

# Practice and Research on Upgrading and Renovation of Sewage Treatment Plant in Guangxi Province

Chunyi Duan, Hong Chen

Guangxi Polytechnic of Construction, Nanning, 530000, China.

**Abstract.** The construction of sewage treatment plant upgrading and renovation projects often needs to be completed under the conditions of ensuring the normal operation of existing sewage treatment plants. The renovation construction process is complicated, and the management and coordination are difficult. Taking the upgrading and renovation project of A sewage treatment plant in N City, Guangxi as the background, the problems faced in the process of upgrading and renovation of sewage treatment plant were analyzed, and reasonable and feasible solutions and management measures were put forward. certain reference value.

**Keywords:** The sewage treatment plant; Upgrading and renovation

## 1. Introduction

The scale of upgrading and renovation of a sewage treatment plant in N City, Guangxi is 200,000 m<sup>3</sup>/d. The main contents include dismantling the existing odor treatment room and sludge dewatering workshop, dismantling and rebuilding the online monitoring room and reclaimed water reuse pool (room), etc. Medicine room, contact disinfection pool, battery room, etc. The upgrading and renovation project of A sewage treatment plant in N City, Guangxi mainly focuses on removing TN, SS and TP, adding advanced treatment technology (mainly chemical phosphorus removal dosing system). The upgrading and renovation project adopts "deep bed filter + contact Disinfection tank" process, tail water discharge implements GB18918-2002 "Pollutant Discharge Standards for Urban Sewage Treatment Plants" Class A Standard and GB3838-2002 "Surface Water Environmental Quality Standard" Class V standards are more stringent. After reaching the standard, it will be discharged to Huadi River. Organization of the Text

## 2. Problems faced by the renovation project

### 2.1 The dehydration machine room and other equipment to be demolished in the renovation area are running and cannot provide a site for the upgrading and renovation.

Due to the needs of sludge disposal in the sewage treatment plant, the three belt-type thickening and dewatering integrated machines in the sludge dewatering

workshop to be demolished in the upgrading and renovation area cannot be stopped. Structures such as backwashing pump house cannot be implemented. Without affecting the sludge disposal of the sewage treatment plant, the overall relocation of the original sludge dewatering workshop is a major problem to be solved urgently in the construction of the renovation project.

### 2.2 The middle water pump house and other equipment to be demolished in the renovation area are running and need to be temporarily transitioned to ensure automatic constant pressure water supply.

Reclaimed water is required for sludge drying system, plant greening spray and chemical phosphorus removal, and the deactivation of reclaimed water will have a great impact on the production of the plant. At present, the reclaimed water system adopts constant pressure automatic control, and the water supply pressure is controlled at about 0.4MPa. Under normal circumstances, 1 to 2 pumps are turned on to supply water. The pump parameters are: head 58m, flow 110m<sup>3</sup>/h. Once the existing medium water pump house is demolished, some workshops in the plant area will stop production, and the water supply such as greening and spraying of the whole plant will be interrupted.

### 2.3 The original effluent system needs to be dismantled in the transformation area, and it is difficult to temporarily transition the effluent and reach the standard operation.

The preliminary design is to dismantle the original water outlet system (remove the ultraviolet disinfection channel,

water outlet metering channel, and online testing room), and build a new contact disinfection pool. How to transition the 200,000 t/d effluent of the sewage treatment plant, how to achieve the standard of effluent quality, and how to disinfect and detect the effluent are the difficulties faced by the current renovation project.

#### **2.4 The sewage treatment plant is running at full capacity and cannot stop water and production.**

The transition between the old and new processes needs to be reasonably designed. Since this upgrade is at the end of sewage treatment, the transition and switching of the old and new processes will affect the operation of the sewage treatment plant. The connection between the old and new processes can only be realized under the condition of water shutdown in the whole plant. How can the sewage treatment plant realize the transition between the old and new processes? and rapid switchover to minimize the impact of the renovation on the operation of the existing sewage treatment plant and realize the rapid transition of the old and new processes. All parties in construction, design, construction and operation need to discuss and study and formulate a reasonable plan.

