Major Science and Technology Project of Water Pollution Control and Management in China

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Abstract

Water pollution has become one of the restriction factors that limit the economic and social development, the economic structure adjustment and the economic transformation of China. According to China's national policy for medium and long-term scientific development (2006-2020), government began to set up major science and technology project of water pollution control and management (water project) from the Eleventh Five-Year Plan in order to provide rational support for water pollution control and management in China.

Keywords

water environment;water pollution control and management;drinking water security;water project from the Five-Year Plan

Introduction of the water project

According to the guideline "Independent Innovation, Key point Breakthrough, Supporting Development and Leading Future", the principle was to resolve the main contradiction, typical basins. The comprehensive demonstrations of water pollution control and water environment protection are chosen and the breakthroughs of the key technologies for water pollution control and management are obtained China. To solve the bottleneck problems of water pollution control and management which restrict the social and economic development of China, the water project focuses on the breakthroughs of the key technologies such as industrial pollution source control and management, agricultural non-point source pollution control and management, urban sewage treatment and reuse, water purification and ecological restoration, drinking water safety and water environment monitoring, early warning and management and so on. Through the comprehensive demonstrations of lake eutrophication control and management technology, river pollution control technology, urban water pollution control and water environment comprehensive improvement technology, drinking water security technology, watershed environmental monitoring and early warning technology, watershed integrated

management technology, water environment management and policy research, the water environment quality of demonstration areas would be improved, the target of safe drinking water would be achieved, the level of watershed pollution and watershed management would be improved.

The water project is organized and implemented in three stages. The first stage aims at breaking through the key technologies that can control pollution source and reduce the amount of discharge. The second stage focuses on the breakthrough of the key technology to alleviate the burden of water environment and its rebuilding. In the third stage, primary target aims at the breakthrough in the technology to integrated regulations of watershed environment.

Objectives of the water project

For solving the bottleneck problems of water pollution control and management with innovations of concept, technology and management, the objectives of the water project are:

(1) Construct the watershed pollution control technical system and the water environment management technical system.

(2) Focus on the technology innovations of source discharge control, monitoring and early warning ability improvement, water environment quality improvement, drinking water security.

(3) Enhance the level of independent innovation and the comprehensive technical ability of water pollution control and management.

Main content of the water project

As the total discharge of pollutants has surpassed the water environment carrying capacity and watersheds are polluted seriously, the comprehensive demonstrations of lake eutrophication control and management technology, river pollution control technology, urban water pollution control and water environment comprehensive improvement technology, drinking water security technology, watershed environmental target management technology, of water pollution control and management strategy and policy are implemented in the water project. According to the comprehensive demonstrations, 6 research topics are set up as the following: lake theme, river theme, urban water environment theme, drinking water theme, watershed monitoring and early warning theme, strategy and policy theme.

Lake theme

Objectives

For lake part, we will achieve the following goals: Firstly, obtain a comprehensive grasp of watershed pollution sources, development of social economy and the relationship between these two aspects and quality change, eutrophication of lake water. At the same time, the basic theoretical framework is put forward to solve China's lake pollution and eutrophication control. Furthermore, the independent and innovative key technology and overall scheme for the control of lake water pollution and eutrophication are developed. Secondly, some key technologies of global to are made breakthrough in control the lake water pollution and eutrophication. Thirdly, the Taihu Lake watershed as a comprehensive demonstration zone and other different types of typical lakes and reservoirs is selected as demonstration zones of this special technology. Thus, controlling the eutrophication of these demonstration lakes and reservoirs effectively is realized the improvement of the water quality in the demonstration zones obviously. Fourthly, the lake watershed integrated management system in line with our national conditions will be formed. All these objectives can be summarized as establish a firm technology foundation for China's lake water pollution management, eutrophication comprehensive control and fundamental improvement of the water environment.

Main research contents

The problems of eutrophication and watershed pollution are acute, which has influenced the production, living and drinking water safety of people around the lake, and sustainable development of the regional social economy as well. Considering that there are various types of lakes in China which located in different geographic regions with different stages of economic development, the lakes are in different eutrophication development process with its own ecological characteristics. It's important to select different types of typical lakes according to eutrophication development stage, nutrient level, lake scale, the formation mechanism and location. The comprehensive analysis and improvement scheme are carried out to trophic level, type, stage and regional economic level. At the same time, typical and representative lake waters will be selected as engineering demonstration. Strategic objectives of National Water Project will be realized step by step from the control of key pollution source of the lakes and the improvement of regional lake water quality to the obvious improvement of overall lake waters. Packaged technology and management experience will be provided for carrying out large -scale eutrophication management of different types of lake in the future.

