Research on Risks and Countermeasures of "Cities Besieged by Waste" in China—An Empirical Analysis Based on DIIS

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Research on Risks and Countermeasures of "Cities Besieged by Waste" in China—An Empirical Analysis Based on DIIS

Abstract
Nowadays, China's fast-growing cities are suffering from the problem of "Cities Besieged by Waste". The true portrayal of China today is people live in cities, while the cities are trapped in waste. China is still in this dilemma that a lot of garbage is difficult to memorial archway, clear, dispose, and manage, although local governments have promulgated corresponding policies in recent years. Tragedies caused by "Cities Besieged by Waste" are still everywhere. The risk situation and countermeasures of "Cities Besieged by Waste" should not be ignored, but should be focused on instead. Based on the DIIS (Data-Information-Intelligence-Solution) framework, this study uses Google Earth and GIS (Geographic Information System) to identify the number, area, and formation of informal landfills in 31 provincial capitals to finally generate the data of the "garbage stock". Besides, based on the DSR (Driving force-Status-Response) risk assessment model, this study identifies the risk of "Cities Besieged by Waste" of 31 provincial capitals. By analyzing the current situation of risk, identifying the source of risk, and clarifying the mechanism of risk occurrence and development, this study works on providing intellectual contribution for government departments to reduce the risk of "Cities Besieged by Waste".

Keywords
Cities Besieged by Waste; garbage disposal; volume of waste; informal landfill

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Research on Risks and Countermeasures of “Cities Besieged by Waste” in China
—An Empirical Analysis Based on DIIS

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Abstract: Nowadays, China’s fast-growing cities are suffering from the problem of “Cities Besieged by Waste.” The true portrayal of China today is people live in cities, while the cities are trapped in waste. China is still in this dilemma that it is difficult to dump, clear, transport, dispose of, and manage copious amounts of garbage, although local governments have promulgated corresponding policies in recent years. Tragedies caused by “Cities Besieged by Waste” are still everywhere. The risk situation and countermeasures of “Cities Besieged by Waste” should be focused on. Based on the Data–Information–Intelligence–Solution (DIIS) framework, this study uses Google Earth and Geographic Information System (GIS) to identify the number, area, and formation of informal landfills in 31 municipalities directly under the central government and provincial regions (31 provincial regions) to finally generate the data of the “garbage stock.” Besides, based on the Driving force–Status–Response (DSR) risk assessment model, this study identifies the risk of “Cities Besieged by Waste” of 31 provincial regions. By analyzing the current situation of risk, identifying the source of risk, and clarifying the mechanism of risk occurrence and development, this study works on providing intellectual contributions for government departments to reduce the risk of “Cities Besieged by Waste.” DOI: 10.16418/j.issn.1000-3045.2019.07.009-en

Keywords: Cities Besieged by Waste; garbage disposal; volume of waste; informal landfill

According to statistics, the annual output of urban household garbage in China in 2011 has reached 2.9 billion tons. The national garbage stock covers a total of 750,000 mu (about 50,000 hectares), and more than 450 cities are surrounded by garbage, forming a situation of “people besieged by garbage.” It is an urgent task to dispose of the garbage, the key point of which lies in the governance of informal landfills. Currently, how many informal landfills exist around cities remains unknown. According to the requirements of the 19th National Congress of the Communist Party of China, the 2017 Central Economic Work Conference clearly pointed out that pollution prevention and control is one of the three critical battles to achieve a moderately prosperous society in all respects. Although the local government introduced relevant policies under the promotion of the central government, in the face of the rapid urbanization process, it is still hard to dispose of, transport, deal with, and manage a large amount of household garbage, and the risk of “Cities Besieged by Waste” cannot be ignored. The pain point and difficulty of waste management lies in informal landfill management. Firstly, as the landfill was once the main waste treatment method in China, and restricted by the technology and process at that time, it was difficult to reach the standard of harmless treatment. Therefore, more than half of the current landfill belongs to informal landfill plants. After the closure of informal landfill sites, there exist potential pollution risks related to many aspects such as air, soil, and water. For example, cadmium pollution occurred in a garbage dump in Liuyang City, Hunan Province in 2014, resulting in two deaths and over 500 people with excessive urinary cadmium. In December 2015, more than 70 people were killed in a landslide caused by the collapsed rubbish dump in Shenzhen, Guangdong Province. Secondly, it is hard to supervise and control informal landfills because they are so widely distributed that can hardly be recognized. How many informal landfills are there in China now? How dangerous is the risk of “Cities Besieged by Waste” in provinces and cities? These problems are crucial to be solved urgently under the current situation of “Cities Besieged by Waste” in China.