### **3. Transition solution for upgrading and transformation process**

#### **3.1 Overall relocation plan of dehydration equipment**

Guangxi N City A Sewage Treatment Plant's original sludge dewatering workshop 3 sets of belt-type thickening and dewatering integrated machines, dosing pump room, blower room deodorization room and middle water pump room and other auxiliary structures are located in the upgrading and renovation design of deep bed filter, anti-reflection In the structural area such as the flushing pump room, the original sludge dewatering workshop should be relocated as a whole without affecting the sludge disposal of the sewage treatment plant during the upgrading and renovation process. The specific solutions are as follows: Build a new equipment warehouse in the open space on the southeast side of the plant, contact the manufacturer of the integrated belt thickening and dewatering machine, organize the formulation of an overall relocation plan, coordinate with the operating unit to formulate a thorough relocation plan, and dewater the sludge in the dewatering workshop without affecting the sludge disposal of the plant. The equipment is dismantled one by one and moved to the new workshop in the factory, and put into use after re-installation.

Due to the limited construction space of the sludge dewatering workshop, it is necessary to disassemble the equipment separately. According to the equipment structure of the belt-type concentrating and dewatering integrated machine, the concentrator and the belt-type filter press are disassembled separately, and the equipment cannot be damaged, which puts forward higher requirements for the disassembly, transportation and installation of the equipment. Mark the disassembled parts

and store them in the designated warehouse in the factory. The three belt-type concentrating and dehydrating integrated machines need to be disassembled one by one. After dismantling one, the basic ground of the equipment should be filled to prepare for the dismantling and transportation of the next one. During the process of equipment dismantling, a full-time safety officer will be stationed to supervise to ensure that the construction work is carried out in a safe and orderly manner.

The overall relocation of the dewatering equipment in the sludge dewatering workshop follows the standard of "removing one, installing one, and commissioning one". After the installation and commissioning of one dewatering equipment is officially put into use, the dismantling and installation of the second equipment will be carried out. In this way, it can be ensured that there are always two sludge disposal equipment in the sewage treatment plant in normal operation, and the relocation is carried out one by one, so as to realize the overall relocation of the dewatering equipment.

#### **3.2 Operation solution of reclaimed water system**

Due to the unstable demand of reclaimed water in the plant area, it will be difficult to ensure the safety of water pressure, water volume and pipeline facilities of the reclaimed water system if the manual start-stop method is adopted during the upgrading and renovation. Before dismantling the original reclaimed water pump house, it is necessary to do the laying of the reclaimed water pipe network, improve the automatic control measures for the reclaimed water system, and minimize the connection and switching time of the old and new reclaimed water systems and the impact on the operation of the reclaimed water system.

In order to ensure the water quality and water supply efficiency of the reclaimed water system, it is planned to install 2 submersible pumps in the original ultraviolet disinfection crossing canal. The submersible pump has a flow rate of 140m<sup>3</sup>/h and a head of 58m. Pump lift and lower. The outlet pipe of the submersible pump is laid down along the outer wall of the crossing canal through the top of the crossing canal. After reaching the ground, it is laid openly along the tank body to the side of the secondary settling tank, and is connected with the main pipeline of the original reclaimed water supply, and an on-site control is set in the open space Room, install PLC control cabinet. A pressure transmitter is installed on the steel pipe to detect the pressure of the water in the pipeline. The transmitter outputs a pressure signal of 4-20MPa and enters the on-site PLC control cabinet to realize automatic control and constant pressure water supply of reclaimed water.

#### **3.3 Operation guarantee scheme of water outlet system**

Through process and design optimization, on the premise of not changing the overall process and effluent indicators, optimize the structure size and layout of the structures, retain the key structures of the original effluent system, and avoid the effluent failure due to renovation.

Operational impact is minimized. The renovation of the sewage treatment plant retains the existing ultraviolet disinfection channel, outlet channel and online testing room, and optimizes the structure size of the newly built contact disinfection tank (increases the depth of the structure and reduces the plane size of the structure), so that there will be no Affect the normal operation of the effluent system of the existing sewage treatment plant.