Selection of demonstration areas

The Taihu Watershed will be selected as comprehensive demonstration zone to carry out lake watershed pollution control and eutrophication management according to the established national key watershed of water pollution control.The Dianchi Lake, located in the Yunnan-Guizhou Plateau and the Chaohu Lake, located in developing region will be selected to carry out research, management and engineering

demonstration of heavily polluted lake.The Three Gorges Reservoir, a large reservoir, will be selected to carry out technology demonstration of water pollution and water bloom control.

River theme

Objectives

Considering the serious state of river water pollution in China, the different typical river will be selected according to geographies, types, causes of pollution and economic development stages, and river management support technology system in line with the different water quality target and function target will be created. The comprehensive regulation program for polluted river water in accordance with different regional economic level and water quality will be developed. We should give priority to make breakthroughs in key technology and the integrated technology of a group of clean production, water recycling and the reduction of point and nonpoint source pollution load. At the same time, the integrated technology of the management and ecological restoration of polluted river, and the technology system of river pollution prevention, control, management and restoration should be breached. What is more, some typical and representative river engineering models will be built. By 2020, the national rivers pollution prevention strategy goal that is the transition from the satisfaction of river water quality to the river ecosystem integrity will be achieved.

Main research contents

The characteristics of pollutants mainly influence the function and the ecological system in the different development stage. Now, consumption oxygen, organic nitrogen, phosphorus nutrients, heavy metal, and organic toxic pollutants, and so on will be focused on in China. The target is to control and govern these main pollutions by selecting river water system or typical river section according to pollution degree, types of pollution sources, types of pollutants, applications of water and the river ecological functions and having a comprehensive analysis of features of point and nonpoint source river pollution load, the evolution process of river water quality and the degradation of applications of water and water ecological system. At the same time, the river water quality comprehensive management technology and water ecology will be established. Key technology to reduce nonpoint source pollutants from industries and agriculture and engineering technology system for river pollution governance, ecological restoration and biological diversity conservation will be developed too. Through technology integration and comprehensive models, our goals will be achieved through significantly reducing river pollutants load, significantly improving river water quality, and preliminary regeneration of water ecological system function structure. In the end, the different geographical river pollution control and comprehensive management technology system will be summarized in the different economic development stage.

Selection of demonstration areas

The Songhua River is selected as water pollution control technology demonstration area, as it has high risk polluted sources and its pollution is transnational and across provincial boundaries. The Liao River is selected as water pollution control technology demonstration with its intensive industry and high pollution load. The Haihe River is selected as river, and grass type lake water pollution comprehensive technology demonstration area because of the shortage of water, the complexity of water supply, and the serious deterioration of water environment. The Huai River is selected as river pollution control demonstration area and lake conservation area using east line of water from south-to-north water transfer project, because it need frequent gate dam and water pollution control and the contradiction between flood control and anti-pollution control is obvious.

In the end, pollution prevention and comprehensive control technology systems, under different development conditions, come into existence in the different regional river. It will provide technical support for river water pollution control and management in China.

Urban water environment theme

Objectives

Through the research and demonstration of the key technologies about urban water pollution control and water environment comprehensive treatment, the spatial and temporal characteristics, along with the variation, of urban water pollution can be identified to establish different functional urban water environment safety guidelines and water emission standards in China. In the national key basins, several cities or urban agglomerations can be selected. They are required to not only have an important strategic position in social and economic development in China, but also have different economic development stages and characteristics, as well as different pollution causes and characteristics. At the core aim of reducing the overall water pollution load and protecting the quality and safety of the urban water environment, what mainly to overcome are the key technologies of clean production, pollution control and recycling in cities or industrial parks, and break through the overall design of the city water pollution control system, the operation control of the whole process and the aquatic ecological restoration technology. Then, combined with the urban water comprehensive treatment and ecological landscape construction, the comprehensive technologies and their integration demonstration have to be carried out. It can initially establish the comprehensive treatment technical system and operational and regulatory technical support system of the urban water pollution control and water environment in China. In addition, in order to promote the standardization, equalization, and industrialization development of the key technology, the corresponding base, industrial base, supervision and performance evaluation management platform have also to be established, which can provide strong technical and management supports for achieving leapfrog development and building a new

generation of urban water environment system.

