CURRENTA

Performance for the chemical industry

NETWORK FOR THE ENVIRONMENT

A Bayer and LANXESS company

TOTAL WASTE MANAGEMENT

Modern waste management necessitates holistic concepts for dealing with production waste that cover all the different aspects of the environment.

The correct, safe disposal of substances and products is essential for ensuring that chemical production processes run smoothly and have the minimum impact on the environment. Disposal is supplemented by measures to prevent waste being generated in the first place. Every ton of waste that is avoided reduces the amount that has to be managed in technical, economic and environmental terms. At first glance, it therefore appears that the recycling or re-use of residual substances should be given priority over their disposal – both in environmental and economic terms. However, more in-depth analyses and case studies have cast doubt on this assumption, at least from an environmental perspective.

The implementation of waste management concepts can be compared to the construction of a house. The roof is the most important factor for the comfort of those living in the house, followed by the walls and foundations. In this analogy, the roof corresponds to the concept of waste avoidance, the walls represent recycling/re-use, and the foundations are equivalent to disposal. A house, however, is built in the reverse order. This analogy demonstrates the critical importance of disposal as a foundation of waste management.

Modern disposal concepts

For practical reasons, avoidance and recycling measures cannot reduce the volume of waste generated to zero. Disposing of waste with the minimum environmental impact will therefore remain the basis for total waste management for the foreseeable future. CURRENTA Environment is continuously optimizing disposal in terms of both technology and methodology. The incineration of waste and its disposal in landfill sites, the cleaning of storage tanks and the treatment of wastewater are all performed to an exceptionally high standard, with safety being a top priority. Emissions into the air, water and soil are minimized and all the relevant environmental factors are taken into consideration.

Safety is a top priority for all disposal measures.

NETWORKED WASTE MANAGEMENT FACILITIES

In-process environmental protection and downstream waste management and administrative facilities complement one another, thereby ensuring environmentally responsible industrial production.

The very substantial reduction in the level of emissions has been achieved in part through a unique combination of systems for the treatment of wastewater, the incineration of waste air and hazardous waste, and the disposal of hazardous waste in landfills. This network enables CURRENTA Environment to prevent environmental contamination simply being passed from one part of the environment to another. One example of this holistic approach is as follows:

- The treatment of wastewater produces purified water, but also sewage sludge and waste air.
  - The waste air is treated in a central waste air incineration plant.
  - The sewage sludge is de-watered in filter presses and incinerated.

Aerial view of the Leverkusen site's Bürrig Waste Management Center

- Incineration produces hot flue gases, ash and slag.
  - The heat present in the gases is used to generate steam and electricity.
  - The cooled flue gases are treated in a multi-stage process.
  - The resultant rinse water is treated in a wastewater treatment plant.
  - Ash and slag are deposited in a hazardous waste landfill.
  - The leachate generated at this site is collected and passed to the wastewater treatment plant.

This systematic approach has been made possible thanks to the waste management network developed by CURRENTA. Rather than approaching each problem individually, a judicious combination of wastewater treatment, waste incineration and waste air treatment plants and landfill disposal is used to achieve optimal results with the minimum environmental impact.

This approach was also adopted for the wastewater generated by the companies at the CHEMPARK sites. If laid end to end, the CHEMPARK wastewater sewerage pipes would have a total length of several hundred kilometers. In reality, they form branched systems transporting wastewater that has been separated from cooling water and clean water and is suitable for biological treatment to the Waste Management Center in Leverkusen-Bürrig. Both the "bio-sewers" leading to the wastewater treatment plant and the clean-water sewers discharging cooling water and organically

