# **GUIDELINES FOR**

# RISK MANAGEMENT AMID OPERATIONS OF RURAL DRAINAGE SYSTEMS DURING THE EPIDEMIC

# Trial





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# Guidelines for Risk Management Amid Operations of Rural Drainage Systems During the Epidemic

(Trial)

**Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences** 

**Rural Environmental Technology Industry Alliance** 

**Chongqing Academy of Science and Technology** 

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# Preface

The rural drainage system bears the important responsibility of collecting and treating rural domestic sewage, and is an important infrastructure for building beautiful villages and ensuring the safety of the rural water environment.

The detection of COVID-19 from patients' feces suggests that the virus may have potential transmission and exposure routes from the toilet to the septic tank, sewage pipe network, and sewage station (plant). In order to ensure the safe and stable operation of the rural drainage system, to reduce spreading risk of the COVID-19 through the drainage system, and protect the safety and health of production personnel and local residents, the Rural Environmental Science and Technology Industry Alliance along with the Eco-Environmental Research Center of the Chinese Academy of Sciences, Chongqing Science and Technology Research Institute Units and other alliance enterprises, fully combining the characteristics of the rural drainage system, on the basis of conscientiously summing up practical experience and extensively soliciting relevant opinions, prepared this guide (trial).

This guide (trial) mainly includes: general rules, foundational regulations, protective measures for on-site personnel, key protective measures for sewage collection systems, and key protective measures for sewage treatment stations (plants). The parts not mentioned in this guide (trial) are implemented in accordance with the relevant regulations of the country and region, as well as relevant technical standards and specifications.

The Rural Municipal Institute of Science and Technology is responsible for technical interpretation in this guide (trial). All units are recommended to make adjustments based on experience and feed back valuable opinions and suggestions during usage.

This guide (trial) is a guidance document for the prevention and control of

rural drainage system operation and management during the epidemic situation, and can also be used as a reference for future public health incident prevention and control similar to the epidemic situation and as a supplement to rural sewage treatment emergency protection. Each area will be implemented according to the local actual conditions with reference to the guideline. When the current prevention and control of the epidemic situation is lifted, the measures which are beneficial to the management of the rural drainage system and the normal operation of the sewage treatment station (plant), could continue to stay in place.

#### Chapter 1 General

#### 1.1 Purpose of the Guidelines

The transmission route of the COVID-19 is mainly through the respiratory tract droplets and contact transmission. It may also be transmitted through aerosols in a relatively closed environment when exposed to high concentrations of aerosols for a long time. In order to ensure the safe and stable operation of the rural drainage system, reduce spreading risk of the COVID-19 through the drainage system, to fully protect the health of production workers and surrounding residents, and to protect the safety of the water environment, this guide is produced according to the Law of the People 's Republic of China on the Prevention and Control of Infectious Diseases, the Emergency Regulations for Public Health Incidents and other relevant regulations.

#### 1.2 Scope of the Guidelines

The guidelines are applicable to the safe operation and management of rural drainage systems during the prevention and control of COVID-19 and similar epidemics. There are many types of rural domestic sewage treatment processes and large differences in facilities and equipment. The guidelines take typical process with complete functions as examples to explain. In actual operation, we can refer to these guidelines according to the site conditions.

#### 1.3 Basis of the Guidelines

1. "Law of the People's Republic of China on the Prevention and Control of Infectious Diseases" (Revised Edition in 2004)

2. "Regulations on Emergency Response to Public Health Emergencies" (State Council Order No. 376)

3."Technical Standards for Rural Domestic Sewage Treatment Engineering" (GB / T51347-2019) 4."Notice on Supervision of Medical Sewage and Urban Sewage in Pneumonia Epidemic Infected by COVID-19" (Office of Ministry of Ecology and Environment [ 2020] 52)

5."Several Suggestions for Strengthening Urban Sewage Treatment and Water Environmental Risk Prevention during the Novel Corona Pneumonia Outbreak" (Special report Vol 3, Office of Major Science and Technology Program for Water pollution control and treatment, Ministry of Housing and Urban-Rural Development)

6."Urban Sewage Treatment Plant Operation, Maintenance and Safety Technical Regulations" (CJJ60-2011)

7. etc.

