

# Pollution Control Policy and Technology Research Status of Construction Land

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**Abstract**—In some cities with high levels of urbanization, on the one hand, there is an urgent need for transformation and upgrading, and the land resources are extremely precious. On the other hand, the urban environment is overwhelmed. The construction land used for urban renewal has hidden environmental risks and the human settlement environment is relatively high. influences. Soil pollution may cause greater harm to human health, and it has become one of the prominent shortcomings in building a well-to-do society. In view of the problems existing in the quality of construction land, especially the pollution of construction land, many countries have formulated corresponding policies and governance techniques. Through reading a large number of documents, this paper summarizes the research status of domestic and foreign policies and technologies in the treatment of land-use pollution, for the relevant research to provide a reference.

**Index Terms**—Pollution, control policy, technology, construction land.

## I. INTRODUCTION

Land is an essential element of the existence and development of human society. It provides the basic conditions for humankind to survive, to eat and to develop space. In the past century, with the rapid development of industry, the acceleration of urbanization and the rapid increase of population, a series of man-land conflicts have emerged. In particular, the contradiction between the quality of human existence and the land for construction has become increasingly acute. The overall situation of the quality of construction land in our country is grim. The construction land in some areas is seriously polluted. Heavy polluted areas and high-risk areas for construction land appear in heavy polluting enterprises or industrial intensive areas, industrial and mining areas and surrounding areas, cities and suburbs.

## II. FOREIGN BROWNFIELD GOVERNANCE POLICY

### A. United States

The United States has become the most proactive advocating and practicing country for brownfield redevelopment and implementation. It has formed a good operating mechanism for the redevelopment of brownfields.

The U.S. government has benefited from this strategy in many aspects, including legal and financial policies. The result is the development of practices Reasons for great success. After the "Ralph Canal Incident" in 1978, the United States began to pay attention to the "brownfield" issue [1].

In 1980, the first "brownfield" governing law, the "Comprehensive Environmental Response, Compensation and Liability Law" (the "Superfund Act") was created. The law empowers the US Environmental Protection Agency to regulate the nationwide contaminated sites and orders those responsible for the pollution Particularly serious site for repair. In the first few years of implementation, it did not achieve very good results, but it caused a heavy burden on related enterprises, especially small and medium enterprises. In 1986, the Super Funds Amendment and Reauthorization Act was promulgated. The law empowers the EPA to regulate the nationwide contaminated sites and requires that the quality of the restored plots must meet federal and state environmental standards to "Safe Drinking Water Law" provisions of the level of pollutants and "Clean Water Act" in the water quality standards.

The United States Environmental Protection Agency issued the "Brownfield Action Agenda" in 1995 calling for multi-stakeholder participation in brownfield management. The Taxpayer Relief Act, enacted in 1997, includes a tax incentive that promotes cleanup and development of brownfields, with side-by-side support for brownfield development. In 2000, the EPA released the Plan for the Economic Rehabilitation of Brownfields, which authorized states, communities and various types of buyers of brownfields to work together to promote the rational assessment, cleanliness and sustainable redevelopment of brownfields [2]. In 2002, the Bush Administration signed the "Small Business Liability Waiver and Brownfield Rehabilitation Act", which exempts small businesses and certain property owners from "superfund" responsibilities and earmarked hundreds of millions of dollars in grazing land for governance every year to assist them. Local landowners and future purchasers have limited liability. The United States Environmental Protection Agency also released the Soil Screening Guidelines to determine soil screening levels or guidelines based on risk management and site management.

After many years of practice, the United States has established a multi-governance structure of the federal government, state government, local government and community and commercial organizations to form a "governance-led and multi-participatory" public governance structure [3]. Whether it is the Comprehensive Law on Environmental Responsibility, Compensation and Liability or the Small Business Liability Relief and Brownfield

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Rehabilitation Law, all fully embody the principle of public participation and give the public the opportunity to comment, express opinions and participate in the rehabilitation and redevelopment process .

#### *B. United Kingdom*

The problem of brownfields in the United Kingdom is also grave. In 2001, the Inland Revenue Department issued a tax deduction and exemption law that exempted companies that control contaminated land by 150% from the value added tax [4].