Main research contents

The lack of urban sewage treatment facilities, the fragile of water circulation system, the decline in the quality of the water environment and the degradation of water function, several cities or urban agglomerations, in the national key basins, can be selected, which not only must have an important strategic position in social and economic development in China, but also have different economic development stages and characteristics, as well as different pollution causes and characteristics. Then with the state water pollutant emission reduction targets and the development goals of the water pollution control and water environment quality improvement in the demonstration towns, the reduce of the total emissions of COD、NH_3-N、TN、TP can be taken as the core indicators to systematic analyze and research the prominent influencing factors of the urban water environment quality, controlling ways and system solutions. Meanwhile, the technology integration and integrated demonstration have to be carried out from such aspects that the planning and management of urban water environment system decision, the collection and treatment of urban sewage, the pollution control of surface runoff, the pollution sources control in the industrial parks, the urban aquatic feature restoration and ecological landscape construction, the monitoring and management of urban water environment. In addition, the overall design of the city water pollution control system, the operation control of the whole process and the aquatic ecological restoration technology have also to be broken through to form a series of integrated treatment programs based on the urban water environment. It can initially establish the integrated treatment technical system and operational and regulatory technical support system of the urban water pollution control and water environment in China. Finally, in order to provide strong technical and management supports for achieving rapid development and building a new generation of urban water environment system, the corresponding base, industrial base, supervision and performance evaluation management platform have to be established.

Selection of demonstration areas

Combined with the research and development of the above key technology, such four integrated demonstration zones are selected, the river network region around Tai Lake, the typical cities in Hai Watershed, the towns in The Three Gorges Reservoir District and the cities in Chao Lake Basin. And the integrated innovation and comprehensive demonstration of the technology have to be carried out, as well as the common technology research of the urban water environment treatment and the integrated management technique research.

Drinking water theme

Objectives

In order to solve the problem of widespread pollution of drinking water sources in China, “The national rural drinking water engineering Eleventh five-year plan planning” and “The national urban drinking water security planning” is enforced.Based on “Standard for drinking water” (GB5749-2006) and the characteristics of the water sources pollution and water supply systems in representative regions, drinking water security technology including water source protection, water purification and pipe network system is built by key technology research and development, technology integration and application demonstration. Besides, standard and supervision management system which set water quality monitoring, risk assessment, operation management, and emergency response will be built in a body. It provides scientific support for enhancing Chinese drinking water security technology level, promoting the development of relative industries and strengthening government regulation ability. Through technology research and development, technology integration and comprehensive demonstration, Chinese potable water security ability is continued to be enhanced, which provides technical support for protecting the safety of people’s drinking water and their health by 2020.

Main Research Contents

Based on the fact that Chinese water is generally suffering from pollution and according to the security risks of different types of sources of water, water quality characteristics and water supply systems, drinking water security technology and supervision system need to be studied and constructed. Water conservation, purification treatment, secure transmission and distribution, water quality monitoring, risk assessment and emergency response is set in a body. By technology research and development, technology integration and comprehensive demonstration, the potable water security ability in China is enhanced continuously.

Selection of demonstration areas

Shandong, Zhejiang, Jinan, Hangzhou, Dongguan provinces and so on are chosen to carry out the demonstration of national, provincial and municipal drinking water monitoring, early warning and emergency response system.

Wuxi city is chosen as a demonstration area to represent the drinking water source from Taihu Lake. Shanghai is chosen as a demonstration area for the drinking water source from Huangpu River, Yangtze River and other rivers. Jiaxing city is a demonstration area for the drinking water source from river network.

In consideration of the pollution problem of drinking water source from Yellow River reservoir and the local water quality characteristics, Jinan, Qingdao and Dongying, these three cities are chosen as a comprehensive demonstration area.

In view of the seasonal variation characteristics of the pollution of drinking water sources from the Pearl River downstream, Guangzhou, Shenzhen and Dongguan, these three cities are chosen as a comprehensive demonstration area.

Around the area of “Huai River, Hai River, Liao River, Taihu Lake, Chao Lake, Dian Lake, Songhua River, Three Gorges Reservoir”, some typical cities and towns are chosen to develop the demonstration of common and applicable technology of drinking water security.