#### Chapter II Foundational Regulations

2.1 Strengthen organizational management and organizational security. The operation and maintenance units of sewage collection, transmission pipeline network and ancillary facilities, sewage pumping stations, sewage treatment stations (plants), decentralized sewage collection and treatment in various regions shall establish an prevention epidemic and safety production working group according to the epidemic situation, which formulates emergency plans, organizes work safety, educates the public, guides and supervises prevention and control of internal epidemic. If it's technologically infeasible, it should be reported to the superior competent unit to coordinate the drainage department, environmental protection, sanitation technical unit or third-party professional technical unit for guidance and implementation.

**2.2 Strengthen information communication.** Sewage collection and treatment units should strengthen information communication with departments in charge of drainage, health, ecology and environment, and keep the outbreak information, such as the living and activities of the diagnosed, suspected and close contacts, and status of medical wastewater treatment at designated treatment points, isolation points, clinics, channel unclogged in the sewage collection area. According to the epidemic situation, take corresponding protective measures. When an incident of water environment safety occurs, it shall be reported to the relevant competent department in time.

**2.3 Implement prevention and control in different levels and regions.** The prevention and control measures should not be "one size fits all", and should be graded (risk level) and partitioned (drainage partition) according to local conditions.

2.4 Strengthen the operation management of the pipe network and sewage treatment station (plant) to ensure normal operation. Sewage

collection, transmission pipe network and other systems are unblocked, the normal operation of sewage treatment stations (plants), and the effluent water quality is stable and meet the standards are the basis for ensuring the health of personnel and the safety of the water environment. The operation management of the pipe network and sewage treatment station should be strengthened to ensure normal operation.

2.5 Strengthen material security. Transportation and management units of sewage collection, transmission pipeline network, sewage treatment station (plant) should ensure the ingredient supply to ensure the normal operation of the drainage system; at the same time, strengthen the provision of materials for personnel protection such as masks, gloves, goggles and disinfection, especially in key prevention and control areas where outbreaks occur within the service scope.

2.6 Strengthen the supervision of rural medical sewage disposal. Urge Health Centers to take measures such as ultraviolet and chlorine to strengthen disinfection according to local conditions to prevent the spread of viruses through medical sewage. It is strictly forbidden to discharge medical sewage directly to the environment and irrigate farmland, etc. The sewage must be treated and discharged into the sewage pipe network. At the same time, the use of chlorine disinfection should be careful of the impact of excess residual chlorine on the subsequent rural sewage treatment system.

2.7 Strengthen the collection and treatment of sewage in key places to ensure the safety of drinking water sources. Strengthen the on-site supervision and inspection of sewage collection and treatment in key places such as farmers' markets, bazaars, supermarkets, stations, docks, etc., to prevent direct sewage discharge, and strictly prevent pollution accidents; know the epidemic situation in water source timely to ensure the safety of drinking water sources.

2.8 Check the drainage system of key personnel residence. The drainage

collection area where confirmed patients and suspected patients live in, and the sewers of houses in the isolation area should be inspected and disinfected under the guidance of the Health and Epidemic Prevention Department. The inspection contents include whether the drainage is clogged, leakage or overflow, whether the drainage facilities of sanitary appliances are perfect, and whether the water seal is intact, etc., and problems must be repaired in time.

2.9 Choose a reasonable disinfection method and ensure the safe use of disinfectant. The surface of the object can be disinfected with chlorine disinfectant, chlorine dioxide and other disinfectants, wiped, sprayed or soaked for disinfection. It is necessary to pay attention to the corrosiveness of some disinfectants. Hand and skin are recommended to choose effective disinfectants such as 75% alcohol, iodophor and hydrogen peroxide disinfectants to wipe and disinfect. For indoor disinfection in the unmanned state, spray disinfectants can be selected. The disinfection products used should meet the requirements of the National Health Department, and we should pay attention to the safety of disinfectant use. The specific disinfection method can refer to the novel coronavirus pneumonia prevention and control program.

