Ecological dual circulation management of TISCO water system

Member company

TAIYUAN IRON & STEEL (GROUP) CO., LTD.

Category

Emissions reduction; Protection of scarce resources; Environmental management system (EMS) development / enhancement

The Challenge

To introduce urban sewage and Municipal Reclaimed Water as production water sources, reduce the normal water consumption, and build an ecological dual circulation management of water system, form an internal virtuous cycle water ecological management system, develop high-quality reclaimed water for external supply to urban wetland parks, and realize the utilization of social resource.

Why?

The need of integration with the city: Taiyuan is a key city for water pollutant reduction and a water-deficient city. With the development of the city, it is not only facing the pressure of domestic sewage collection and treatment, but also building a Fenhe River wetland park with a length of about 6 KM, which needs perennial ecological water replenishment. Adhering to the road of "integration with the city", TISCO has not only achieved harmony and win-win in the introduction and utilization of municipal sewage and reclaimed water, but also used the high-quality drainage after the bid lifting as reclaimed water for ecological water replenishment of urban wetland parks, creating a model of "integration with the city".

The need of resource recycling: with the accelerating process of industrialization and the rapid development of social economy, it brings a large number of industrial wastes such as waste liquid, which not only needs high treatment costs, but also causes environmental pollution that is difficult to control. The large cycle of resource socialization is the key way to solve the problem, it will promote the exchange and utilization of waste resources between enterprises and between enterprises and society, and improve the efficiency of resource utilization through chain symbiosis, mutual supply of raw materials and resource sharing.

Needed Action

1. Build an internal virtuous cycle of water ecological management system

Within the enterprise, guided by process water saving, cascade water use, water control by quality, system coupling, dynamic optimization, high efficiency and intensification, TISCO adheres to the two wheel drive of technological innovation

and management innovation, deeply taps the potential of water conservation and emission reduction, and continuously improves the utilization efficiency of water resources and the performance level of water environment. In recent years, the water recycling utilization rate of TISCO has remained stable at more than 98%, which has greatly alleviated the restriction of water resources.

2. Using unconventional water sources as production water

The domestic sewage treatment facilities of TISCO are used to collect and treat the domestic sewage of residents in the surrounding areas of the enterprise, which is used to replenish the production water of the enterprise; TISCO will use the reclaimed water treated in the urban sewage treatment plant to produce high-quality demineralized water by configuring membrane treatment facilities.

3. Connection of internal and external circulation

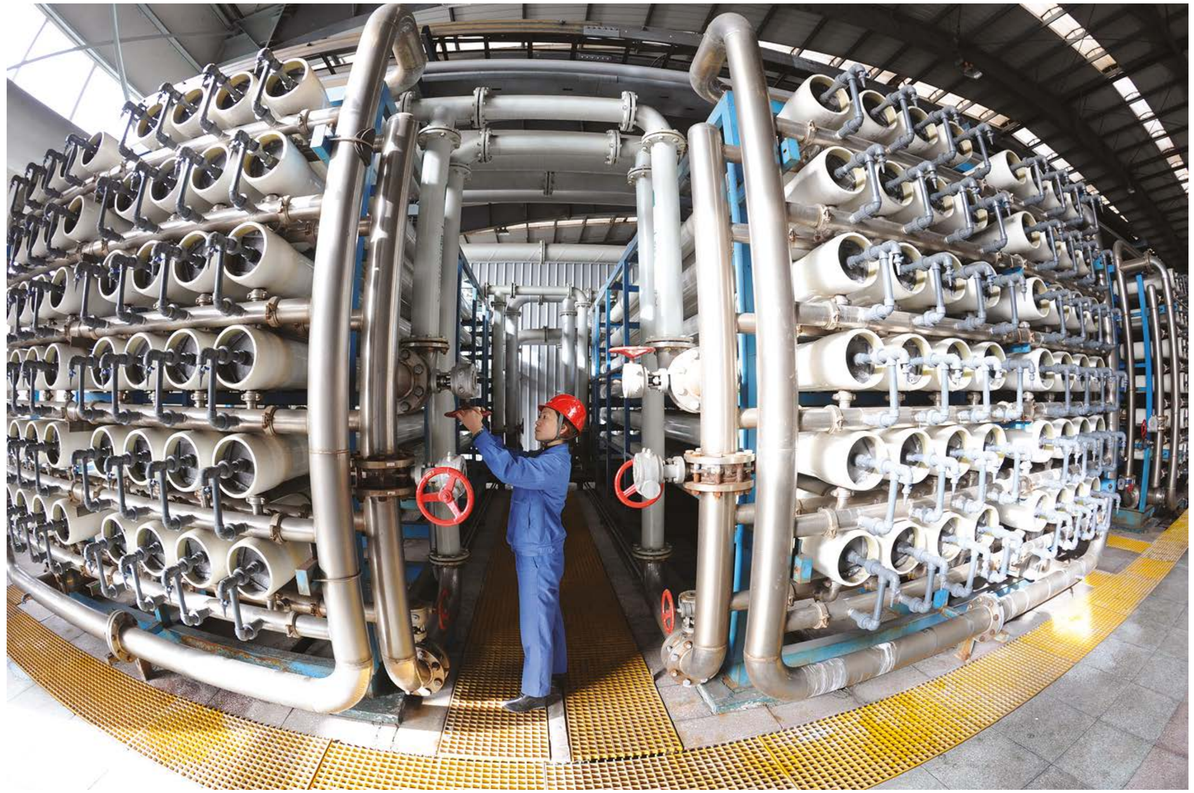
In terms of acid control, the acid control at the source of each process is forced by the control of wastewater discharge from the steel rolling process. Each process realizes the discharge of waste acid according to the standard by issuing the concentration control standards of acid for different varieties and units, reduces the use of acid at the source and indirectly reduces the salt discharge.