Through sorting out existing studies, we found that the studies on the risks of informal landfills and waste containment in academic circles mainly focus on disciplines including environmental science and engineering, geological resources and engineering, and public health and preventive medicine, with emphasis on the “hard science” research on...
the material identification of waste risks, environmental impact, and medical consequences. Xu et al. [1] divided the technical risk of leachate leakage into three stages through systematic analysis of the construction operation and closure stages of informal landfills and their environmental characteristics and evaluated the technical risk of different stages with distinct models. The “soft science” research on the risk of “Cities Besieged by Waste” from the social science level focused on the macroscopic system construction, policy suggestions, and disposal methods. Yue [2] proposed that the solution to “Cities Besieged by Waste” and pollution from the source lay in waste classification. He specifically proposed the principle of “government leading–citizen as the majority–social participation–market operation–incentive means–scientific and technological support” for community waste classification and treatment.

It can be concluded from the existing studies that there is still a lack of empirical research on the “combination of hard and soft sciences” of the risk of “Cities Besieged by Waste,” a lack of effective identification of informal landfill sites around major cities in China, and the risk of “Cities Besieged by Waste,” which will hinder people’s comprehensive understanding of waste risk. The risk of “Cities Besieged by Waste” refers to the possibility that, on the basis of the existing garbage stock, the area of the informal garbage landfill around the city may continue to increase due to factors like management measures, governance initiative, population, and industrial positioning. On one hand, the current research on the risk of “Cities Besieged by Waste” mainly adopts the methods of data collection, field investigation, and measurement, supplemented by a small amount of exploration, which makes it difficult to identify and analyze the risk of large-scale or even nationwide informal landfills [3]. On the other hand, the current research on the evaluation indicator system of the risk of “Cities Besieged by Waste” mainly focuses on the measurement of the risk of environmental pollution rather than the comprehensive risk evaluation system [4]. Han et al. [5], based on the hazard characteristics of wastes in informal landfills and the hydrogeological conditions of the sites, used analytic hierarchy process (AHP) to conduct stratified research on the hazard factors of wastes and environmental risk factors of groundwater pollution and established the classification method and indicator system for the risk evaluation of informal landfills. However, this method is only suitable for detailed case analysis. The study itself only identifies informal landfills in small areas and lacks comprehensive consideration of overall risks.

In this study, “Data–Information–Intelligence–Solution” (DIIS), the scientific and technological think tank method, proposed by Pan et al. [6] is taken as the research idea (Figure 1). Besides, the multi-dimensional spatial data software “Google Earth” (GE) and Geographic Information System (GIS) are used to identify the number and area of informal landfills around 31 municipalities directly under the central government and provincial regions (31 provincial regions), and then to draw the distribution map. Then an indicator system is established to identify and evaluate the risk of “Cities Besieged by Waste” in 31 provincial regions. Based on the evaluation results, this paper analyzes the current situation of “Cities Besieged by Waste” in 31 provincial regions, as well as the problems faced by garbage disposal, and then puts forward solutions and policy suggestions to respond to the necessity and urgency of garbage disposal in China’s “13th Five-Year Plan.”

![Figure 1](image)

**Figure 1** DIIS framework of risk research on “Cities Besieged by Waste”

### 1 Method and data

Based on the software of GE and GIS, and field research methods, this paper investigates the area, location, and quantity of informal landfills within 10 kilometers around the buildings in 31 provincial regions. The status of the landfills at different time is observed to track the informal landfills that have been covered through the historical imaging feature of GE software. For example, there was a “7” shaped pond in the field of a village in the Haidian District, Beijing in 2002, which was partially filled in 2006 and fully filled in 2007. In 2009, the pond was covered with green plants to form a flat land (Figure 2).
Different types of informal landfills appear in distinct forms in satellite images. According to the location of landfills, informal landfills in cities are mostly bright white, with the shape of ring, fan, and ribbon, while informal landfills in villages and towns are mostly milky white and dark brown, with round and linear belts. Based on the types of waste, informal landfills composed of household garbage are mostly black or bright white, scattered and concentrated near roads, ponds, and buildings, while informal landfills made up of construction waste are mainly yellowish brown or reddish brown, mostly distributed near construction facilities and in mountain streams. Figure 3 shows waste dumping conditions in four different geographical locations, including waste dumping conditions around buildings (Figure 3a), among mountains (Figure 3b), in ponds and lakes (Figure 3c), and near water (Figure 3d).