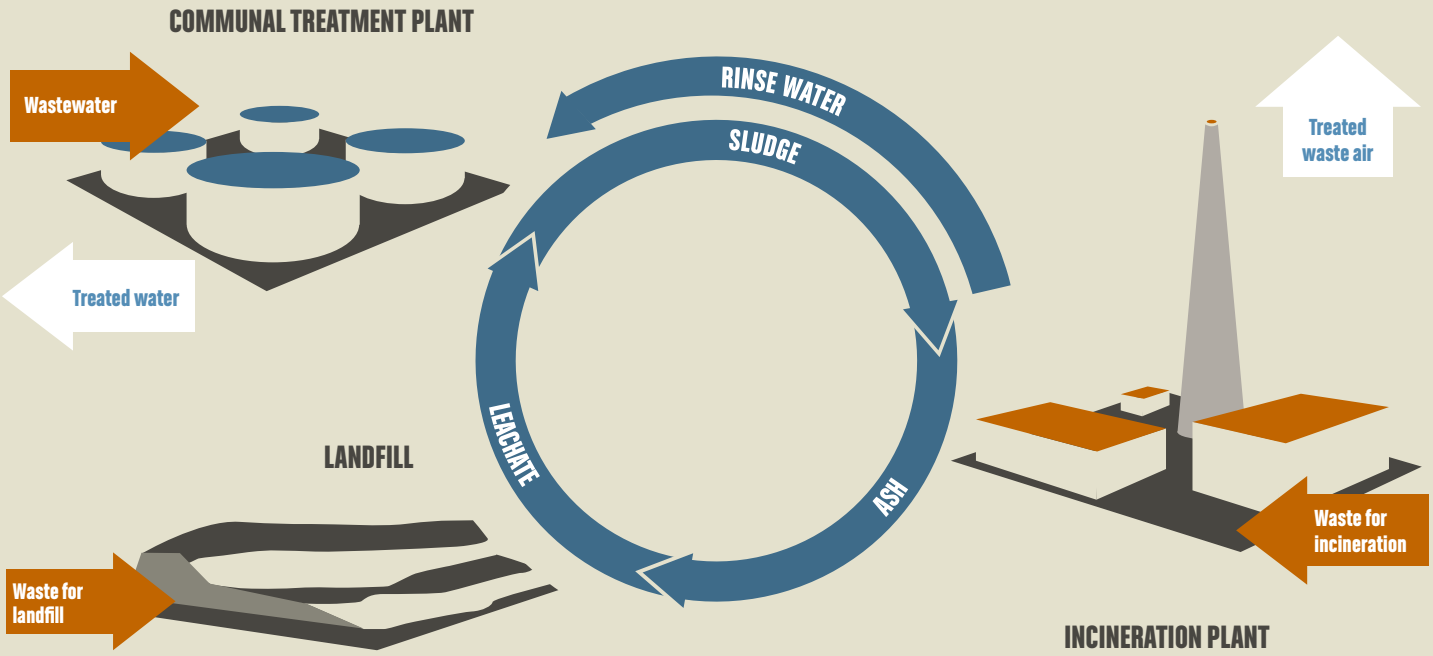


Fig. 1: Systematic approach to disposal

uncontaminated water into the Rhine are continuously monitored.
Automated measurement systems detect increased cooling water contamination which may occur, for example, as a result of sudden plant malfunctions or leaks, or the presence of extinguishing water. To ensure the Rhine is protected, even in such situations, any contaminated water is routed to collecting tanks. The Leverkusen site has a total of four such tanks at its perimeter, each with a capacity of 5,000 cubic meters, and the Leverkusen-Bürrig wastewater treatment plant has its own tank with a capacity of 10,000 cubic meters for contaminated water that is suitable for biological treatment.

The collected wastewater is only passed to the treatment plant after careful analysis and pre-treatment where necessary. This means that CURRENTA Environment can ensure proper disposal of the wastewater generated by the production companies at CHEMPARK, even in critical situations.

Reduction and re-usage

A modern waste management concept also needs to aim, wherever possible, for a reduction in the volume of waste generated and utilization of the energy generated by its incineration. For example, CURRENTA Environment looked into various ways of significantly reducing the volume of sewage sludge from the three treatment plants – approx. 100,000 metric tons per annum in total. The heat released during waste incineration is used to generate steam and electricity. It is also possible to use the ash and vitreous slag remaining after incineration in road construction. As the volumes involved are relatively small, they are used to underlay the roads at the landfill site. Whether or not slag can be used as a raw material for construction also depends on whether this is acceptable to society.

Decentralized treatment of waste

In addition to the interlinked central waste management facilities, the individual production plants also have their own decentralized treatment processes. These are used for initial treatment of solid waste, wastewater and waste air before their subsequent central treatment.

This decentralized pre-treatment makes sense whenever it avoids expensive disposal measures or simplifies waste disposal in technical terms. For instance, the constituents of wastewater with poor biodegradability can be converted into a more readily biodegradable form using catalytic oxidation. This replaces expensive wastewater incineration with inexpensive wastewater treatment.

Other ways of treating waste streams are presented in the diagram on page 6.

CURRENTA Environment provides companies at the CHEMPARK sites with information on the decentralized treatment of waste and on the associated technical, economic and ecological aspects.

In-process environmental protection

The concept of waste avoidance is now an integral part of the development of new production processes. Processes already in use are thoroughly analyzed and subjected to regular review.

A typical example of waste avoidance is the steady increase in the yield of a chemical process. This increased yield is scrutinized to ascertain if it involves disproportionately high energy consumption or use of chemicals, with an attendant impact on the environment.

Where a synthesis involves a number of stages, the aim is generally to improve the yield of each stage through enhancements in process engineering. A substantial reduction in the volume of waste can often be achieved simply by changing the raw materials or reducing the number of stages in the synthesis. Alternative options are shown in the left-hand diagram below.

