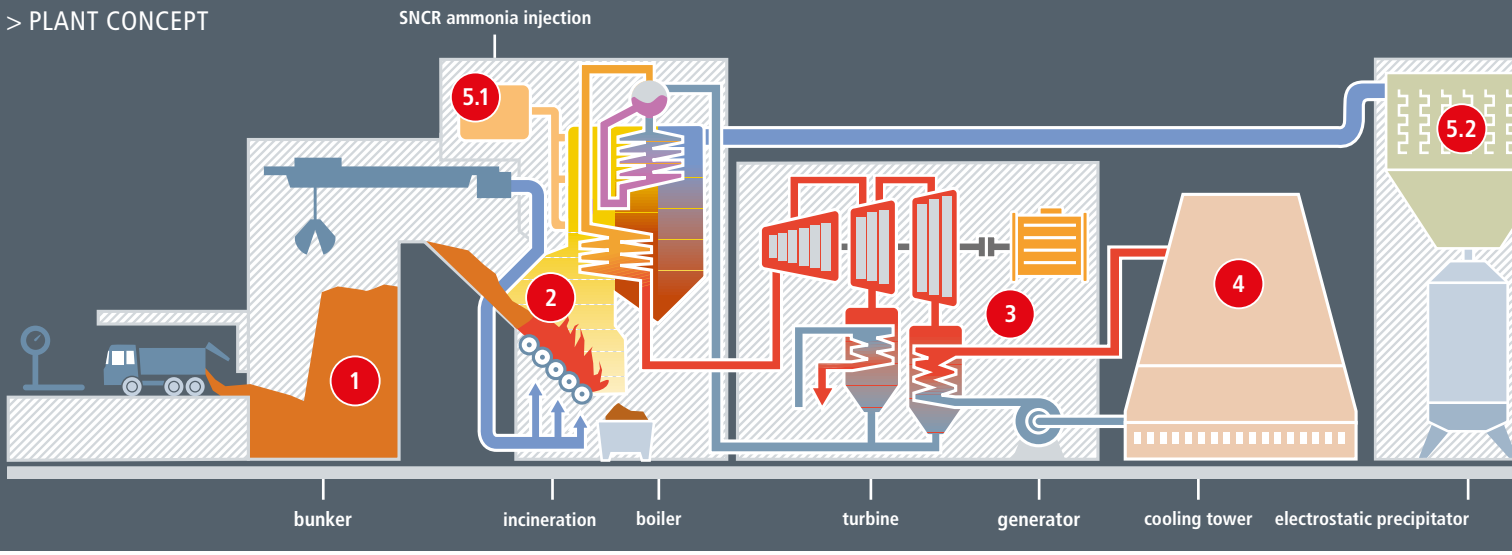
In 1968, the mine power plant belonging to Concordia Bergbau Aktiengesellschaft was converted into an incineration plant with three boiler lines and was put into operation in 1972. Just three years later, the first extraction condensing turbine for heat recovery was already producing electricity. Over the following years, money was invested in modern flue gas cleaning systems, in new boilers as well as in a new turbine. In 2001, REMONDIS bought a 49% share in the GMVA from the cities of Duisburg and Oberhausen who had previously been the sole owners. The capital brought in by REMONDIS was used to convert the DeNOx system from the SCR system to the more economical and reliable SNCR technology. Besides this, a boiler and a turbine were replaced between 2003 and 2006 and an auxiliary condenser was installed. As part of the modernization measures implemented, all the boilers were also converted to lower steam parameters – from 60 bar and 480 °C to 40 bar and 400 °C – in order to reduce corrosion on the heater surface of the boilers and so reduce repair costs and increase system availability.