**Figure 2** Satellite identification of informal landfills in a village in the Haidian District, Beijing in different years
(a) 2002; (b) 2006; (c) 2007; (d) 2009

**Figure 3** Satellite images of landfills in different areas
(a) Waste dumping conditions around the city; (b) Waste dumping conditions among mountains; (c) Waste dumping conditions in ponds and lakes; (d) Waste dumping conditions near water
There are differences in shape and color between the muck pile and the garbage dump during GE satellite imaging. Overlooking the muck pile, you can find that the whole is in a trapezoidal shape, and its edge is fan-shaped, while overlooking the dump, you can find that the whole is lumpy with irregular edges. The color of muck pile without canvas-cover is brownish yellow (Figure 4a), while the color of canvas-covered muck pile is dark green or brown black (Figure 4b).

Through the historical image function of GE software, informal landfills are determined, and a layer is established in GE to draw the area of landfills in circles. Finally, GE data are imported into GIS software to determine the location and area information of landfills in various regions.

In this paper, a field survey is conducted on the informal

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Table 1 Risk evaluation indicator system of “Cities Besieged by Waste” in the 31 provincial regions based on the DSR model

<table>
<thead>
<tr>
<th>Objective level</th>
<th>Primary indicators</th>
<th>Secondary indicators</th>
<th>Unit</th>
<th>Plus (+) or minus (−)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Driving force indicators (A1)</td>
<td>Household garbage clearance volume (B1)</td>
<td>10³ t</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garbage stock area (B2)</td>
<td>10⁴ m³</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban population (B3)</td>
<td>10⁶ people</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GDP growth (B4)</td>
<td>%</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>S. Status indicators (A2)</td>
<td>Built-up area (B5)</td>
<td>km²</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green area coverage (B6)</td>
<td>ha</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-enterprise organization of ecological environment (B7)</td>
<td>Entry</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social group of ecological environment (B8)</td>
<td>Entry</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>R. Response indicators (A3)</td>
<td>Expenditure on urban maintenance and construction (B9)</td>
<td>10⁶ CNY</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Documents related to garbage disposal (B10)</td>
<td>Piece</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Harmless disposal ability of household garbage (B11)</td>
<td>t/d</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quantity of sanitation vehicles (B12)</td>
<td>Entry</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staffs in water conservancy, environment, and public facilities management (B13)</td>
<td>People</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garbage disposal or city sanitation (B14)</td>
<td>10⁶ CNY</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burning capacity or sanitary landfill capacity (B15)</td>
<td>%</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burning capacity or harmless disposal ability of domestic garbage (B16)</td>
<td>%</td>
<td>−</td>
<td></td>
</tr>
</tbody>
</table>

The research data of this paper are from relevant statistical yearbook and network. Among them, the yearbooks include China City Statistical Yearbook, China Statistical Yearbook on Environment, China Urban-Rural and Urban Construction Statistical Yearbook, China Population and Employment Statistics Yearbook, and China Statistical Yearbook. Network data include the Ministry of Ecology and Environmental of the People’s Republic of China, and Environmental Protection Bureaus in these provincial regions.
landfill in Beijing identified by GE to ensure the accuracy of the informal landfill. In addition, GIS software is used to calculate the area of the landfill shape drawn by GE software to ensure the standardization of the calculation process and the accuracy of data results.

2 Information disclosure

2.1 Construction of risk evaluation indicator system of “Cities Besieged by Waste”

This paper establishes the risk evaluation indicator system of “Cities Besieged by Waste” to measure its driving force, current situation, and resistance of each city. Based on the conceptual framework of “Driving Force–Status–Response” (DSR) model, this paper measures the risk of “Cities Besieged by Waste” and emphasizes the interaction between economic operation and environmental impact, so as to better identify the hazards brought by informal landfills to residents’ lives. The risk of “Cities Besieged by Waste” is measured based on the DSR model, in which “Driving force” (D) represents the driving force of economic development, population expansion, and other human activities on the risk of “Cities Besieged by Waste.” “Status” (S) refers to the status quo of people’s social and natural environment. “Response” (R) refers to the actions and measures taken by individuals and relevant institutions to avoid the risk of “Cities Besieged by Waste” based on risk-driving factors and the current situation. The core to evaluate the risk of “Cities Besieged by Waste” through the DSR model is to see whether a city’s capacity of garbage management response can keep up with the driving force of garbage growth, which means that the risk of “Cities Besieged by Waste” is low if they match.