Watershed monitoring and early warning theme

Objectives

In order to secure the social sustainable development and harmony between national environment and economy, this key project intends to do research in following themes and subjects. Aiming at the basin water environmental issues of China, the subject of “The basin water pollution prevention, monitoring and early warning technology and integrated demonstration” will be implemented. Innovation of theory, technology and management on basin water pollution monitoring and prevention is promoted. The basin water quality and water ecological security and basin water quality management system in order to form monitoring and early warning abilities are foucused. Research on subjects such as dividing watershed water ecological functional areas, managing river water quality, monitoring water environment, evaluating water environment risks, early warning and prevention of water pollution is conducted. Comprehensive management system of water pollution prevention that suits the condition in China will be builded. Evaluating system and platform for technology of water pollution control to support water environment management and decision-making is established.

By 2020, the management pattern and system transformation of basin water environment which aiming at the protection of water ecology system will be realized. Thus, the formation of a complete set of technical methods and standard of controlling water pollution, supervising and early warning of water environment which based on the division of watershed water ecological functional areas will be accomplished.

Main Research Contents

Aiming at the problem that Chinese water environment management system is imperfect currently, and combining with the technical demand of the construction of *'three system'* which needed by national pollutant total amount control and monitoring, the theory and method study of the division of watershed water ecological functional areas will be carried out in system. By means of establishing index system and technical structure of the division of water ecological functional systems, the first, second regional division of key basin water ecological systems, the third regional division of demonstration areas and the formulating of pollution control plan will be accomplished. The water quality standard having regional diversities, integrating with the watershed water quality management target to create a set of standards of specific pollutants are established. Through the integration of technologies of setting water ecological functional areas, water quality target management, monitoring and early

warning of water quality and water pollution control, Chinese technological system of watershed water environment management will be established. Till 2020, the water quality monitors and management patterns ensuring the safety of water ecological systems in the national seven main watersheds will be built.

Selection of demonstration areas
According to the key river valleys for water pollution prevention determined by the state, Taihu Lake, the Dian Lake, Chao Lake, Liao River, Huai River, Hai River, Songhua River and Three Gorges Reservoir Area are selected as demonstration areas.

Strategyand policy theme

Objectives
The theme is oriented by reinforcing the water-managnent efficiency and improving the water quality in the demonstration area of Water Project. It will be sustained by building the water management platform for decision-making and technology-applying, the clarification of production relationships among the water management, and productivity increasing resulted from the implementation of water management policies. Water pollution control system will be better and the role of the market-oriented economic measures will be stronger by the determination of the road map for the national short and long-term water pollution control, and main directions of the innovation about the management system, institutions and policies. Investment and productivity will be improved for the water pollution control on the condition that the responsibility of the government and enterprises are explicit for environment protection. In addition, by the enhancement of the management supervision and policy implementation, the efficiency of implementation will be higher and the effect resulted from these policies will be more obvious. Generally, long-acting management system and policy mechanism will be established for the water quality improvement in the demonstration area for the water pollution control in China.

Water system for the management and technology will be completely built which is consistent with the Chinese situation by 2020, and so will be the whole fundamental platform for the national environmental management, the comprehensive managing system and the long-acting mechanism of water policies. They will benefit the water pollution management and policies implementation of the watershed, ensuring the slash of pollution release, significant improvement of water quality, reliability of drinking water safety and sustainable development of social economy in the relevant watershed. Meanwhile, batches of professional talents with high levels will be cultivated in different aspects, followed by the emergency of large quantity of world-class specialists in the field of water management and policy study.

Main Research Contents
The water management and policy system including finance, revenue, price,

investment, punishment, and compensation with information publication will be studied orthe water management institution planning of the watersheds, rivers and cities, the distribution of water resources and wastewater treatment to other environment resourcesdistribution. The objective of the watershed pollution control aims to solve the problems about the supporting decision, system & mechanism, and environmental policies during the work period of water pollution control, and providing the economy and technology guarantee. The main details of the study are as follows: the strategic decision-making of water protection, institutions planning of water management, investment and financing and price and tax policies about watershed pollution control, relevant institutions about sewage discharging license, co-management of trans-boundary pollution, compensation of watershed pollution, offset designing for the ecology deterioration, institutions of public participation and information publication, policies and laws system about the area pollution in the agriculture of the watershed, infrastructure construction of urban water pollution control, policies about the development of relevant industries, managing policies system of the drinking water safety.

Selection of demonstration areas

The watershed of the Taihu Lake and the Liao River, the city of Suzhou will be selected as the study demonstration area.