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Problems and Suggestions in The Operation and Management of Township Sewage Treatment Projects

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Abstract: In the context of current environmental protection and sustainable development, township sewage treatment projects are important measures to improve rural environmental quality and protect water resources. The effectiveness of their operation and management is directly related to the success of the projects. This study delves into the various problems encountered during the operation and management of township sewage treatment projects and proposes practical solutions to these issues, aiming to provide useful references and insights for the efficient operation and management of such projects in China.

Keywords: Township; Sewage treatment; Operation management; Analysis and suggestions.

1. Introduction

Township sewage treatment is one of the key tasks of ecological environment protection and pollution control in China. In response to the national policy requirements, local governments at all levels have taken active action and invested a lot of money in the construction of township sewage treatment facilities. A large number of technical processes and equipment have been developed and applied to the field of township sewage treatment, and a large number of township sewage treatment projects have also emerged. However, due to the differences in the construction mode between municipal sewage treatment and township sewage treatment, the problems of low return on investment of township sewage treatment projects and high idle rate of sewage treatment facilities are also particularly prominent.

In view of the above different situations, some domestic scholars have carried out a variety of research work, analyzed the investment decision-making problems of township sewage treatment projects through data simulation, studied the technical breakthroughs in standardization, automation and intelligence, studied the problems such as the excessive design of township domestic sewage treatment, proposed the research on the intelligent management mode of township sewage projects, and studied the sewage treatment systems of typical villages and towns. The above research analyzed the problems encountered in rural sewage treatment projects from the perspectives of project investment, design optimization, management mode, and technical system, and put forward reasonable suggestions, but it was lack of tracking and analyzing the problems existing in the project from the perspective of operation management. The author put forward relevant suggestions by analyzing the problems existing in project operation management, In order to provide reference for the operation and management of township sewage treatment projects in China [1-4].

2. Problems Existing in The Operation and Management of Township Projects

2.1. Increasing difficulty in operation management

The difficulty of operation management is increasing, which not only shows that the operation management unit is difficult to participate in the project decision-making, the design and construction are congenitally deficient, and it is more passive to undertake the project, but also the operation management conditions are complex, and the risk of exceeding the standard is high.

In most cases, the positioning, economic indicators, development prospects and other objectives of township sewage treatment projects have been determined at the project approval stage. It is generally difficult for the operation and management units to intervene in advance, nor to participate in the preparation of the project feasibility study report or implementation plan. There are some quality problems in the construction of township sewage pipe network. For example, the construction unit arbitrarily changed the slope of the pipeline, resulting in siltation in the future operation of the pipeline; The quality of pipe joints is poor, and there are risks such as disconnection and displacement; The water leakage of the pipeline is serious, resulting in no water collection; The backfilling of trenches and inspection wells did not meet the specification requirements, resulting in obvious settlement of inspection wells. During the operation and management of the project, even if the problem of insufficient water quantity and quality is found, it is difficult to improve the influent concentration and water quantity in a short term, which brings great difficulties to the safe operation and maintenance management.

At present, many Township and rural sewage treatment facilities that have been built and operated have problems. The survey of the sewage treatment project in a township of G basin found that in the 35 sewage treatment plant samples, most of the operating load rate was about 83%, and the sewage treatment capacity of some township sewage treatment plants could not meet the design requirements of 40%. The influent quality is only based on COD, and the actual COD concentration of most influents is below 100mg/l,

which is also far lower than the design value of 300mg/l.

2.2. High operation and management costs

The treatment costs of township sewage treatment plants are mainly determined by wages and benefits, management fees, electricity fees and maintenance fees, which together account for more than 90% of the operating costs. Taking the sewage treatment project of township a in G basin as an example, the following problems exist in the samples of 21 sewage treatment plants surveyed:

(1) Most township sewage treatment plants have insufficient water supply from the pipe network, resulting in high power consumption per unit output.