TISCO has mainly done three tasks in terms of series connection and recycling of waste acid water. First, the series connection utilization of sulfuric acid pickling has been carried out; Second, the reduction of saline wastewater is promoted; Third, the recycling of waste hydrochloric acid in cold rolling process is focused on.

In terms of emission reduction, TISCO has mainly carried out the consumption

and treatment of low-quality water and optimized the allocation of wastewater resources.

In terms of water saving, it mainly implements high-quality drainage and nearby utilization projects.



4. Social recycling of external water system

Outside the enterprise, according to the concept of circular economy, municipal sewage, which is “urban waste”, is regarded as a valuable water resource for enterprises; The “enterprise waste” of drainage will meet the relevant standards after recycling and treatment, and will be used as a valuable urban water resource.

After waste exchange, it can be transformed into their own available resources, which improves the overall utilization efficiency of water resources and realizes the harmonious integration of enterprises and cities.

Action Review

Specific;

Since the implementation of the ecological dual circulation management system of water system, a series of fruitful work has been carried out and good results have been achieved. The main work includes:

1. Build an internal virtuous cycle of water ecological management system

Through the investigation and analysis of water quantity and quality of various water sources and drainage of coking, sintering, ironmaking, steelmaking, steel rolling and water system of the whole company, combined with water balance analysis, the disadvantages and bottlenecks of water system process are determined and optimized.

In accordance with the principles of system planning, key management and control, classified disposal and economic efficiency, TISCO has formulated a water system process optimization scheme, focusing on the “salt extraction” of the water system, separating the high salt water and severe pollution sources originally hidden in the large circulation system from the circulation system, and directly discharging them into the end treatment system reconstructed and constructed by the external drainage upgrading standard of TISCO in 2019 through “short connection”, Make full use of the treatment process and capacity of the system to realize high-quality and up to standard discharge of external drainage; At the same time, the original circulating system has been further

improved, the salt content has been reduced, the concentration multiple has been increased, the water replenishment has been reduced, and the operation cost has been reduced. In addition, due to the reduction of treatment difficulty, the effluent quality index has been greatly improved, and the internal circulation of the water system has been operated healthily.

As high salt water and bad pollution sources are recognized as water treatment problems in the industry, in order to ensure the standard discharge of external drainage, TISCO has implemented the connection of internal and external circulation with "salt control, emission reduction and water saving" as the main content around the source treatment of sewage.

2. Connection of internal and external circulation

2.1 Salt control

Through the laboratory analysis, the acid discharge and acid treatment of the rolling system is the main factor affecting the change of salt content in water, and there are two aspects of salt control have been done as below.

2.1.1 Acid control

The improvement space and implement the measures are found out by the quantitative comparison of acid consumption index of pickling.