Despite increasing production by over a third since 1990, Bayer and LANXESS have achieved a substantial reduction in emissions – up to 90 percent in some areas. This was made possible by a combination of in-process and "end-of-pipe" environmental protection measures. The diagram clearly shows that technical innovations have removed the correlation between the production process and emissions.

Environmental protection network

A modern waste management concept has to be based on a systematic approach that looks at both the environmental and economic aspects of waste avoidance, recycling and disposal. An in-depth economic and environmental analysis is required to determine whether recycling should be given priority over disposal.

CURRENTA Environment can provide both production companies located at the CHEMPARK sites and external customers with information on all the various disposal options for waste contaminated with chemicals, taking into consideration environmental, technological and economic factors. In-process environmental protection and end-of-pipe disposal measures, both central and decentralized, are assessed in their totality. The two approaches are complementary and – as an "environmental protection network" – ensure efficient production processes with the minimum impact on the environment.

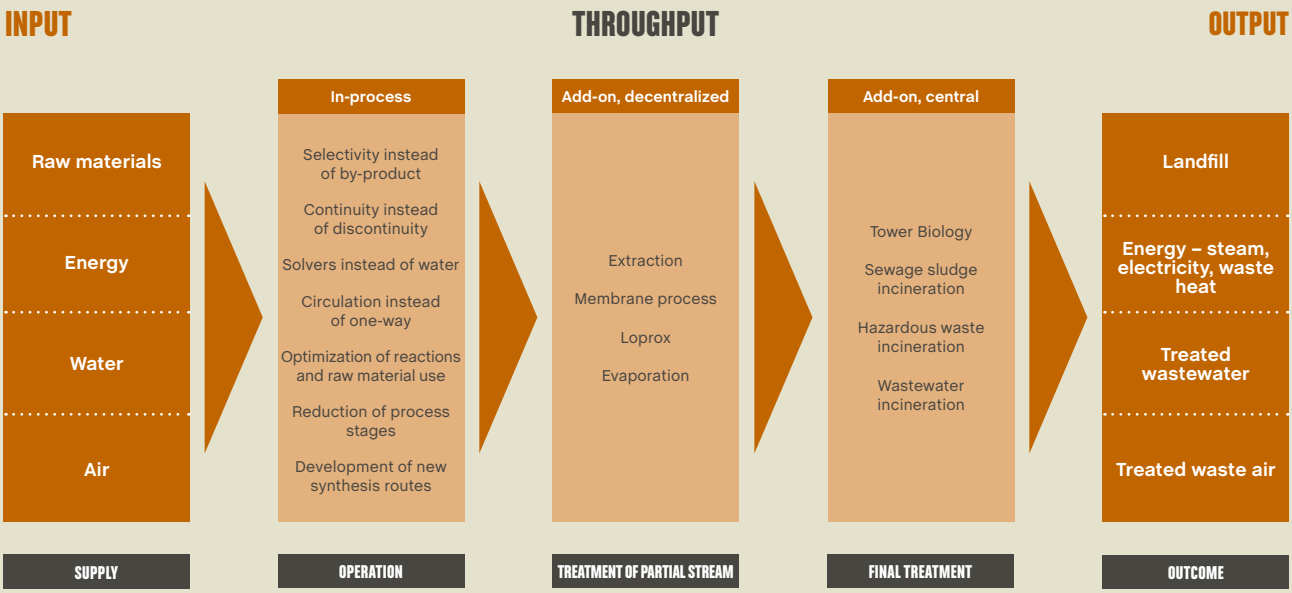


Fig. 3: Decentralized processes for the initial treatment of solid waste, wastewater and waste air

