

## ADVANTAGES OF CLOSED WATER SUPPLY SYSTEMS OF INDUSTRIAL ENTERPRISES

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***Abstract.** Closed water supply systems today are the only rational solution to the problem of water use in industry. The use of closed water circulation systems in the design of enterprises makes it possible to locate these facilities in areas with limited water resources, but with favorable economic and geographical conditions. This engineering and environmental direction is the most progressive and promising, allowing you to simultaneously solve the problems of water supply and environmental protection.*

***Keywords:** Closed systems, water supply, sewerage, waste water.*

The organization of a closed system is expedient when the costs of water purification and recovery of substances are lower than the total costs of water treatment and wastewater treatment up to standard indicators that allow it to be discharged into water bodies, i.e. without contamination of the latter. Closed water management systems should be introduced at newly built, operating and undergoing reconstruction enterprises. In the latter case, the introduction of closed systems goes step by step, with a gradual increase in circulating water supply as the technology improves. In general, low-waste production with circulating water supply can be represented in the form of a diagram shown in the figure. The creation of closed water management systems of industrial enterprises is possible with a radical change in the existing principles in water supply, sewerage and wastewater treatment. The basic principles of creating such systems include the following.

Water supply and sewerage should be considered together when a single water management system is created at the enterprise, including water supply, wastewater disposal and wastewater treatment, as preparation for their reuse. At the same time, it is necessary to establish scientifically sound requirements for the quality of water consumed in production and discharged.

The creation of closed water supply systems should be combined with the organization of low-waste production, the technology of which is focused on the maximum extraction of basic products from raw materials with simultaneous

regeneration of valuable components and bringing the resulting waste to a marketable product or secondary raw materials with minimal material and energy costs.

Wastewater streams should be distinguished by species, phase, concentration, enthalpy characteristics in order to develop appropriate methods of local purification of each stream, up to the flows of individual stages of the technological process.

In closed systems, it is necessary to combine the workshops of water treatment and local cleaning of the enterprise, as well as use stormwater runoff from the industrial site in the circulating water supply system. The main ones for water supply should be treated industrial and urban wastewater, as well as surface runoff. Fresh water in production should be used only for special purposes and to replenish water in systems.

Local flows of spent technological solutions and wastewater should be regenerated, while local closed water supply systems should be created, which are the main link of closed water management systems of industrial enterprises.

In order to achieve the best technical and economic indicators when creating closed water supply systems at enterprises, the following issues should be worked out:

- 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 contaminated wastewater, for the neutralization of which effective local treatment methods can be selected;
- regeneration of waste acids, alkalis and saline technological solutions using extracted products as secondary raw materials;
- heat recovery and utilization of process fluids and solutions by heat exchange between their hot and cold streams or by obtaining energy or process steam;
- introduction of stabilization water treatment, which allows to prevent the formation of mineral deposits and biofouling, inhibition of corrosion processes, to ensure optimal economical operation by reducing the amount of make-up and purge water.

It is desirable to develop closed water management systems of industrial enterprises step by step, with a gradual increase in the share of water used in circulation. The initial stage in the creation of such systems is the definition of scientifically sound requirements for the quality of water used in all technological processes. In most cases, there is no need to use more expensive drinking water. To ensure sanitary and hygienic and toxicological safety at enterprises, it is advisable to conduct comprehensive studies to develop optimal schemes for the treatment of recycled water.

Analysis of existing solutions and design materials shows that the creation of economically rational closed water management systems at enterprises is quite difficult, but quite solvable task. The complex physico-chemical composition of

wastewater, the variety of compounds contained in them and their interaction make it impossible to select a universal structure of closed circuits. The creation of such systems at enterprises depends on the features of technology, technical equipment, requirements for the quality of products and water used, etc. When creating closed water management systems, the design of water supply and sewerage systems of industrial enterprises should be carried out simultaneously with the design of the main production.

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