However, TISCO's mixed line and hot line have taken the lead in changing to HCl + mixed acid (HNO3 + HF) in the industry. The pickling process is unique. The use of HCl has greatly increased the salt content in the water treated by the neutralization station (acid ion SO42- can be combined and precipitated, while Cl- cannot be neutralized and removed by lime). Measures need to be taken urgently. Through the benchmarking analysis, it is considered that the pickling consumption of some treatment lines is relatively high, and the high acid consumption means the increase of salt content in the water system, so it is very necessary to control the acid consumption; After the hot line is changed to HCl + mixed acid (HNO3 + HF), Cl- in the neutralization station increases, resulting in an increase in the salt content of the effluent from the neutralization station, which must be treated separately.

2.1.2 Series connection and recycling of waste acid water

TISCO has mainly done three works in terms of series connection and recycling of waste acid water. First, the series connection utilization of sulfuric acid pickling has been carried out; Second, the reduction of saline wastewater is promoted; Third, the recycling of waste hydrochloric acid in cold rolling process is focused on.

2.2 Emission reduction

In terms of emission reduction, the following work has been done:

2.2.1 Treatment of inferior water

The transformation of alkali injection of blast furnace gas in the No.3 and No.6 blast furnaces and the project of using the wastewater from the South plant area in the processing plant for slag stewing, dust suppression and water pumping are organized and completed, and the absorption and treatment of some discharged inferior water is realized.

2.2.2 Optimization of the allocation of wastewater resources

Combined with the new project, the rational allocation of water resources of the whole company shall be considered as a whole. While meeting the water demand of the new project, the post-treatment drainage of TISCO Jianshan mine and the drainage of 1549mm rolling line turbid circulating water shall be deeply

treated and reused. At the same time, the 1549mm rolling line sodium ion exchanger shall be replaced and eliminated to prepare soft water process, and the part of membrane concentrated brine shall be used for watering and dust suppression in the raw material yard to realize the reuse and emission reduction of wastewater.

2.3 Implements of high-quality drainage projects nearby

A number of long-standing key and difficult projects are organized and implemented, such as constant drainage recovery of 300MW unit boiler, constant drainage and continuous drainage recovery of CDQ boiler, steam condensate and sewage recovery of converter in north area of No. 2 steelmaking mill, AOD waste heat boiler, heating condensate recovery in cold rolling wide area, realized the nearby utilization of high-quality drainage, made significant progress in emission reduction of the company's water system, and realized water saving of 855m3 / h. Through water-saving management, the new water volume per ton of steel in TISCO is 2.4% lower than that before implementation.

3. Building a water ecological management system with external virtuous circle

TISCO is equipped with a 50000 TONS / DAY domestic sewage treatment system, which is mainly used to treat the urban domestic sewage in the area in and around TISCO.

MSBR treatment process is adopted for domestic sewage treatment. The sewage is separated from large impurities by coarse grid and then flows to the water collecting well by itself. Then, it is lifted by the submersible sewage pump to the grit chamber through the fine grid to remove the inorganic sand particles in the sewage, and then flows to the oil separation sedimentation tank to remove the heavy particle suspended substances and some oil. The effluent from the oil separation sedimentation tank flows automatically to the MSBR reaction tank for biochemical reaction. MSBR is an improved continuous flow sequencing batch reaction process, which degrades organic pollutants through the growth and reproduction of various dominant bacteria and microorganisms in domestic sewage, and achieves the purpose of nitrogen and phosphorus removal through biochemical processes such as nitrification and denitrification of ammonia nitrogen in sewage, release and absorption of phosphorus. The MSBR effluent is filtered through the fast filter to further remove the residual suspended solids and COD in the water. The filtered water flows into the clean water tank by itself. The water pumped from the clean water tank is disinfected by the ultraviolet sterilizer, and all the disinfected effluent is reused. The effluent is filtered through the fast filter to further remove the residual suspended solids and COD in the water. The effluent goes through the reverse osmosis membrane (secondary membrane) for advanced treatment and reuse. It can reduce more than 5000 tons of CODs and reuse more than 1800 tons of municipal sewage for the city every year.