By referring to relevant studies [9–12] and making some improvements, we can establish the risk evaluation indicator system of “Cities Besieged by Waste” in the 31 provincial regions (Table 1). The system involves (1) driving force indicators, including household garbage clearance volume, garbage stock area, urban population, and gross domestic product (GDP) growth; (2) status indicators, including built-up area, green area coverage, non-enterprise organization of ecological environment, and social group of ecological environment; (3) response indicators, such as expenditure on urban maintenance and construction, documents related to garbage disposal, harmless disposal ability of household garbage, the quantity of sanitation vehicles, staffs in water conservancy, environment, and public facilities management, garbage disposal or city sanitation, burning capacity or sanitary landfill capacity, and burning capacity or harmless disposal ability of household garbage.

2.2 Risk evaluation results of “Cities Besieged by Waste”

Based on the DSR model, the 31 provincial regions are evaluated. Two rounds of expert scoring are adopted to obtain the indicator weights of driving force, status, and response, which are 0.583 4, 0.103 2, and 0.323 4 respectively (Figures 5 and 6).

(1) In general, since the issuance of the “12th Five-Year” National MSW Treatment Facilities Construction Plan,” the number and scale of informal landfills have been reduced. Based on the historical image function of GE, it can be seen from the historical data of informal landfills that in the past five to ten years, the number of informal landfills has been on the gradual decrease with the progress of urbanization and the continuous sprawl of urban margins, especially after the key disposal of the “12th Five-year Plan.” However, a gradual shift in the location of informal landfills towards exurbs or low-value land can be observed. As human activity expands further, the number of informal landfills in the further suburbs witnesses a smooth increase.

(2) Half of the megacities have a high risk of “Cities Besieged by Waste,” which is attributable mainly to the over-large population, the low priority given to disposal, and the weak capacity for health care. Chongqing and Chengdu have a large stock of informal landfills while a few urban power plants of waste incineration and sanitary landfills. The information disclosure does not show that the government and society actively participate in garbage disposal. All of these lead to the high risk of “Cities Besieged by Waste.” Megacities with medium risks, such as Xi’an and Zhengzhou, have a relatively weak capacity of garbage disposal. However, due to their large urban area and the active garbage disposal carried out by the government and the society, the risk of “Cities Besieged by Waste” is not raised due to their overlarge population.

(3) In megacities, garbage is disposed outside the province, which increases the risk of “Cities Besieged by Waste” in surrounding cities. Compared with those of Guangzhou, the garbage disposal capacities of Beijing and Shanghai are weaker but the garbage stock around the two cities is smaller. On the contrary, there is a large waste stock in the surrounding areas of Shijiazhuang and Hangzhou, the neighboring provincial regions of Beijing and Shanghai, respectively. Among them, Shijiazhuang has twice the per capita capacity of dealing with waste that of Beijing, indicating that there are waste discharge and transportation in megacities, which undoubtedly increases the risk of “Cities Besieged by Waste” in the discharged cities.

(4) More than half of the supercities have a high risk of “Cities Besieged by Waste,” but their garbage disposal ability is weak. Garbage disposal in coastal cities is relatively active,
followed by cities with slow economic growth, and those with fast growth slack in garbage disposal. Most supercities are in a medium risk of “Cities Besieged by Waste.” Although there is a 34% difference between the average population and that of megacities, there is a 67% difference between the corresponding garbage disposal degree and that of megacities. In supercities, there is a lack of enthusiasm for garbage disposal and a relatively large amount of garbage around the city. For example, cities including Zhengzhou, Wuhan, Fuzhou, and Xi’an have issued less than 100 documents related to garbage disposal, while Shanghai has issued more than 2,000 such documents.

5) Provincial regions with special positioning have a low risk of “Cities Besieged by Waste.” Cases in point are Kunming and Haikou.

3 Comprehensive judgment

This paper analyzes the problems in the current situation from four aspects, including the target, participants, the relationship between participants, and regulation.

