

## Wastewater Treatment Technology

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**Abstract:** At present, general principles of creating closed water management systems at industrial enterprises have been developed; the main ones include

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A huge amount of waste water is generated at machine-building plants. For rational water use, the most promising, environmentally and economically effective methods are used: closed and repeated use. They are described in more detail below.

The necessity and expediency of creating closed systems of technical water supply for individual industries, enterprises and industrial units, depending on local conditions, can be determined by three main factors: water shortage; exhaustion of the assimilating ability of water bodies intended for receiving wastewater; economic advantages compared to direct-flow water supply systems and wastewater treatment before their discharge into water bodies to the conditions stipulated by the requirements of the Rules of Water Protection and State Water Supervision .

The use of closed water supply systems in the design of enterprises makes it possible to place these objects in areas that have limited water resources, but have favorable economic and geographical conditions for the development of productive forces. Such an engineering and environmental direction of water management development is the most progressive and promising, it allows solving the problem of water supply with simultaneous satisfaction of the requirements, concerning environmental protection.

At present, general principles of creating closed water management systems at industrial enterprises have been developed; the main ones include the following:

- the creation of closed water supply systems should be combined with the organization of waste-free production, the technology of which is focused on the maximum extraction of basic products from raw materials;
- the design of closed systems should begin with a detailed study of measures aimed at removing waste from technological processes mainly in anhydrous solid form, and if this is not possible, then in the form of highly concentrated solutions for their subsequent disposal;
- the schematic diagram of water management in waste-free production should include at least one of the three main cycles of repeated use of water: thermal for cooling; extractive for washing, dissolution, leaching, etc.; transport for hydraulic transportation of substances, materials and waste disposal;
- wastewater flows should be divided according to species, phase, concentration, enthalpy characteristics in order to develop an appropriate method for local purification of each stream up to the flows of individual stages of the process;
- for the most water-intensive operations or technological processes, it is necessary to establish scientifically justified requirements for the quality of water consumed in production and standards for the quality of wastewater discharged; the most polluted and heated waters are subject to priority diversion for local treatment or treatment;

- in closed systems, it is necessary to combine water treatment workshops with local cleaning workshops of an enterprise or group of enterprises, as well as use storm water runoff from an industrial site in a recycled water supply system.

When designing systems, it is mandatory to take into account possible negative consequences (for example, the possibility of biological fouling of pipelines and walls of cooled units, atmospheric pollution), and provide appropriate engineering measures to prevent such phenomena.

The analysis of existing solutions and design materials shows that the creation of economically rational closed water management systems at enterprises is a rather difficult, but quite solvable task. The complex physical and chemical composition of wastewater, the variety of compounds contained in them and the interaction of one with another make it impossible to select a universal structure of closed circuits. The creation of such systems at enterprises depends on the features of the technology, technical equipment, requirements for the quality of the products obtained and the water used, etc.

The decision to use water in industrial enterprises in a closed cycle is closely related to the development of the technology of the main production. It is necessary to create a unified system of water management of the enterprise, including water supply, sanitation, wastewater treatment and their preparation for technological water supply, as well as excluding the discharge of wastewater into water bodies.

Fresh water from water sources should be used only for feeding closed systems (if there is a lack of treated wastewater to compensate for water losses in these systems), for drinking and household purposes, as well as for technological operations in which treated wastewater cannot be used in accordance with hygiene conditions and special requirements of production technology.

Modern technology and purification techniques ensure the production of water of essentially any

given degree of purity from any waste water, i.e. the creation of closed systems can only be hindered by economic reasons.

To achieve the best technical and economic indicators when creating closed water supply systems at enterprises, the following issues should also be worked out: the maximum introduction of air cooling instead of water; multiple (cascade) use of water in technological processes, including in order to obtain the smallest volume of polluting wastewater, for the neutralization of which effective local treatment methods can be selected; regeneration of waste acids, alkaline and saline technological solutions using extracted products as secondary raw materials.

The creation of closed water circulation systems determines the need to develop scientifically based requirements for the quality of water used in all technological processes and operations. As practice shows, in most technological processes there is no need to use drinking water, so it is advisable to determine the maximum permissible limits of the main water quality indicators in each specific case, which have a decisive impact on the quality of the resulting product or the trouble-free operation of technological equipment.

Local wastewater treatment for their reuse in production is in many cases cheaper than their complete treatment in accordance with existing requirements, and the creation of closed systems that provide for the complete separation of all components from wastewater is an important component of waste-free production.

The scientific and technical task of creating economically justified closed systems can be formulated as follows: the costs of water regeneration from wastewater and the costs of bringing the waste water formed during wastewater treatment to a commercial product or secondary raw materials should be lower than the total costs of water treatment and wastewater treatment to indicators that allow the latter to be discharged into water bodies.

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