



Research on Industrial Development and Environmental Pollution in Neijiang City

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Abstract: This article conducts research on the industrial development and environmental pollution issues in Neijiang City, Sichuan Province, mainly focusing on the current impact of factories and enterprises on environmental pollution. I went to Wenxin Brick Factory in Dongxing District, Neijiang City to conduct research and analyze dust pollution, air pollution, and water pollution based on local conditions.

Keywords: Neijiang City; Industrial development; environmental pollution

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I. Introduction

In the context of ecological environment protection, environmental pollution has continuously achieved new results, and public happiness has significantly increased. However, there is still a certain gap between the growing demand for a beautiful ecological environment and the current environmental governance capacity, with outstanding environmental pollution performance^[1]. During his research in Neijiang, Zhang Zhongwei, Deputy Secretary of the Provincial Party Committee and Governor, emphasized that in order to achieve rapid and good economic and social development, it is necessary to adhere to the scientific development concept to lead the overall economic and social development, adhere to the path of new industrialization, firmly establish the concept that environmental protection is development, increase environmental protection efforts, further transform the growth mode, and strive to achieve economic development, clean development, and safe development^[2].

As a typical traditional old industrial city, Neijiang has a relatively low industrial level, and environmental problems in the industrial sector are relatively prominent^[4]. Neijiang city is located in the central part of Sichuan Province, China, with geographical coordinates of approximately 28 ° 50 'N and 105 ° 02' E. Neijiang has a relatively flat terrain and is part of the Sichuan Basin, with abundant water resources, including the Tuojiang River. The main economic pillars include manufacturing, chemical, metallurgical and other industrial sectors, and industrial development has made a significant contribution to the economy of Neijiang City. Neijiang City has convenient transportation, with transportation networks such as railways and highways. The development of highways and railways has promoted the connection between Neijiang City and surrounding cities. In addition, Neijiang City has a long history and rich cultural traditions, with some historical and cultural attractions such as Guangfu Temple. Despite rapid industrial development, agriculture still occupies a place in the economy of Neijiang City, with main agricultural products including rice, wheat, rapeseed, etc.

1 One Current status of atmospheric environment in Neijiang city:

Figure 1.1 Concentration and Changes of Pollutants in Counties (Cities, Districts) of Neijiang City in 2022

单位：CO为mg/m³，其余为μg/m³

县(市、区)	SO ₂		NO ₂		CO		O ₃		PM _{2.5}		PM ₁₀	
	浓度	同比	浓度	同比	浓度	同比	浓度	同比	浓度	同比	浓度	同比
高新区	9	12.5%	25	4.2%	1.1	-8.3%	160	21.2%	29	-9.4%	41	-14.6%
东兴区	8	-11.1%	22	-8.3%	1.1	10.0%	159	17.8%	33	-10.8%	47	-13.0%
市中区	8	-11.1%	23	9.5%	1.0	-16.7%	160	14.3%	33	-10.8%	44	-10.2%
经开区	8	-20.0%	26	0.0%	1.0	-9.1%	162	16.5%	34	-2.9%	50	-12.3%
威远县	9	-43.8%	19	18.8%	1.1	-8.3%	148	21.3%	35	25.0%	59	20.4%
资中县	10	-44.4%	18	-21.7%	1.4	-12.5%	158	20.6%	29	3.6%	47	0.0%
隆昌市	13	-7.1%	21	-19.2%	1.2	-14.3%	155	19.2%	37	0.0%	60	-3.2%

As shown in Figure 1.1 and survey data, in 2022, the average annual concentrations of sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), inhalable particulate matter (PM₁₀), and fine particulate matter (PM_{2.5}) in Neijiang urban area were 8 micrograms/cubic meter, 24 micrograms/cubic meter, 1.1 milligrams/cubic meter, 160 micrograms/cubic meter, 46 micrograms/cubic meter, and 32 micrograms/cubic meter, respectively, with year-on-year changes of -11.1%, 0.0%, and 0.0%, respectively 16.8%, -11.5%, and -8.6%; The comprehensive index of environmental air quality was 3.58, a year-on-year decrease of 1.4%, indicating an improvement in air quality.