The GMVA Gemeinschafts-Müll-Verbrennungsanlage Niederrhein GmbH is owned by the Wirtschaftsbetriebe Duisburg and Stadtwerke Oberhausen as well as by the environmental service company, REMONDIS

The average calorific value of the material treated at the GMVA is higher than that of the brown coal extracted e.g. from the Rhineland open-pit mines

> Technical Data

No. of incineration lines	4
Energy input	270 MW
Annual capacity	670,000 – 720,000 t
Incineration technology	roller grate with parallel-flow firing concept
Incineration temperature	850 – 1,100 °C
Flue gas cleaning capacity	4 x 133,000 Nm^3/h (wet)
Flue gas cleaning	SNCR reduction process, electrostatic precipitator, HCl scrubber, SO_2 scrubber, entrained-flow adsorber with downstream fabric filter
Electric network supply	335,000 – 355,000 MWh
District heat supply	60,000 – 150,000 MWh



Transforming waste to energy efficiently

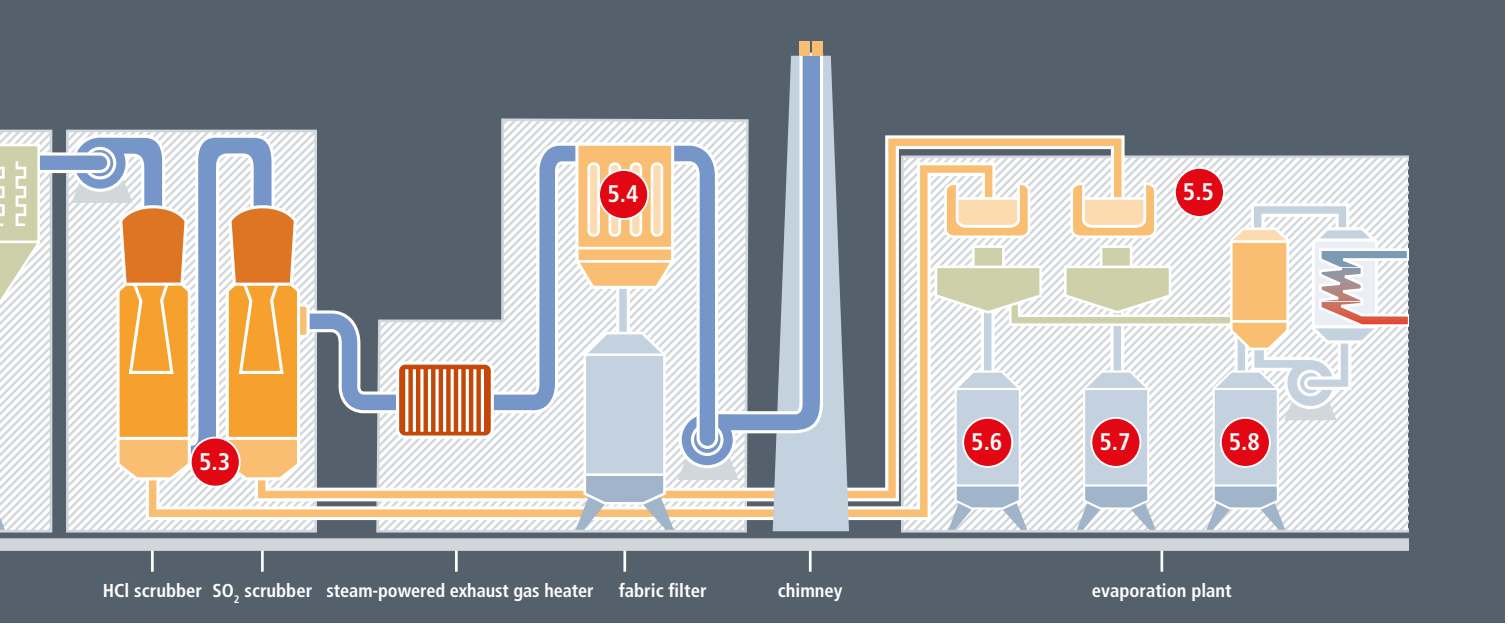
The GMVA has four incineration lines. Each incineration line consists of the material feeder, the grate and firing system, the steam generator and a complex flue gas cleaning system. Between 20 and 25 tonnes of material are incinerated on each line every hour – this means a total capacity of up to 2,400 tonnes per day or 700,000 tonnes per year.

The bunker can store up to 26,000 m³ of material. This guarantees that the plant is kept in operation 24 hours a day and on Sundays and bank holidays, too

Incineration in five stages

The four boilers are the heart of the GMVA. They are fed with material from one central bunker via three cranes with gripper arms. The material picked up is transported to the combustion grate via the feeder ram. The roller grate then transports the material mixture through the various incineration stages in a controlled manner: the drying, degasification, ignition, main combustion and burn-out zones. Temperatures of up to 1,200 °C are reached in the main combustion zone.