### **3.4 New and old process transition solutions**

Change the position of the lifting pump house, optimize the position of the preliminary designed lifting pump house to the south side of the outlet channel, and add a valve well (see Figure 3) at the position of the original preliminary design lifting pump house (on the original outlet pipe), and the transition between the old and the new process can be realized through the valve and switching, which not only ensures the normal operation of the sewage treatment plant, but also realizes the rapid transition between the old and new processes.

## **4. Key points of the management of the construction process of upgrading and renovation**

The upgrading and renovation project of the sewage treatment plant has a compact layout. At the same time, it is accompanied by a large number of existing pipelines and new pipelines. The pipelines are staggered and complex, and the pipelines in operation are connected, which will cause uncertain risks in the management of safety, quality, progress, and cost of the renovation project. The increase has caused great pressure on the realization of project management goals. Therefore, it is necessary to adopt a reasonable plan, careful planning, careful organization, effective coordination, real-time monitoring, timely communication, and strict management to achieve the established goals with quality and quantity.

### **4.1 Determine a reasonable plan through investigation and arrangement and plan comparison.**

The upgrading and renovation plan of the sewage treatment plant is directly related to key issues such as the amount of construction and operating costs, the quality of the treatment effect, the size of the floor space, and the convenience of management. Therefore, before upgrading and upgrading the sewage treatment plant, it is necessary to investigate and arrange in various aspects, and do a good job in the comparison and selection of the scheme. The most important thing in the upgrading and renovation of sewage treatment plants is to adapt measures to the times and combine the characteristics of the existing sewage treatment system to ensure the rationality and feasibility of the sewage treatment process. At present, the main problem of upgrading the first-level A standard is the compliance of TN, TP and SS. Since each sewage treatment plant is located in a different location and has

different influent water quality, it is the most important to choose a suitable upgrading and transformation plan. .

First of all, the main points of the original design of the existing sewage treatment plant should be fully understood, mainly including the original design water inlet and outlet indicators, and the main design parameters of each treatment process unit. Secondly, it is necessary to comprehensively understand the current operation status of the sewage treatment plant, mainly analyze the data from the inflow and outflow indicators, determine which indicators are not up to standard, and analyze the reasons for not up to the standard. Then combined with the original design and the actual operation of the current situation, the process route of the upgrading and transformation is determined. The upgrading and renovation project should give priority to the process with simple operation and management and low operating cost. Finally, according to the determined process route, the structure of the building (structure) is designed to be upgraded and reconstructed, and the supporting professional design is carried out, and the layout is optimized according to the actual situation on the site and the current situation of the sewage treatment plant.

Through investigation and analysis, the upgrading and renovation process of Guangxi N City A Sewage Treatment Plant adopts "deep bed filter + disinfection tank" to further remove SS in sewage, and the effluent meets the requirements of Class A standard. Combined with the current situation of the original plant area, the structure design and layout are optimized to minimize the impact of upgrading and renovation on the operation of the sewage treatment plant.

### **4.2 Attach importance to the management of the upgrading and transformation plan, and proceed in an orderly manner according to the steps.**

The original underground pipeline of the sewage treatment plant for upgrading and renovation is complex, and there are many working faces connected with the operating sewage treatment plant. Before construction, find out the pipelines and buildings (structures) that need to be relocated, demolished or protected, and refine the demolition and construction of the project. The sequence and planned time will be discussed by all units, departments and professionals involved in the project to form a construction plan. All participating units and departments coordinate and actively cooperate with each other, and organize the implementation according to the plan. During the implementation of the construction plan, the process monitoring shall be strengthened. If it is found that the work is delayed and affects the overall plan, measures shall be taken in a timely manner, and the construction plan shall be revised regularly.

### **4.3 Strengthen personnel and site management, and promote construction and production in a safe and orderly manner.**

The upgrading and renovation project is located in the operation plant area, and the construction site is small. In the design, only the location of the building (structure) is

often considered, and the renovation facilities are close to the existing facilities. The temporary construction site construction area and production area cannot be strictly separated. On-site management is difficult.