(1) The chaotic goal of urban environmental protection is the main reason leading to the high risk of “Cities Besieged by Waste.” The goal of environmental protection in most cities is chaotic. The question of whether “garbage disposal” is a primary or secondary goal under “management” is worthy of in-depth discussion by the governance body. At present, the government’s efforts in garbage disposal mainly focus on the development of the end-treatment industry of garbage. The management of garbage classification in the early stage is low. Although garbage classification devices have been widely used in every corner, the procedures of supervising citizens in garbage classification by management means are absent. However, the ultimate goal of environmental protection is to achieve the symbiotic stage of harmonious development between human and nature. If the “management” in the early stage is not in place, it will bring greater pressure to the “disposal” in the later stage.

(2) In cities that are actively engaged in garbage disposal, a single participant leads to a lack of predictability in garbage disposal and a lack of hierarchical disposal methods, which will increase the risk of “Cities Besieged by Waste.” At present, the main body of environmental governance is the government. Therefore, once the government slackens its missions, its garbage stock will continuously accumulate and the risk of “Cities Besieged by Waste” will be higher. The main reason is that the participant in the garbage disposal is solely the government without social resources, while the secondary reason lies in that the formulation of disposal policies mostly relies on the awareness of the severity of the grassroots government, which often brings the expediency of disposal policies as well as the lack of predictability and overall picture, ultimately leading to a higher risk of “Cities Besieged by Waste.”

(3) Unclear distribution of interests among participants
affects the overall disposal progress, thus increasing the risk of “Cities Besieged by Waste.” Green development is the key to the healthy and sustainable survival of the members of society. However, from the perspective of practical actions, individual behavior is conducted mainly for the immediate vested interests due to their limitations, which is often contradictory to the collective overall actions. Individuals pursue rapid economic interests, but garbage disposal is a public welfare undertaking with much investment and little obvious return. Therefore, when the collective governance action is opposed by the individual’s limited interest demand, the individual often shows “free rider” behavior. Due to the lack of shaping the deep-rooted overall and long-term garbage disposal thinking of social members, garbage disposal policies lead to the lack of motivation for collective action of garbage disposal, which ultimately increases the risk of “Cities Besieged by Waste.”

4 The lack of power regulation directly leads to a higher risk of “Cities Besieged by Waste.” The governance of “Cities Besieged by Waste” and its benefits are special and sophisticated. On one hand, the economic and social benefits release slowly. On the other hand, garbage disposal benefits do not have a leverage effect, which cannot drive other economic structures. These two reasons result in the lack of subjective initiative of each subject in garbage disposal. When the external incentive mechanism is missing, the risk of “Cities Besieged by Waste” will go up directly.

Policy suggestions

Aiming at the problems in the four aspects of the comprehensive judgment, such as the target, participants, the relationship between participants, and regulation, this paper proposes four policy suggestions.

4.1 Definition of garbage disposal target

Identifying the goals for garbage disposal requires first defining the garbage disposal requirements. A new garbage disposal mode should be built to realize the “good disposal” of garbage and maintain effective and sustainable garbage disposal. In the new government-dominant mode operated in accordance with law and regulations, citizens take part and the market plays its role. The current garbage disposal needs to be transformed from “post-management” to “front-end management” mode: ① The government should change from the direct contracting based on the government to forming a government-led pattern in which the market and society orderly participate in the governance through policy guidance, service provision, and market supervision. ② The old passive emergency management way needs to be updated, and the sudden remediation is as the source of governance and long-term management. The regulation means should be changed from administrative leading to mainly by legal norms and economic means. ③ Management process transforms from the current “end treatment” to the mode of whole process and comprehensive management, namely, “classification–collection–cleaning–use–processing.” These changes require the participation of more departments in the planning and implementation, such as the Ministry of Ecology and Environment, the Ministry of Commerce, the Ministry of Agriculture and Rural Affairs, and the Ministry of Industry and Information Technology of the People’s Republic of China. The change of disposal concept needs to be reflected in the establishment of the waste discharge evaluation objectives, such as controlling the amount of waste incineration, composting, and sanitary landfill in each province and city, and clearly stipulating the daily clearance volume of waste per capita.

4.2 More kinds of participants in garbage disposal

As a quasi-public service, garbage disposal is not the sole responsibility of the government. Therefore, increasing the kinds of participants of garbage disposal from the legal perspective is the only way to solve the problem of the “government-alone,” and also the fundamental way to avoid the risk of “Cities Besieged by Waste.” The government should actively seek consensus with Environmental Non-Governmental Organization (NGO), experts, scholars, and news media to exert the power of social organizations and individuals. Specific practices include fostering a unified, open, competitive, and orderly market environment for garbage disposal and providing multiple channels for enterprises to make profits. In addition, a “reduction and classification” oriented model of the government and social cooperation in garbage disposal should be formed, and social organizations, enterprises, and individuals (volunteers) should be encouraged and standardized to engage in garbage disposal in accordance with the law, so as to form a networked and law-based garbage disposal system.