1.1 Current Situation of Air Environment Quality

In 2022, the environmental air quality in the main urban area of Neijiang City reached the second level standard, and the air quality improved year-on-year. 307 days of compliance, with a compliance rate of 84.1%, an increase of 0.3 percentage points year-on-year; The comprehensive index of environmental air quality was 3.58, a year-on-year decrease of 1.4%. The compliance rate of environmental air quality in counties (cities, districts) of Neijiang City is between 82.0% and 90.7%; The comprehensive index of environmental air quality is between 3.46 and 3.93. The air quality in the High tech Zone and Weiyuan County decreased year-on-year, while the air quality in other counties (cities, districts) improved year-on-year.

In 2022, the air quality in rural areas such as Yuquanshan Village and

Yangpingchong Village was good or above, with 307 days of good air quality in Guyu Village, accounting for 84.1% of the total.

In addition, in 2022, the precipitation in Neijiang City significantly decreased, with an annual average pH of 6.30 and an acid rain frequency of 1.0%. It belongs to a non acid rain area and there is no local acid rain pollution. The monthly average range of precipitation pH is 5.68 to 6.98, with an average annual value of 6.30, a year-on-year decrease of 0.79. The frequency of acid rain occurrence is 1.0%, an increase of 1.0 percentage point. The annual average concentration of the main acidic anions sulfate and nitrate in precipitation has significantly increased^[9].

1.2 Analysis of atmospheric pollutant composition

Industrial exhaust gas contains a large amount of pollutants, such as sulfur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter, etc. After being discharged into the atmosphere, these pollutants mix with other gases and aerosols to form pollutants such as ozone, acid rain, and fine particulate matter, which directly affect air quality. The air pollution in Neijiang City is a typical coal smoke type pollution. The composition type of pollutants is mainly the industrial structure type dominated by coal consumption. Coal, as the main industrial power, raw material, and civilian energy source, accounts for more than the total emissions of atmospheric pollutants. In addition, the dust emitted from building materials, smelting, and construction also accounts for a considerable proportion.

1.3 Classification and Impact of Air Pollution

Air pollution includes inhalable particulate matter (PM₁₀) and fine particulate matter (PM_{2.5}), which have a direct impact on the respiratory system and human health. Sulfur dioxide (SO₂), nitrogen oxides (NO_x),

carbon monoxide (CO), ozone (O₃), and other gases have significant impacts on air quality and human health [6]. Waste gas emitted from industrial production processes, including harmful chemicals and particulate matter. The exhaust gas generated by burning fuel from vehicles such as cars and trucks, including particulate matter and nitrogen oxides. Exhaust gases from households, businesses, and other daily activities, such as carbon monoxide and particulate matter produced by burning fuel.

2 Conduct research on the on-site situation of Wenxin Machine Brick Factory in Dongxing District, Neijiang City

Industrial development has made a significant contribution to the economy of Neijiang City, but it has also generated a lot of pollution. Therefore, I went to the local Wenxin Brick Factory for on-site inspection. Figures 2.1 and 2.2 show some of the external and internal structures of the brick factory.



Figure 2.1



Figure 2.2

2.1 Location and Introduction of Brick Factory

Wenxin Brick Factory in Dongxing District, Neijiang City, Sichuan Province, is located on the west side of National Highway 247 in Dongxing District. It is an enterprise mainly engaged in the non-metallic mineral products industry, used for manufacturing non-metallic mineral products, stone and other building materials. As shown in Figure 2.3, it is the internal structure of the brick factory. It can be seen from the figure that there is a large amount of coal powder accumulation, some mixing machines, etc. The ground environment is basically clean, but some buildings are slightly dilapidated, with a lot of dust flying and poor air quality.