**2.10 Carefully carry out large-scale environmental disinfection.** It is not appropriate to carry out large-scale disinfection of the outdoor environment if the external environment is covered in rain or snow; do not disinfect the outside air; do not directly use disinfectant (powder) to disinfect the whole body of personnel by spraying; do not add disinfectant (powder) to the pool, reservoir, artificial lake and so on; do not use chemical disinfectants to disinfect indoor air if there is someone in the room.

2.11 Strengthen public awareness and education to improve the level of safety protection. The first is to strengthen the publicity and education of the production and operation personnel of the drainage system, improve the understanding of the ways and hazards of biological transmission of sewage, strengthen the training of the correct use of protective equipment, and improve their own safety protection awareness and level. The second is to improve rural residents' awareness of water and drainage safety, stay away from sewage treatment stations (plants), and call on not to drop masks, plastic bags, and other debris into the drainage network to keep the drainage pipes clear.

#### Chapter III General Protective Measures for On-site Workers

3.1 Please do take epidemic prevention and control seriously. The relevant operation and management units of each drainage system should take all necessary protective measures in accordance with the regional conditions, classification, and zoning to ensure the health and safety of on-site workers during work.

3.2. The operating unit should organize risk awareness training and education to allow front-line employees to improve their awareness of the potential exposure of virus and other pathogenic microorganisms from the ideological awareness, and block the respiratory tract, digestive tract, skin wounds, mucous membranes of the eyes and other targets that may be attacked by the virus, to promote the follow-up prevention and management work can be effectively carried out.

3.3 According to local actual conditions, on-site workers should take protective measures such as wearing masks, goggles, and waterproof gloves. In addition to wearing goggles, protective masks (first choice N95 protective mask, second choice disposable medical surgical mask), and waterproof gloves, on-site inspection staff in key areas and key units should also wear protective clothing or waterproof clothing, carry disinfectant and other protective equipment, and work time should be controlled within half an hour. Workers entering the underground closed space for operation or spraying with sewage are required to wear full-body protective clothing (such as class C small amount of splash-proof chemical protective clothing).

3.4 Workers who may be in direct contact with sewage should be equipped with spare masks. The masks should be replaced immediately after being soaked in water to prevent the masks from becoming invalid after being soaked. At the same time, they should report the mask failure to the superior and the superior should pay close attention to the health status of the person.

3.5 All personnel working on-site must have their hands disinfected. They can choose to use alcohol-containing quick-drying hand disinfectant or alcohol compound quick-drying hand disinfectant, or directly wipe with 75% ethanol for disinfection. Those with alcohol allergies can choose effective non-alcoholic hand disinfectants such as quaternary ammonium salts. Under special conditions, you can also use 3% hydrogen peroxide disinfectant, 0.5% iodophor or 0.05% chlorine-containing disinfectant to wipe or soak your hands, and extend the disinfection time appropriately. When contaminants are visible to the naked eye, wash hands with running water for at least 15 seconds, and then disinfect as described above.

3.6 After the operation is completed, the individual is recommended to clean the whole body and spray disinfection, and the working tools should be cleaned and disinfected, and then placed them on the road for ventilation.

3.7 Pay attention to the safe use of disinfectants to avoid discomfort caused by excessive doses, and to prevent some flammable dangers of disinfectants. Some disinfectants such as alcohols and fortifiers (chlorine and peroxides such as bleaching powder) should be kept away from fire sources, and attention should be paid to the corrosive and irritation of strong oxidizing disinfectants on the skin.

3.8 Personnel in all positions should strengthen protection. High-risk places such as the pre-treatment of sewage lifting pump station and grille room, grit chamber, closed workshop, aeration tank, dewatering room, integrated equipment aeration outlet, natural treatment process and water distribution sections should be paid special attention, and the protection level should be increased when patrolling or operating in these places.

3.9 The emergency rescue work should be instructed by the main leaders; in case of emergencies such as emergency pipeline overflow, pipeline collapse, etc.,

the personnel own safety protection work should be done (refer to 3.3 personnel protection measures for key units in key areas); all kinds of operations should be based on mechanical, hydraulic and other operations that can reduce direct contact. When emergency repairing sewage treatment facilities and equipment, personnel should wear masks, goggles and waterproof gloves, preferably wearing protective clothing or one-piece waterproof clothing to prevent direct skin contact with sewage and sludge. After the rescue or maintenance is completed, the personnel should immediately change the clothes, wash, and disinfect the exposed skin, hang the ventilated place after disinfecting the clothes, and we should pay close attention to the changes in the health status of the rescue personnel.