The UK also enacted the Garbage Act, which promotes the re-use of building materials by increasing charges for waste disposal and adding new building costs. All these laws implicitly or implicitly affect the issue of brownfields.

#### *C. Canada*

The Canadian government sees brownfield as the heritage and opportunity left by industrialization to modern society. In 1989, the Canadian Environment Commission (CCME) launched the National Contaminated Sites Remediation Program (NCSRP) [5]. The plan reiterated the "polluter pays" principle and established the "Assessment and Restoration of National Grading Systems for Contaminated Sites," which provides a guiding framework for governance of brownfield activities at all levels of government in Canada. The Ontario Amendment to the Brownfields Act 2001 supports the government participation and coordination of brownfield redevelopment through a legal framework [6].

#### *D. Germany*

For the prevention and control of soil pollution, Germany promulgated the "Federal Soil Protection Law" and "Federal Soil Protection and Pollution Venues Regulations", requiring all states to strictly abide by [7]. The goal of the Federal Soil Conservation Law is to reduce or avoid soil pollution and to clean up abandoned contaminated sites. The Federal Soil Conservation and Pollution Venue Regulations supplement or refine the Federal Soil Conservation Law and provide detailed rules for field investigation, sampling strategies, laboratory analysis methods, evaluation and restoration systems. German law of brownfield management system and technical instructions are: "Waste Disposal Ordinance", "Landfill Ordinance", "Underground Waste Storage Ordinance" and other provisions, and "Urban Waste Technology Directive", "Waste Technology Directive" and other directives.

### III. CHINA'S BROWNFIELD GOVERNANCE POLICY

At present, there are no laws and regulations on brownfield management and restoration in our country. The management system of brownfields is not perfect, brownfields are insufficiently managed, the awareness of brownfields is not strong and the consciousness of governance and restoration is not strong, and soil pollution caused by brownfields The quality and safety of agricultural products and mass incidents have increased year by year, becoming an important factor affecting the health and social stability of the people [8], [9].

China's policies and laws and regulations related to the

management of brownfields are fragmented, and no theoretical system has been formed for the study of brownfield management. With the acceleration of industrial development and the acceleration of urbanization in our country, the industrial structure of cities is undergoing restructuring and the layout of urban space needs to be adjusted. The redevelopment of brownfields in China is facing challenges. In the face of such an environmental law as Brown Land, the enactment of laws can give full play to the advanced nature of the State in the management of brownfield land, and can effectively utilize the state rights in the management of brownfield land to make up for the deficiencies in other brownfield management measures .

At present, most of the regulations related to brownfields in our country appear in the form of technical specifications, lacking mechanisms for guaranteeing implementation at the legal level. Some local governments have promulgated relevant emergency regulations for specific incidents.

#### *A. Take Beijing As an Example*

Urban development requires substantial supply of land to accommodate residential, communal facilities and commercial sites [10]. In order to improve the living environment and readjust the industrial structure, the Beijing municipal government started the closure and relocation of industrial enterprises in urban centers since the 1980s. During 2001-2011, Beijing relocated more than 400 factories and displaced tens of millions of square meters of land for reuse. Large-scale industrial relocation also leaves a lot of brownfield plots [11]. Part of the site of the pollutants is very complex, the plots of soil and groundwater was seriously polluted. As a result, restoration and redevelopment of brownfields are necessary [12].

Beijing's brownfield management activities originated from the wounding of brownfields in the Songjiazhuang subway station. In order to avoid the recurrence of such tragedies, the Beijing municipal government promulgated a series of local regulations and documents and adopted a series of measures.

Among them, in January 2007 and July 2007, the Beijing municipal government successively promulgated the "Guidelines for Site Environment Assessment" and the "Notice on Issues Related to the Assessment of Soil Environment in the Original Sites after Industrial Enterprises Moving", the two normative documents [13].