TISCO has built an ultrafiltration system + reverse osmosis system for the production of high-quality demineralized water from reclaimed water. The function of ultrafiltration system is to remove suspended solids in water, including colloids, bacteria and other impurities, and provide qualified influent for reverse osmosis: ensure that the turbidity of reverse osmosis influent is less than 0.2ntu and SDI is less than 3; Ensure the safe operation of reverse osmosis system. The ultrafiltration system includes: ultrafiltration water distribution channel filter screen, ultrafiltration unit, ultrafiltration water production suction pump, ultrafiltration cleaning unit, ultrafiltration backwashing unit, ultrafiltration drug preparation and

dosing unit, ultrafiltration product pool and process compressed air storage tank. Reverse osmosis system: the water treated by the ultrafiltration system enters the reverse osmosis system. The primary reverse osmosis device is selected for the reverse osmosis system, and the membrane products are selected with wide inlet channel, strong anti-pollution ability, high desalination rate and stable membrane performance.

After the combined process of "anaerobic anoxic aerobic denitrification nitrification biological activated carbon filter high-density sedimentation tank V-shaped filter contact disinfection" for the end water treatment of the external drainage of TISCO, the drainage water quality is further improved, which fully meets the requirements of the special discharge limit of water pollution of iron and steel enterprises and the standard of urban landscape water, and meets the requirements of environmental protection discharge, It has created conditions for realizing the great cycle of social resources.

In 2020, the construction of Fenhe River Wetland project will be completed, the whole line will be connected, and the water supply will be successful. While helping Fenhe River to have abundant water, good water quality and beautiful scenery, it also provides a set of brand-new solutions for zero discharge of wastewater from iron and steel enterprises, so as to solve the problem of water discharge from enterprises at the lowest cost and solve the water problem of Taiyuan, a water-deficient city, It is an initiative of the ecological dual circulation management system of TISCO.

Measurable; Over the past two years, the salt content in the external drainage of TISCO has been reduced by more than 35%, the external drainage per ton of steel has been reduced by 7%, and the new water per ton of steel has been reduced by 2.4%; TISCO's reclaimed water reuse Urban Wetland Park project has been completed in 2020, with successful water delivery, realizing the social resource utilization of TISCO's wastewater regeneration.

Achievable; TISCO implemented the water system improvement project with "salt control, emission reduction and water saving" as the main work content by optimizing the disposal process of the water system, so as to realize the benign operation of the internal circulation of the water system; By improving the drainage quality and promoting the "transfer from drainage to supply" of the external drainage of TISCO, the external drainage that has fully met the special discharge limit of water pollution of iron and steel enterprises and the urban landscape water standard will be returned to the wetland of Fenhe River for the replenishment of urban landscape water, so as to participate in the socialized large cycle system, so as to further strengthen the inclusive development with the city, Realize the win-win situation of internal circulation of steel plant and external circulation of social resources.

Realistic; According to the concept of green and low-carbon cycle development, TISCO carefully examines the shortcomings of the water system. After research, TISCO innovates the water system management and decides to build an ecological dual circulation management system of the enterprise water system, so as to form a virtuous cycle water ecosystem involving production, reuse, treatment, discharge and reuse, running through multiple upstream and downstream processes and spanning the enterprise and society.

Time-bound; The project has been implemented in 2020, which effectively utilizes urban domestic sewage and reclaimed water, and normalizes the treated high-quality water for the wetland of Fenhe River.

Horizontal Expansion Capability

Ecological dual circulation management of TISCO water system effectively reduces the consumption of new water, and treats the wastewater as high-quality water to feed back to the wetland. It provides a model for water conservation and emission reduction in water deficient areas, and the measures and application concepts adopted can be extended to other water deficient areas.

Outcome

By constructing the ecological dual circulation management system of enterprise water system, 12.12 million cubic meters of urban reclaimed water will be used and 16.04 million cubic meters of urban sewage will be treated in 2021. Over the past two years, the salt content in the external drainage of TISCO has been reduced by more than 35%, the external drainage per ton of steel has been reduced by 7%, the new water per ton of steel has been reduced by 2.4%, and the operation cost has been reduced by 11.25 million RMB/year; TISCO's reclaimed water reuse Urban Wetland Park project was also put into operation in 2020, with successful water delivery, realizing the renewable resource utilization of TISCO's wastewater, and supplying 30000 tons of high-quality water to the wetland park every day.