#### Chapter IV Key Protective Measures of Sewage Collection System

Rural sewage collection system mainly includes courtyard sewage collection system, sewage transmission pipe network and ancillary facilities.

#### **4.1 Exposure and Risk Points**

According to the transmission route of the COVID-19, the main exposure and risk points of sewage in the collection and transmission process are toilets, septic tanks (storage ponds or tanks), biogas tanks, inspection wells, falling wells, overflows, pipeline leaks and other ancillary facilities. These areas are prone to aerosol escape, or may be in contact with sewage, which have a higher risk of virus contact and aerosol transmission.

#### **4.2 General Provisions**

4.2.1 Ensure the smooth and safe operation of the sewage collection and transmission pipeline network.

4.2.2 Raise the awareness of the importance of drainage systems and sewage treatment, and call for the protection of drainage pipes and sewage treatment facilities, and to help monitor the normal operation of drainage pipes and facilities.

4.2.3 Strengthen the inspection of the sewage pipe network, and promptly find running water, water pouring, dripping, leaking, and whether there is any missing or loose manhole cover on the pipeline. If hidden dangers are found, we should report them in time and set up corresponding warning signs to isolate the crowd. The operating unit or the competent department shall check the upstream epidemic situation according to the hidden danger points, and then carry out corresponding protection before handling.

4.2.4 According to the situation, reduce or suspend the planned maintenance work such as opening inspection, endoscopy inspection, pipe dredging and water sample collection of drainage pipes and channels. However, drainage inspections should be strengthened to ensure smooth drainage.

4.2.5 According to regional and family conditions, reduce or stop cleaning septic tanks, dry toilets, sewage ponds or tanks, and suspend the dropping of manure into the fields.

4.2.6 For the excreta and dirt produced by confirmed or suspected cases, if they have an independent septic tank, they need to be sterilized before being discharged into the sewage pipe network. We can regularly add chlorine-containing disinfectant to the pool, and the initial addition of effective chlorine is more than 40mg/L, and ensure that the total residual chlorine amount reaches 10mg/L after 1.5 hours of disinfection. The sewage after disinfection shall comply with the "Water Discharge Standards for Medical Institutions". When there is no independent septic tank, a special container is used to collect excreta, which is discharged after disinfection treatment. We can use chlorine-containing disinfection solution with 20000mg/L of effective chlorine, soak and disinfect for 2h according to the ratio of feces and medicine 1: 2. If there is a large amount of diluted excrement, apply a dry powder containing 70% -80% effective chlorine, which should be mixed according to the ratio of feces and medicine at 20: 1 and mixed thoroughly to disinfect for 2 hours. No disinfected excreta and dirt are strictly prohibited to be discharged directly into the sewage pipe network system.

4.2.7 Strengthen the disinfection of the surface of objects in the household of confirmed, suspected, or isolated personnel.

# 4.3 Courtyard Sewage Collection and Discharge System

#### 4.3.1 Key Prevention and Control Parts

Family toilets, public toilets, septic tanks (sewage ponds or tanks), biogas tanks, dry toilets, public toilets, individual households without built-up sewage collection

(scattered discharge and direct discharge), especially the sewage discharge and collection system of designated medical institutions, temporary quarantine places and families with isolation personnel or home observers.

#### **4.3.2 Protective Measures**

(1) Ensure the septic tanks, dry toilets and biogas tanks are covered and always in good condition. Spray disinfect the cover twice a day, or cover it with a flexible shield soaked in high-concentration disinfectant. Pay attention to keep the air vent open, and breathable flexible covering soaked in high-concentration disinfectant.

(2) Septic tanks, dry toilets and biogas tanks with temporarily added sheltering measures should be sprayed twice a day within 2-5 meters of the surrounding area.

(3) Warning signs and warning lines at a distance of not less than 10 meters shall be provided in the sewage storage and discharge places in key courtyards, such as septic tanks, biogas tanks and sanitary toilets.