The Circular on Relevant Issues Concerning the Evaluation of Soil Environment in the Original Site after Industrial Enterprises Moving Regulated the Liability of Brownfield Management, which reiterated the restatement of the principle of pollution site management, namely "who pollutes and who governs" [14]. This notice is to some extent an accompanying document of the Guidelines for Site Environment Assessment. The notice stipulates that the redevelopment and utilization of brownfields must carry out environmental assessment of the site [15]; developers must formulate a soil remediation plan for brownfields; the cost of brownfield management shall be the responsibility of the enterprises that cause the pollution; and after the brownfields are qualified for remediation and treatment, Can be used for other purposes development and construction [16]. Beijing

Brownfield governance framework focuses on determining the responsibility of the parties and the parties involved. In the legal framework, the principle of "who pollutes, who govern" has been clearly defined, and responsibilities of different government departments also have corresponding provisions.

#### *B. Take Chongqing As an Example*

Chongqing is the youngest municipality in China and a large industrial city in Southwest China. Industry is a pillar industry in Chongqing. Chongqing's industrial sectors cover chemical, metallurgy, machining, instrumentation and fine chemicals. Since 2002, in order to improve the urban environment and promote the healthy development of the city, the Chongqing municipal government decided to relocate the old polluted enterprises from the urban center. Up to now, 113 polluting enterprises have been relocated one after another, and after the relocation, the vast majority of industrial land will be redeveloped for urban development. However, long-term industrial production discharge of pollutants lead to a lot of soil pollution.

In accordance with the relevant provisions of the China Environmental Protection Law, the General Rules of Civil Law and the Land Administration Law, various departments in Chongqing successively issued a series of relevant laws and regulations governing the management of contaminated sites. For the principle of brownfield governance, the Chongqing municipal government clearly stipulates the three major principles: "Who pollutes, who govern", "Who invests, who benefits" and "Who owns, who is responsible" [17]. At the same time, the government takes the lead in regulating the sources of funds for restoration and management of brownfield land, repairing and redevelopment of brownfields in enterprises, applying for preferential loans from international financial institutions, and setting up removal relocation funds for helping relocation enterprises. The fund system provides that relocation enterprises without the financial management of brownfield repair, you can apply for a loan to the repaired with the land transfer repayments of loans. The environmental protection department and the financial land department coordinate with each other to set up the "Land Pollution Control Special Subsidy System." From the land transfer fee for urban construction land every year, it is accrued that a subsidy fund for land pollution control of urban construction land shall be set aside as a special subsidy for land pollution control. The system stipulates that [18] "the government may provide special subsidies for special subsidies for land pollution control to those contaminated land with unclear land tenure, unclear pollution responsibilities or no transfer development plan in the short term or contaminated land for urban public facilities construction in cities ". These successive regulations and documents show that the Chongqing municipal government attaches great importance to the issue of brownfields and regards the repair and redevelopment of wasteland and brownfields as an important way to achieve sustainable urban development. Chongqing Municipality has stipulated the principle of "prevention first and combination of prevention and control"; and solidly promoted the treatment of contaminated sites according to the principle of "refusing to

owe new accounts and repay old debts" and achieved good results.

#### IV. FOREIGN BROWNFIELD MANAGEMENT TECHNIQUES

Soil in situ remediation technology [19]-[21] refers to the soil remediation technology of directly remediating contaminated soil in the contaminated site without excavation. It has the characteristics of low investment and small impact on the surrounding environment and is a hot research topic in soil remediation. Soil in situ remediation techniques are mainly leaching, gas phase extraction (SVE), multiphase extraction (MPVE), gas injection (IAS), biodegradation, in situ chemical oxidation (ISCO), in situ chemical reduction, , Plant repair and so on. The leaching method is mainly used for controlling heavy metals and non-volatile organic compounds in highly permeable soils. Soil gas phase extraction and spray technology is suitable for the treatment of volatile contaminants in soil. It is often used in combination with heating technology and biological treatment technology to promote the volatilization of pollutants and promote the decomposition by oxygen. Multiphase extraction is mainly used to control the presence of a large number of non-aqueous fluid contaminated sites, the soil organic pollutants can be directly extracted. Biodegradation of biological aerobic degradation, biological anaerobic degradation, biological reduction of a variety of degradation, degradation by the type of pollutants and geological conditions. Chemical methods can be oxidized or reduced pollutants into low-toxic non-toxic substances, the cycle is generally shorter. Immobilized contaminants can be added directly into the reagent to form a precipitate, and the microorganisms can also be produced under appropriate conditions to generate ions that can precipitate heavy metals. Phytoremediation is mainly used for enriching heavy metals with low cost, but the efficient utilization of plant enriched with heavy metals remains to be further studied.