As soon as the incineration process has been completed, the slag is removed which is now only 8 % of the original volume and contains less than 1 % combustible material. The slag is then treated, whereby any remaining valuable substances, such as iron and non-ferrous metals, are recovered and the inert material screened and collected according to particle size. The processed slag is then used for other purposes, such as in road construction. As stipulated by the 17th Ordinance of the Federal Emissions Control Act, the reaction gases resulting from the incineration process are kept at a temperature of at least 850 °C for at least two seconds after the final combustion air supply in order to ensure the gases are burnt out and that any dioxins are destroyed. Following this, the hot flue gases are cooled down to about 220 °C via the boiler heating surface. The heat is used to generate steam with main steam parameters of 400 °C and 40 bar. The generated steam is then fed into the two extraction condensing turbines. When required, steam is removed via the turbines' extraction outlets to supply district heat. The remaining steam is fed into the condensation section. The flow of energy, which has not been removed as heat, is transformed into mechanical energy in the turbine generator to produce electricity.



An overview of the GMVA's main units and components:

1 Bunker

The bunker has ten dumping points with hydraulic sliding rams, two shears and three crane systems. It has an overall capacity of 26,000 cubic metres. Each year, ca. 700,000 tonnes of material, delivered by 80,000 trucks, is put through the bunker.

2 Incinerator unit and steam generator

The incineration process is carried out on roller grates in four parallel-flow fired incineration units with a total heat input of 270 MW. The four steam generators, connected to this system, are operated under a pressure of 40 bar and at a temperature of 400 °C. Together, they produce 305 tonnes of steam an hour.

3 Energy conversion and output

Two turbine generators, with a power output of 25 MW and 44 MW respectively, generate electricity for the plant's own requirements as well as for the public grid (110 kV and 25 kV). Furthermore, district heat and process steam can be removed and supplied to the industry.

4 Cooling towers

In order to close the cycle of steam in the power plant, the steam, which has not been fully condensed in the turbines, must be condensed back to water in the condensers. Two cooling towers, with 9,000 m³ and 4,000 m³ of circulating water per hour respectively, ensure that the heat of condensation is cooled back down again.

The GMVA's efficient combined heat and power system means a reduction in CO_2 emissions helping to protect the environment

5 Flue gas cleaning

The harmful substances are carefully filtered out in the modern, multi-phase flue gas cleaning system. The low emissions of the individual parameters prove just how efficient our system is (see illustration on page 7). The flue gas cleaning systems used for each of the incineration lines consist of an SNCR NOx reduction system (5.1) and an electrostatic precipitator (5.2), whereby each filter is equipped with three filter chambers which are connected in series. The dust is stored temporarily in silos and processed. The HCl scrubber and SO_2 scrubber (5.3) follow next as well as the entrained-flow adsorber with a downstream fabric filter (5.4). The wastewater generated by the scrubbers is treated and evaporated in the wastewater treatment facilities (5.5) so that the system functions without wastewater.

The residual materials remaining are hydroxide sludge (5.6) from the water treatment stages, gypsum (5.7) and calcium chloride brine (5.8).

If all the material incinerated each year at the GMVA were piled onto a football pitch, then the result would be a "tower" 200 metres high

The GMVA's flue gas cleaning system consists of several different process stages

Flue gas cleaning without wastewater

No matter how good the incineration technology may be, waste cannot just disappear into thin air. Not only slag is created as a result of this process but flue gases, too. These gases, however, are treated and carefully filtered out during the flue gas cleaning process so that the air emitted by the chimney into the atmosphere is practically pollutant free.