(4) We should pay attention to prevent rainwater from entering septic tanks and dry toilets.

(5) Protective measures for public toilets: spray disinfection of public toilets twice a day; uncovered septic tanks should be temporarily sheltered, and sprayed twice per day within 2-5 meters of the surrounding area; if the effluent from the septic tank is discharged directly, a disinfection device should be added temporarily. It is recommended to add a concentration of chlorine dioxide of not less than 20 mg/L, or a disinfectant with an effective chlorine content of not less than 10 mg/L to ensure an appropriate amount of residual chlorine. Pay attention to the impact of excess disinfectant on the water environment.

(6) The key areas should be well disinfected at the source, in accordance with the "Novel Coronavirus Contaminated Medical Waste-water Emergency Treatment Technical Plan" to ensure that the relevant sewage treatment standards are met, and that direct sewage discharge and leakage into the environment are forbidden.

#### 4.4 Sewage Collection Pipe Network and Ancillary Facilities

#### 4.4.1 Key Prevention and Control Units

Inspection wells, lifting pump stations, drop wells and other auxiliary facilities of designated medical institutions, centralized isolation points, outbreak villages, residential isolation points and surrounding drainage network; overflows, pipeline leakage points and uncovered ditches.

#### 4.4.2 Operation and Safety Protection

(1)According to the actual situation, warning lines with a protection distance of not less than 10 meters should be promptly set up for the pipeline network and auxiliary facilities that have occurred water running, water pouring, dripping and water leakage, and personnel shall carry out repairs according to the protective measures of emergency rescue work in section 3.9.

(2) After the operation is completed, on-site personnel should wash their hands in time, clean protective equipment (except masks), working tools, and disinfect. If necessary, use a chlorine-containing disinfectant with available chlorine of 10 mg/L or chlorine dioxide of 20 mg/L or more to spray and disinfect the spilled mud and sewage. The flushing and disinfection water should be introduced into the sewage pipe as much as possible. The solidified sludge can be temporarily disinfected with lime or other things in the overflowing sludge water, and then removed in time.

(3) The pipeline dredging should use mechanical equipment such as vacuum suction trucks or hydraulic flushing as much as possible to reduce the direct contact between workers and sewage, and at the same time, strengthen the protection of workers. If the waste is cleaned up, it should be promptly eliminated with high-concentration disinfectant or 10~15% bleaching powder and then further disposed.

(4) Set warning signs for pipeline inspection wells, lifting pump stations, water drop wells and other ancillary facilities; overflows and vents. Spray disinfection twice a day within 2-5 meters of the surface of the manhole cover and the surrounding area, or cover the inspection wellhead and the vent with the breathable flexible covering that has been soaked with high-concentration disinfectant.

#### **Chapter V** Key Protective Measures of Sewage Treatment Station (Plant)

Rural domestic sewage treatment mainly includes three methods: urban sewage pipe network, rural centralized sewage treatment and household sewage treatment. Treatment technologies mainly include septic tank, anaerobic biofilm pool, biological contact oxidation tank, biological filter tank, biological turntable, oxidation ditch, traditional activated sludge aeration tank, artificial wetland, artificial rapid infiltration, stable pond, chemical removal phosphorus and so on. The degree of process integrity varies in different regions. This chapter introduces the key points and measures for epidemic prevention and control during the operation and management of sewage treatment stations (plants) based on typical complete processes.

#### **5.1 Exposure and Risk Points**

Leakage and overflow of the household-type integrated device; primary treatment and removal facilities of the sewage station (plant), such as grid slag, coarse sand, primary sedimentation, sludge disposal units and overflows in front of the plant. Barrier slag, primary sediment, activated sludge and so on are easy to accumulate viruses, and the aeration tank is very easy to produce aerosol, which is easy to meet the characteristics of COVID-19 contact and aerosol transmission. Those places have a higher risk of contact with COVID-19 and aerosol transmission.

#### **5.2 General Provisions**

5.2.1 Strengthening operation management to ensure the safe, stable and up-to-standard operation of sewage treatment stations (plants) is the key to pollutant reduction and microbial control, and it is also the last barrier for "pollution control and anti-poisoning".