4.3 Identification of the relationship between the main bodies of garbage disposal

A clear division of the power between the central government and local governments at all levels in the garbage disposal can fundamentally avoid unclear distribution of interests among participants.

(1) The responsibilities of governments at all levels on garbage disposal should be distinguished to ensure that all work is carried out in an orderly manner, avoiding overlapping and “wrangling.” Specifically, the central government is mainly responsible for the formulation of laws, regulations, and policies for garbage disposal, as well as local supervision. The provincial governments are mainly responsible for the overall coordination, supervision, and inspection of garbage disposal within their jurisdiction areas. The governments at district and county levels should assume the main responsibility of garbage disposal.

(2) Dynamic regulation for the inter-subject relationship between government departments will be designed, which
helps play the initiative of governments at all levels and ensure the effective implementation of garbage disposal. ① The lifelong accountability system for disposal officials and environmental protection projects is established, and the environmental protection effect is included in the performance evaluation criteria of the official promotion so as to avoid fake disposal and poor engineering. In addition, it needs prompt disposal before development and inspection. ② The dialogue and cooperation mechanism between coastal cities and central and western cities on disposal experience needs to be established; the mechanism for building disposal capacity at the grassroots level should be improved; the ability of front-line workers to identify and evaluate garbage risks will be actively cultivated. The developed coastal regions, such as Shanghai and Guangzhou, will be encouraged to provide technical support to the central and western regions, and experts and scholars are organized to give a series of lectures on the development of garbage control technologies and the establishment of a government–market cooperation mechanism, so as to promote the central and western regions to improve their own disposal concepts and technologies. The grassroots government and its staff are the foundation of garbage disposal, and the ability of grassroots staff to identify risks and deal with problems is the key to disposal. ③ The governments at all levels in the city cooperate to jointly build a city brand plan to inject impetus to disposal. A city brand plan will be created to establish a long-term brand image for the city. In addition, civic ecological education, the cultivation of environmental protection, and healthy lifestyle advocacy are carried out so as to avoid the conflict between individual narrow interests and overall interests, making citizens proud of the city where they live to maintain the image of the city and jointly seek the future development here.

4.4 Power regulation of garbage control

(1) The “No littering” mechanism is promoted, and the garbage-disposal charging mechanism is established and improved. Through social supervision at the community level, at a certain time, citizens are allowed to put the classified garbage in specified locations, and those who dump garbage privately will be educated and punished. Garbage collectors process and recycle the classified garbage, and finally reduce the amount of garbage through incineration, landfill, and composting, thereby diminishing the risk of “Cities Besieged by Waste.”

(2) The garbage-disposal charging mechanism will be established and improved. ① The scope of income increase will be expanded. Enterprises and individuals of different natures are included in the scope of expropriation, thereby supplementing the garbage disposal funds and improving the capacity and level of the disposal. The garbage disposal charging policy is implemented differently, and the collected fees are used as a government fund which will be managed separately and dedicated exclusively to garbage disposal. ② A “dynamic fee mechanism will be established for household waste. In accordance with the principle of “pay more for more emissions, pay less for fewer emissions, charge more for mixed waste, and charge less for classified waste,” the generation of total garbage and the increase in garbage disposal funds are controlled to reduce the risk of “Cities Besieged by Waste.” It is necessary to make full use of the mature technology platform to increase the charging rate.

(3) Technology is used to promote the transformation of waste management methods and effects, and advanced science and technology are used to promote the fundamental transformation of waste reduction, recycling, and harmless disposal. The R&D support and practical application of advanced science and technology will be the guarantee of tackling “Cities Besieged by Waste,” which is conducive to the efficient and harmless operation of waste discharge, transportation, and disposal. At present, on the basis of sanitary landfill, biochemical treatment, and incineration, the exploratory, applicable, and prospective technological achievements have emerged. In terms of the disposal technology of landfill leachate, there have been advanced technologies such as physicochemical treatment technology and membrane separation technology in the world. In China, the old landfill leachate treatment technology with biological methods still remains, and the treatment effect is not ideal. Therefore, China must follow up the research on international advanced technology to form a garbage disposal technology system with reverse osmosis technology as the cutting-edge technology and multiple technologies combined to realize green and sustainable garbage disposal.

References


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