(2) The influent COD concentration is low, the TN concentration is high, the C/N ratio is seriously unbalanced, the TN removal rate is very low, and the effluent TN is difficult to meet the standard. In extreme cases, additional carbon sources need to be added to ensure that the effluent meets the standard, and the reagent cost increases.

(3) The DO concentration of the return liquid and sludge in the aeration area of the biochemical tank of the township sewage treatment plant using A2/O process is high, which seriously affects the anaerobic and anoxic environment, resulting in poor biological phosphorus and nitrogen removal.

(4) The influent organic matter load is low, and it is easy to aerate excessively, resulting in fine activated sludge flocs and poor settleability. The effluent SS concentration of the secondary sedimentation tank is high, and the filter load is large.

(5) The effect of biological phosphorus removal is poor, and phosphorus removal basically depends on chemical phosphorus removal. However, due to the long dosing pipeline, small pipe diameter and easy blockage, it is difficult to control the dosage of chemicals stably, which makes it difficult for the effluent TP to reach the standard stably.

(6) The influent organic matter load is low, the activated sludge culture is slow, and the degree of inorganic is high.

(7) The degree of automation of process control is low, and it relies heavily on manual operation. For example, the lifting pump is not equipped with a frequency converter, and the lifting water volume depends on manually adjusting the valve opening of the branch pipe in the sand setting area; The blower frequency converter can not remotely control the start and stop and frequency modulation for the time being, and it depends on manual frequency modulation, so it is difficult to stably control the do; The filter inlet pump is not equipped with a frequency converter and is controlled by the float switch of the intermediate tank, so the operation reliability is low and the filter system is difficult to operate continuously and stably.

(8) The failure rate of equipment and facilities such as truss type mud scraper and suction machine, filter system and submersible mixer is high, which makes the production operation difficult to be continuous and stable, and affects the stability and standard of effluent quality.

(9) Based on the treatment process, automatic control level and reliability of equipment and facilities of the existing township sewage treatment plants, the production and operation has high requirements on the number and technical quality of personnel for on-site inspection and process control, and the existing staffing is difficult to meet the needs of production and operation.

All the above conditions lead to the low stability of the effluent quality. If there is a little negligence, the effluent is prone to exceed the standard. In order to ensure that the effluent is stable and up to standard, the operation management unit has to increase the operation management cost.

2.3. The operation cost of sewage treatment is complicated

There are great differences in the payment mechanism of township sewage treatment projects [5]. Taking a township sewage treatment plant in a county in the G basin as an example, the project involves 13 sewage treatment plants in 12 townships, and the fees are charged quarterly. The payment process of the operation and management fee is that the county drainage and management office will jointly assess the township sewage treatment plants after the end of the quarter, determine the proportion of the towns in the operation and management fee according to the ranking of the assessment results, and start the payment mechanism process. Then the operation and management party will complete the bill submission and review through the process link. After the financial funds are in place, the local government agencies will complete the payment process according to the process. The payment procedures are relatively cumbersome.

2.4. Analysis of existing problems

The overall management of the whole life cycle of the early planning, design, construction and operation management of township projects is very important to promote the rationalization and standardization of the implementation mode of township projects. Only by integrating design, construction and operation management, including pipe network and sewage treatment plant, paying attention to the synergy between each other, and creating a full life cycle project, can we effectively avoid the "congenital" defects and lay a good foundation for operation management services.

3. Suggestions on Operation and Management of Township Sewage Treatment Projects

3.1. Project planning, design and management

The operation management unit shall fully communicate with the project implementation Department of the local government, intervene in the project planning and project establishment stage as far as possible, and guide or even lead the preparation of the feasibility study report or project implementation plan. When the feasibility study of some projects has been finalized, it is necessary to conduct a technical assessment of the overall project to reduce the risk of operation and management.