5.2.2 If the water intake increases, the sludge discharge can be reduced. Properly increase the concentration of sludge, appropriately increase the amount of aeration, and enhance the impact load resistance of the biochemical system to ensure the

quality of the effluent.

5.2.3 Rural water use has greater unevenness. We can make full use of the volume of the regulating tank and the reaction tank to adjust the flow rate, and try to ensure the stability of the inlet and outlet water flow.

5.2.4 If it is found that the residual chlorine in the water affects the activity of microorganisms, it can be removed by adding a reducing agent in the pretreatment tank.

5.2.5 Strengthen the management of personnel entering and exiting the sewage treatment station (plant). Set up warning signs around the factory and prohibit unrelated personnel from entering or approaching the factory to reduce the risk of sewage contact or aerosol transmission.

5.2.6 According to the regional situation, remote monitoring and inspection should be strengthened, and the number of people and the frequency of inspections in high-risk areas (such as lifting pump rooms or wells, grilles, etc.) in the sewage plant should be reduced or suspended, and the on-site stay time should be reduced.

5.2.7 Prevent unrelated persons from entering the equipment room of the lifting pump station because the lifting pump room is prone to aerosols. The personnel should enter after protection and try to avoid direct contact with domestic sewage, grid slag and grid slag waste liquid in the pump station. According to the disinfection regulations, spray disinfection of walls, floors, equipment, garbage bins and the surrounding environment with a chlorine-containing disinfectant solution with an effective chlorine concentration of 500 mg/L at least once a day to ensure a clean environment in the production area. The grid slag and the grid slag waste liquid should be promptly disinfected on site with high-concentration disinfectant or bleaching powder, and transported to a place that meets the regulations for disposal.

# 5.3 Decentralized Processing of Single or Multiple Households

5.3.1 The single-family or multi-family decentralized processing facilities are inspected by the users under the organization of the management committee

5.3.2 Pay attention to checking whether the cover is intact and sealed, and whether the pipeline and integrated tank are damaged, leaked or overflowed.

5.3.3 When damage, leakage, overflow and other dangers are found, the safety protection of emergency repair personnel should be strengthened and dealt with in time; those who are diagnosed, suspected or in close contact should immediately report to the village committee, and we should set warning signs on the spot. Carry out emergency repair after personnel protection, and coordinate professional organizations or units for emergency repair according to section 3.9; if there is overflow of waste-water, please refer to section 5.9 for disinfection measures of overflow sewage before the plant, and waste residue should refer to point 3 of section 4.4.2.

5.3.4 According to the situation, spray disinfectant around the integrated tank, add emergency disinfection device to the effluent and add disinfectant continuously or intermittently.

#### **5.4 Primary Treatment Facility**

Refer to section 4.3 for septic tank protection measures.

#### 5.5 Sewage Treatment Station (Plant)

#### 5.5.1 Activated Sludge Method

Taking the  $A^2/O$  process, that is, coarse grid lift pump--fine grid--aeration sedimentation tank-- $A^2/O$  biochemical tank--sedimentation tank--disinfection as an example, other activated sludge processes can refer to this example.

### (1) Key Prevention and Control Units

Primary treatment units (such as grid room, aeration and sedimentation tank), aerobic aeration tank of biochemical unit, sludge disposal unit, overflow in front of the plant and odor treatment system.

#### (2) Production Inspection and Safety Protection

1) Reduce manual monitoring of water samples, instead focusing on online or portable monitoring.

2) When the amount of incoming water is conventional, we can try to keep the collection well in front of the plant running at a low water level, which is under the conditions of ensuring safe operation. For example, the pipeline network has an intermediate lift pump suitable for low water level operation to ensure the safety of the pipeline network.

3) Temporary protective cover should be added in front of the equipment prone to sewage splash, such as grid, air float degreaser, etc.

4) Strengthen the management of pretreatment units such as grid slag, grit and so on to prevent direct contact, spraying with high-concentration disinfectant or spraying with  $10 \sim 15\%$  bleaching powder, and sealing treatment.