The modern control centre has an overview of all the different data and values. These are continuously being evaluated and automatically fed straight away into the control system. The emission data is forwarded online to the Environmental Protection Agency

Each of the GMVA's four incineration units has its own separate flue gas cleaning system

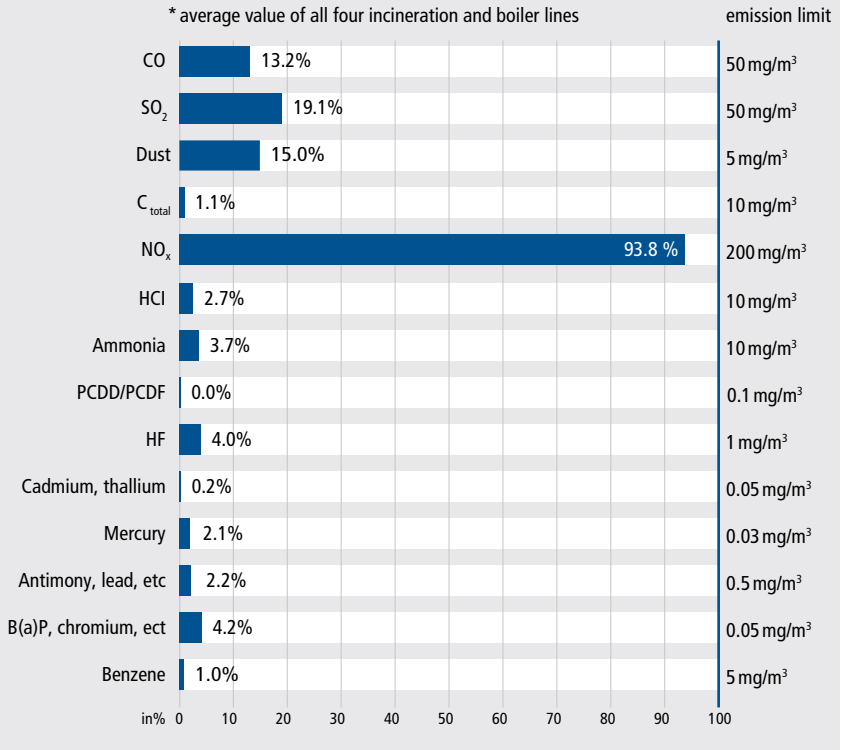
Covering 65 % of the building space, the flue gas cleaning facilities make up a large part of the plant

A good job done well

- Nitrogen oxide is already reduced in the boiler. To achieve this, an ammonia solution is injected as a reducing agent – and at a temperature at which the NO_x reduction process is at its most efficient. The reaction is most effective if it is carried out at a temperature lying between 880 °C and 1,000 °C. The actual temperature range is, therefore, measured and then the right level for injecting the agent is automatically selected.
- Each boiler has its own flue gas cleaning facilities with a capacity of 133,000 Nm^3/h (wet). As soon as they leave the boiler, the flue gases are fed directly into the electrostatic precipitator where the dust is collected on the collecting surface using an ionized electric field. This is then followed by the two-phase flue gas cleaning process:
- During the first cleaning stage, the HCl scrubber, hydrogen chloride, the remaining dust, heavy metals and dioxins are removed.
- In the second cleaning phase, the SO_2 scrubber, the remaining acidic pollutants, primarily sulphur dioxide, are removed from the flue gases.
- Once they leave the SO_2 scrubber, the flue gases, which are saturated with water vapour, are heated up to 115 °C by a steam-heated tubular heat exchanger. A fabric filter then removes fine dust as well as any remaining heavy metals, dioxins and furans and further reduces the acidic content of the flue gases. A mixture of lime and coke is added to the flow at the entrance to the fabric filter to adsorb the harmful substances mentioned above.

The GMVA emissions are well below the strict emission limit values stipulated in the 17th Ordinance of the Federal Emissions Control Act

> GMVA Emission Data 2017*



GMVA is a business part-owned by the REMONDIS Group, one of the world's largest recycling, service and water companies. The company group has branches and associated businesses in more than 30 countries across Europe, Africa, Asia and Australia. With over 30,000 employees, the group serves around 30 million people as well as many thousands of companies. The highest levels of quality. Working for the future.

GMVA Gemeinschafts-Müll-Verbrennungsanlage Niederrhein GmbH
Liricher Str. 121 // 46049 Oberhausen
Germany // T +49 208 8594-0
F +49 208 8594-210 // info@gmva.de // gmva.de

A company part-owned by the REMONDIS Group