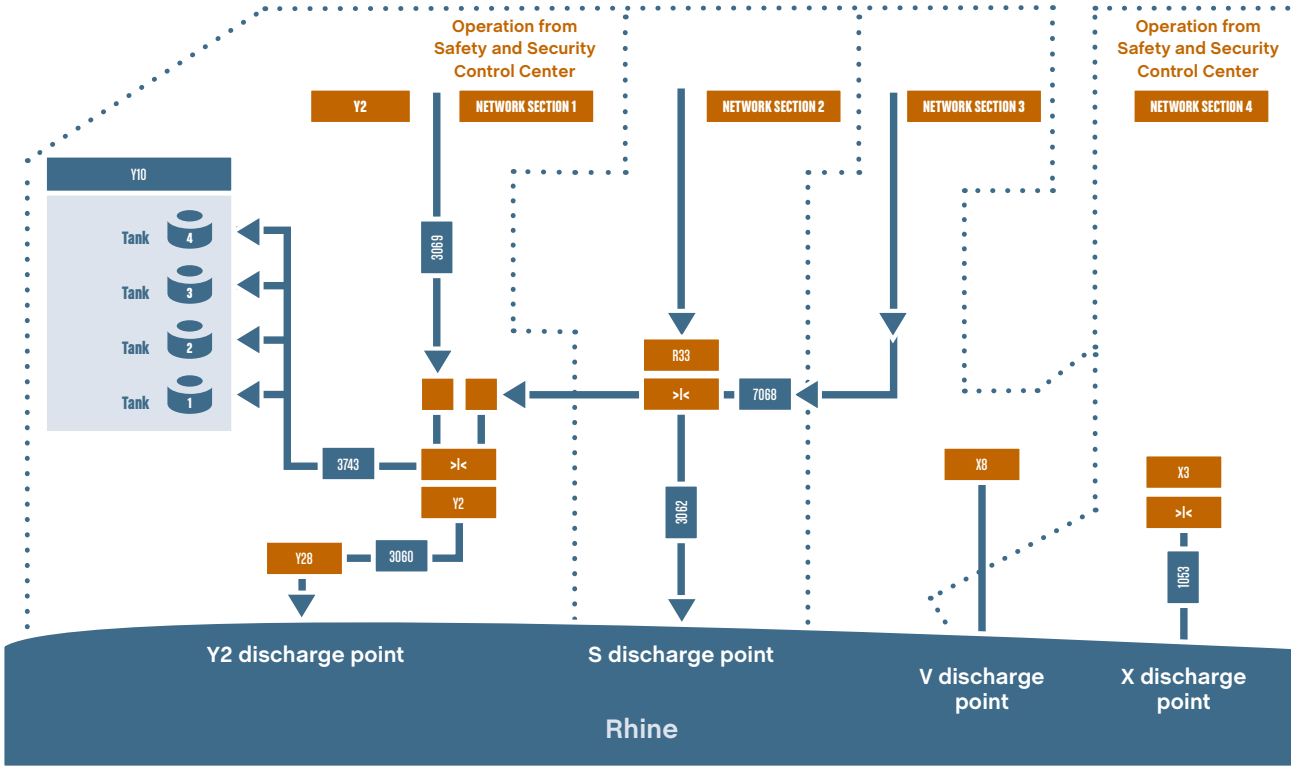
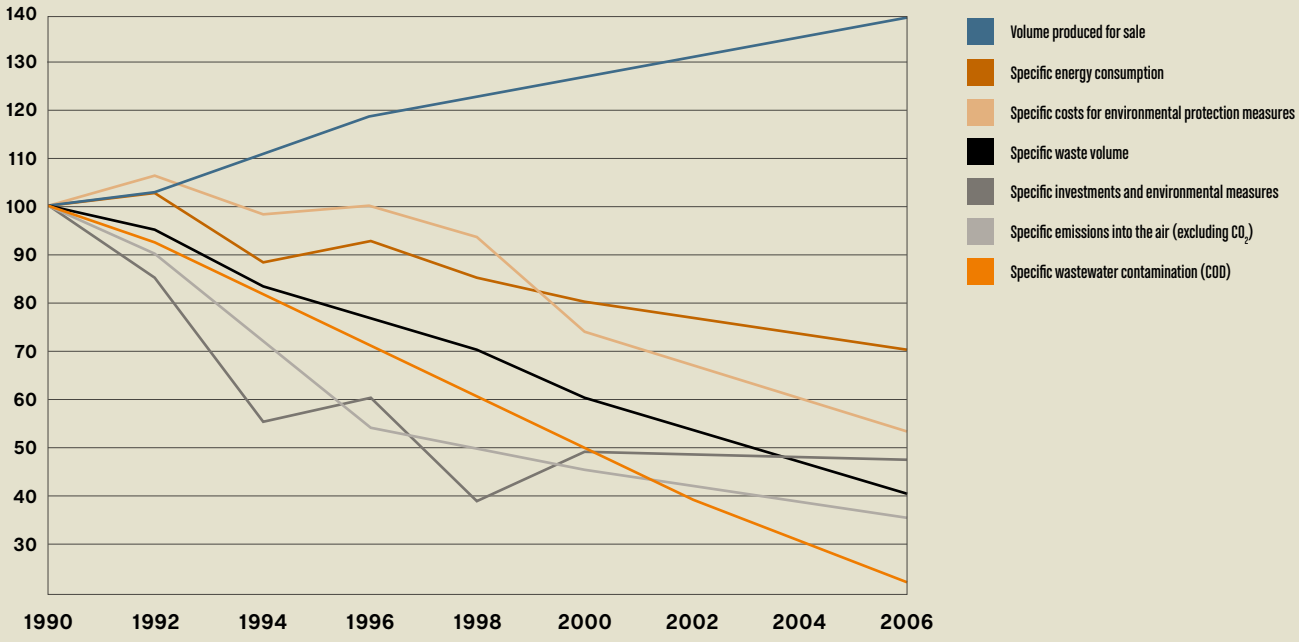


Fig. 2: Sewer systems for cooling water and organically uncontaminated water



Emission levels as at 2008

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