5) Reduce on-site inspection of pretreatment units and aeration tanks, try to avoid direct contact with grid slag and precipitated sludge, use chlorine-containing disinfectant solution with an effective chlorine concentration of 500mg/L on walls, floors, equipment, garbage bins and the surrounding environment to spray disinfection to ensure the sanitation of the production area.

6) Keep a safe distance from the sewage, and avoid direct contact with the sewage, especially in the high-risk places such as the grille room, aeration sedimentation tank and desilting workshop.

7) On-site inspection work should be carried out after strengthened protection

of on-site personnel.

#### (3) Notes on Other Typical Processes

1) The water distribution system of the biological filter is prone to aerosols, and the inspection should be conducted after strengthening the protection. It is not advisable to turn the packing; if there is a backwashing system, it is not appropriate to observe on site during backwashing.

2) Reduce or stop the inspection of the bio-film status of the bio-rotary disk process (covered).

3) Reduce on-site inspection of the oxidation ditch process for aeration of the turntable, especially in the aerobic section.

# 5.5.2 Natural Biological Treatment Method

Take artificial fast penetration with complete pretreatment as an example:

#### (1) Key Prevention Parts:

Pretreatment units (such as grid, sludge and sewage), water distribution and treatment units.

### (2) Process Inspection and Safety Protection:

1) Strengthening pretreatment and reducing the content of suspended matter entering the fast-seepage tank can effectively reduce the maintenance frequency and flooding risk of land treatment facilities.

2) Strengthen the management of pretreatment units such as grid slag, grit and so on, and can refer to point 4 of article 2 of section 5.5.1.

3) To strengthen the management of pretreated sludge, please refer to section5.6.

4) Suspend the cleaning and tiding of the filler to prevent direct contact with sewage and sludge. If manual work is indeed required, additional protection for the personnel should be applied; the cleaned solid wastes or fillers need to be treated with high-concentration disinfectant or bleaching powder after on-site disinfection.

5) Strengthen the monitoring of the TN index of the effluent. If TN does not meet the standard, measures such as adding a carbon source or adjusting the dry and wet cycle should be added to ensure the nitrogen removal capacity of the biological treatment system.

#### (3) Notes on Other typical Processes of Natural Biological Treatment:

1) For constructed wetlands, we should suspend plant harvesting and impurity removal in constructed wetlands. For other operations, please refer to section 5.5.2.

2) For stable pond, we should suspend the management of aquatic plant harvesting and impurity removal in the pond, pay attention to prevent people from approaching, especially prevent direct contact with sewage in the pond, such as hand washing and laundry.

#### 5.5.3 Integrated Equipment

# (1) Key Prevention Parts:

Pretreatment unit, ventilation on the top of the equipment and outlet.

### (2) Process Inspection and Safety Protection:

1) Strengthen the management of the pretreatment unit, please refer to point 4 of article 2 of section 5.5.1 for grid slag and pretreatment sludge.

2) Reduce on-site inspections, use intelligent integrated equipment, and use remote inspections and controls as much as possible.

3) Strengthen the frequency of remote inspections to ensure the normal and

stable operation of equipment.

4 ) Strengthen signs and warning reminders to avoid irrelevant personnel approaching.

#### 5.5.4 Sewage Pipe Network Connected to Urban

Refer to section 4.4 for execution.

#### 5.6 Sludge Treatment and Disposal

5.6.1 Viruses are easily transferred from the liquid phase to the sludge during the sewage treatment process. The sludge dehydration, transportation and treatment personnel protection should be strengthened.

5.6.2 Strengthen the ventilation and disinfection of the sludge dehydration room.

5.6.3 The sludge dehydration treatment that comes into contact with the human body should be avoided as much as possible, and it is best to use a centrifugal dehydration device.

5.6.4 Minimize the storage of sludge in the plant area. If possible, the sludge can be stabilized by adding lime and alkali, or by adding 10~15% bleaching powder and other disinfectants in the sludge concentration tank or sludge storage tank to deactivate before dehydration.

5.6.5 If conditional, the sludge can be used to inactivate viruses by high-temperature composting.

5.6.6 When sludge is transferred, the closed operation should be strengthened, if necessary, the vehicles, tools and the operation site should be disinfected, and the protection of the transfer personnel should be strengthened.