(1) In terms of personnel management: There are many working surfaces connecting the upgrading and renovation project with the operating plant. In addition to complying with the personnel management regulations of the construction unit, construction personnel must also strictly abide by the management requirements of the operating unit. Before entering the plant, they must report and apply for entry and exit permits, homework tickets, pre-class safety education and disclosure before work.

(2) Site management: a temporary fence will be set up on the site of the upgrading and renovation project to isolate the construction area from the operation area to avoid accidental injury and ensure construction safety and operation safety. The solution is to rent houses outside the construction office and living areas or build temporary houses off-site, and set up temporary offices and temporary warehouses on the construction site; small production and processing areas are set up in the construction area according to local conditions, and large parts such as formwork and steel bars are processed externally and delivered to on site.

During the construction process, it can be arranged according to the progress plan, and the construction site built first can be fully utilized for the construction site later.

#### **4.4 Improve the level of project coordination and management to ensure the realization of project goals.**

Under the condition of a narrow construction site, the upgrading and renovation project must not only maintain the progress target but also not affect the daily operation of the sewage treatment plant. If the responsibilities of the construction party and the operation management party are not clearly defined during the renovation construction, it will bring great difficulties to the construction and operation of the project. There are many project coordination contents, and monitoring is difficult. Therefore, before the implementation of the project, a project management team with rich management experience and strong management ability should be established, various management systems should be established and improved, the responsibilities of management personnel should be clearly defined, and the responsibility system should be implemented.

In project construction, strengthen on-site monitoring and coordination, establish a project coordination and communication mechanism, and participate in process monitoring and coordination management of construction, construction, operation, and design parties, and clarify the communication coordinators and responsibilities of construction, construction, design, and operation parties. Regular or irregular coordination meetings are held to solve problems in the process of project construction in a timely manner, and advance according to the established transformation plan to ensure the realization of project goals.

## **5. Summary**

Guangxi N City A Sewage Treatment Plant upgrading and renovation project has a narrow site, poor geological conditions, complex surrounding environment and high construction risk. In the later stage, through detailed investigation and arrangement, a reasonable plan was determined, a feasible renovation plan was formulated, and process control and coordinated management were strengthened, so that the project safety and quality were controlled, the effluent quality was up to standard, and the construction effect was good, which will raise the standard for similar sewage treatment plants in the future. Renovation project construction has accumulated experience.

## **Acknowledgements**

Fund Project: 2020 Guangxi University Young and Middle-aged Teachers' Basic Research Ability Improvement Project: Analysis of the Formation Mechanism of Black and Smelly Water in Rural Areas and Research on Control Measures (No.2020KY35023). The 2021 Guangxi Zhuang Autonomous Region course ideological and political demonstration course "Sewage Treatment Technology".

## **References**

1. Status Quo and Path of Upgrading and Renovation of Sewage Treatment Plants in Suzhou Area [J]. Xu Minxian, Ye Zhengxiang, Du Rongdong, Guo Han. Urban and Rural Construction. 2021(09)
2. Research on the upgrading and renovation process of urban sewage treatment plants under Zhejiang standards [J]. Zhou Aijun, Wang Xiaomin, Mei Rongwu. Environmental Pollution and Prevention. 2021(10)
3. Upgrading renovation and operation effect of an urban sewage treatment plant [J]. Guo Haipeng, Zhou Yiqin, Lin Hui, Cai Jiaqing, Ji Zexia, Ji Sidong. Guangzhou Chemical Industry. 2022(01)
4. Analysis of the upgrading and transformation process of urban sewage treatment plants and their effectiveness: Taking the second sewage treatment plant in Xianyou County, Putian City as an example [J]. Chen Dailin. Strait Science. 2020(12)
5. Research on the upgrading and renovation plan of domestic sewage treatment plants in Northwest China: Taking Yongdeng County Sewage Treatment Plant as an example [J]. Ma Zhenghui. Agriculture and Technology. 2021(09)
6. Upgrading and renovation project and operation of urban sewage treatment plant [J]. Yu Chuan, Cui Ming. New Industrialization. 2021(01)