In view of the long-term insufficient water collection and low concentration during the operation and management of township sewage treatment projects, the operation and management unit shall conduct regular inspection and desilting of the sewage collection system to improve the sewage collection rate. Fully investigate and analyze the sewage pipe network in the catchment area, find out the living habits, drainage habits, industrial characteristics, drainage system, etc. of residents within the scope of water collection in villages and towns where the project is implemented, and determine the water quantity and quality by continuously summarizing the continuous operation and management data of the project.

In addition, we should flexibly adjust the sewage treatment

process, reasonably allocate equipment, and improve the efficiency of sewage treatment. For example, a regulating tank or a treatment process with strong impact load resistance are used to cope with the change of water volume; It is linked with the operation management of the pumping station of the pipe network and adopts the intermittent operation control mode according to the characteristics of the water inflow; Unify the online position of the influent, and place the online position of the influent in the front of the regulating tank, which can truly reflect the actual influent concentration, ensure that the mixing equipment of the regulating tank is turned on, and avoid the settlement of suspended solids; Low liquid level operation is adopted in the inlet pump house to improve the carbon source of the inlet water of the sewage treatment plant. Clarify the sampling and detection methods of process management, formulate regulatory rules, and ensure the reliability of project implementation and project operation data.

3.2. Operation management and maintenance

The operation and management of township sewage treatment should be adapted to local conditions, especially in the face of the characteristics of sewage treatment projects with many points and a wide range, and adopt intensive operation and management measures to improve the level of comprehensive management and maintenance.

Establish the transportation management center and regional management mode, carry out standardized management of all sewage treatment plants in their respective regions of the project, and realize intensive management by sharing resources such as central control, water quality testing, sludge disposal, material storage, overhaul and maintenance, so as to reduce operation management costs and improve operation management efficiency.

Unified scheduling of production and operation, implementation of intensive human resource management of "strengthening personnel management and optimizing talent team" and intensive production management of "large plants driving small plants" to improve the comprehensive technical ability (process, electrical, equipment), process operation and maintenance ability, fault diagnosis and problem handling ability of technical personnel.

Establish a remote monitoring system to monitor the operating conditions and instrument data of each plant in real time, and understand the on-site process and equipment conditions. Establish a mobile terminal full range monitoring and reporting system, which can query the process instrument data of the sewage treatment plant in real time and realize alarm. The production operation management system can automatically store, analyze and generate reports on the production data, and provide the basis for the production management personnel's operation scheduling. The operation management process can realize informatization and intelligence. The specific methods are as follows:

(1) Real time perception of the operation status of the drainage system (pipe network, pump station, sewage treatment plant) through various sensors, water quality and water level instruments and other online monitoring equipment.

(2) The advanced pipeline network detection equipment is used to comprehensively detect, diagnose and output the detection results for a variety of pipeline conditions.

(3) Take the sewage treatment information platform as the carrier, track the whole process of equipment maintenance, and realize the standardized management of equipment maintenance.

(4) Combined with the daily operation and maintenance data of the pipeline network of each market town, the classification management is carried out from the risk level, failure frequency, seasonal change, region, geological conditions and other aspects of the pipeline.

3.3. Economic mode of operation management

According to the characteristics of large fluctuations in water quality and quantity of township projects, the operation management unit should set the minimum water quantity in the implementation plan or bidding documents. If the minimum water quantity cannot be set in the implementation of the project, the operation management cost should be set in two parts of fixed cost+variable cost or in the mode of cost (government payment)+profit (technical service) to reduce the charging risk caused by water quantity; For PPP projects, the payment mode of availability fixed income+operation and maintenance should be adopted.

4. Conclusion and Suggestions

The problems in the field of township sewage treatment are caused by a variety of reasons. The operation management unit should fully grasp and analyze all basic data related to the operation management project, such as design and construction, and fully visit and investigate the operation management project site. According to the overall situation of the project, especially the requirements for operation management, basic requirements for process compliance, and the geographical distribution characteristics of the operation management project, a scientific, reasonable, and economic operation management plan is formulated to continuously improve the operation management and maintenance level and give full play to the due role of the project.

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