5.6.7 If the sludge is not transported out in time, it should be sprayed with high-concentration disinfectant or sterilized with 10-15% bleaching powder and then

sealed with a lid. Strictly prevent rain or ground runoff from washing the deposited sludge to form muddy water outflow.

#### 5.7 Disinfection

5.7.1 Disinfection is a key link to control the safety of microorganisms in sewage treatment. The disinfection work should be strengthened to ensure the normal operation of disinfection equipment. A number of enhanced or continuous disinfection measures such as the addition of disinfectants and the use of ultraviolet can be taken, to ensure the maximum efficiency of the disinfection process and the safety of the microbes in the effluent.

5.7.2 The dosage of disinfectant can be appropriately increased to ensure the disinfection effect, but care should be taken not to affect the aquatic organisms in the receiving water body.

5.7.3 Pay attention to the location and method of disinfectant addition, and multi-point addition method can be used. At the same time, the medicine outlet must be submerged below the water surface.

5.7.4 Sewage stations (plants) with imperfect disinfection facilities should be equipped with emergency or temporary drug delivery devices to ensure disinfection effect. We can use integrated disinfection equipment (on-site pharmaceuticals), simple dosing tank (medicine storage), etc. Ensure the contact time of the disinfectant with sewage (generally more than 15mins). Pay attention to the corrosion and irritation of the disinfectant on the skin and respiratory tract, and strengthen the safety protection of the personnel.

#### 5.8 Tail Water Discharge

During the epidemic prevention period, a warning sign shall be set at the outlet of the sewage plant to clearly indicate the safety risks of contact with water bodies. Residents shall be prohibited from approaching rivers, lakes and fields that are discharged from sewage receiving water plants during the epidemic prevention period.

#### 5.9 Overflow in Front of the Plant

Block the overflow point where is in front of the plant, and strictly prohibit overflow of sewage. If it is difficult to block, a temporary dosing device should be added at the upstream of the overflow port. The effective chlorine concentration of the disinfectant is not less than 10mg/L or the chlorine dioxide is not less than 20mg/L.

#### 5.10 Rural Small Sewage Treatment Facility With Patrol Inspection System

5.10.1 Strengthen patrol inspection to prevent the overflow and leakage of sewage in the pipe network and sewage station (plant), ensure the normal operation of facilities and equipment, pay special attention to whether the disinfection equipment is normal, and ensure that the water quality is stable and meets the standard discharge.

5.10.2 Strengthen the inspection of auxiliary facilities such as pipeline inspection wells and overflow outlets, add safety warnings and precautions in the plant area, and reduce the possibility of villagers coming into direct contact or close contact with sewage.

5.10.3 Personnel protection should be strengthened during on-site inspection, operation and maintenance.

#### Chapter VI Other Suggestions

6.1 Rural sewage should be developed with different quality and resources. Separately collect and process the manure sewage, kitchen water and washing water for resource utilization. For example, fecal and urine sewage has good organic matter content and is a good organic fertilizer, which can be used for agricultural irrigation after treatment; kitchen water and washing water can be used for greening, road washing, agricultural production water and ecological base flow.

6.2 Form a "uniform planning, construction and management integration" development model. Rural sewage treatment generally has the characteristics of small quantity, scattered and remoteness, which is difficult to operate, manage and maintain. It is recommended to take the basin or region as the unit and adopt the "unified planning, construction and management integration" construction and operation management model. Among them, the integration of construction and management is conducive to the normal and stable operation of facilities and equipment, especially integrated sewage treatment equipment.

6.3 The choice of suitable mode for rural sewage treatment. In view of the actual situation of sewage discharge and farmland irrigation in rural areas, combined with the needs of water replenishment and ecological water conservation, took the basin or region as a unit, "integrated consideration, targeted selection", choose decentralized sewage treatment technologies and products that have less pollution, environmental friendliness, simple operation and maintenance; realize local treatment, reuse and discharge of sewage.

6.4 Actively build a rural smart drainage system. According to the actual situation, actively carry out the development and construction of rural smart water affairs, reduce the artificial participation in operation and maintenance through internet and other technical means, comprehensively strengthen the level of rural sewage treatment intelligence, and improve the ability to respond to infectious

diseases and technical reserves.