#### V. CHINA BROWNFIELD MANAGEMENT TECHNOLOGY

The system of remediation of contaminated soils in our country has been gradually formed. With the development of science and economy, various rehab techniques have been significantly improved, such as in situ bioremediation and natural remediation technologies.

##### *A. Bioremediation Technology*

Soil bioremediation absorbs, transforms or degrades pollutants in soil through different biological species to achieve the purpose of soil remediation. It belongs to the green science environmental remediation technology and generally includes microbial remediation, phytoremediation, and biological remediation. Microbial remediation technology is the use of microbial degradation of pesticide or oil contaminated soil remediation, microbial repair by microbial strains of highly efficient degradation of the soil to restore the original ecological functions, the use of ecological technology so that contaminated soil can be restored, Due to its ecological advantages, the technology of microorganisms has drawn people's attention and promoted the development

of ectopic microbial remediation technology. Phytoremediation technology uses the plant's own functions or accumulative functions to adsorb and filter the pesticides, heavy metals or other harmful substances contained in the soil so as to restore the ecological character of the soil. This technique is generally applied to restore the contaminated farmland soil or fill Surface coverage of the landfill, and ecological restoration, to a certain extent, can also be carried out to repair the marginal soil in the mining area.

### *B. Physical Repair Techniques*

Physical remediation technology [22] is the use of physical reactions to separate or remove contaminants in the soil, mainly thermal desorption technology, microwave heating technology and steam extraction technology, which can effectively repair due to benzene, PCBs, Dioxins, polycyclic aromatic hydrocarbons and other contaminated soil. Thermal desorption belongs to one of the physical remediation technologies that can recycle the restored soil to reduce the production of dioxins in contaminated soils of chlorinated organic matter. In the long-term remediation of organic contaminated soil, the main research direction of this technology is to treat different types of contaminated soils by the same principle because of the high equipment cost and high treatment cost of the technology, which limits the application of the technology. On the other hand, Vapor Extraction plays a key role in the repair of volatile organic contaminated soil. This technique does not destroy the soil structure during application, avoids the secondary pollution of the soil, and has low cost and high operability.

### *C. Chemical Repair Technology*

Removal of contaminants in contaminated soils by inducing chemical reactions between fixatives and contaminants, known as chemical repair techniques, can generally be divided into: 1) Curing-stabilization techniques, which are less expensive to operate and repair, and has significant effect on soil polluted by heavy metals. 2) Leaching technology, which can effectively remove the pollutants from the contaminated soil or sediment, and the wastewater generated during the remediation process More difficult to handle and more expensive; 3) oxidation-reduction technology [23], [24], which is to restore contaminated soil by chemical reducing agent or oxidant; 4) photocatalytic degradation technology [25], which is applied to soil polluted by pesticides; 5) Electrokinetic repair, combined with the complex interaction between electrochemistry and electrodynamics, restores the soil [26], [27].

### *D. Contaminated Soil Joint Repair Techniques*

Joint repair technology refers to the use of two or more repair methods for remediation of contaminated soil to improve the efficiency and speed of repair, to effectively avoid the lack of single repair techniques [28]. First, the combination of microbial / animal-plant repair[29], [30], the use of rhizosphere enhancement, mycorrhizal organisms and other technologies to degrade and absorb organic pollutants in soil, is the key direction of repair technology; second, chemical / physico-biological joint repair technology, Use to improve the bioavailability of contaminants in soil to achieve

a higher recovery effect; Third, the physical - chemical joint repair technology, the effective use of surfactants or organic solvents photolysis of organic pollutants in the contaminated soil for Bit processing [31]-[33].

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