Figure 2.3

2.2 The production process of brick factories

The production process of bricks includes stages such as raw material preparation, forming, drying, and firing. Clay is one of the main raw materials, and brick factories usually extract clay from underground or open-pit mines. Mix clay with other soil raw materials to obtain the desired composition and properties. Squeeze or cut the mixed raw materials to form bricks. Use a molding machine or mold to shape bricks into standard sizes and shapes. Bricks are exposed to the natural environment on an open-air site and undergo initial drying through natural wind. Bricks may undergo a certain period of natural air drying before being dried more quickly by manual means. Place the bricks in front of the kiln for preheating to reduce temperature shock inside the kiln. Bricks enter the high-temperature kiln and undergo a certain period of high-temperature treatment to harden and possess structural strength. Then inspect the fired bricks and package the qualified products. The packaged bricks are transported to customers or stored in warehouses. As shown in Figure 2.4, there are some raw materials from the brick factory. From the figure, it can be seen that the materials and other combustibles are in powder form and placed outdoors, which can easily cause dust to fly through the wind and lead to air pollution. And the brick factory is built around the road, which further exacerbates the local air pollution and dust.



Figure 2.4

3 Environmental pollution impact and prevention and control

The production process of brick factories may lead to various environmental pollution problems, mainly concentrated in dust, gas, and water pollution. According to the research on the air pollution situation in Neijiang City, it was found that the atmospheric environment quality is comprehensively affected by factors such as motor vehicle exhaust emissions, industrial enterprise pollution emissions, construction site dust, and straw burning^[3]. Neijiang City is an old industrial base, and the task of state-owned enterprise reform is heavy, making it difficult to adjust the structure. We must fully implement the Scientific Outlook on Development and adhere to the path of new industrialization^[2].

3.1 Dust pollution

Dust pollution in brick factories refers to the potential threat to air quality and human health caused by the diffusion of dust particles generated by squeezing, cutting, shaping, drying and other operations into the surrounding environment during the production process.

(1) The following is the current situation of dust pollution in brick factories:

On the one hand, the stages of extrusion, cutting, and forming involve the processing and forming of raw materials, which may produce a large amount of small particles. During the natural air drying and artificial drying processes of brick adobe, small particles that can fly can also be produced. Different types of clay and soil raw materials have different particle characteristics, which affect the generation of dust. The use of different molding and drying processes can affect the generation and diffusion of dust. The operation and maintenance status of the equipment can also affect the amount of dust generated.

On the other hand, dust emissions from brick factories can lead to an increase in the concentration of particulate matter in the surrounding air, affecting air quality. Small dust particles may enter the respiratory tract, posing a potential threat to the respiratory system of residents, especially for workers and residents of surrounding communities who are exposed for a long time.

(2) We can take the following measures to prevent and control this:

Firstly, use enclosed extrusion, cutting, and forming equipment to reduce the diffusion of dust. Secondly, in the

process of generating dust, a water spray system is used to reduce the concentration of particulate matter. Install dust collection equipment to effectively collect and treat the emitted dust. In addition, brick factories can establish effective communication mechanisms with surrounding communities, listen to feedback from residents about dust pollution, and take appropriate measures to solve problems.

Overall, effective dust control is an important part of brick factory environmental management, which helps to reduce negative impacts on the surrounding environment and human health. Adopting comprehensive management measures and technical means can minimize dust pollution to the greatest extent.

3.2 Atmospheric pollution

Industrial enterprise pollution is an important source of air pollution in Neijiang City^[5]. The industrial structure of Neijiang City is not reasonable enough, and many industrial enterprises only focus on the layout close to the water source at the beginning of the layout without considering the urban wind direction, resulting in air pollution. Moreover, there are relatively few laws and regulations regarding the atmospheric environment, and the lack of action or timely supervision by environmental regulatory authorities continues to cause pollution to the atmospheric environment in the urban area of Neijiang City^[6].

Air pollution in brick factories refers to the problem of gas emissions caused by combustion, chemical reactions, and other operations during the production process, which may have an impact on air quality and the environment. According to field investigations, as shown in Figures 3.1 and 3.2, the actual emissions of pollutants during the production process of brick factories are shown. From the pictures, it can be seen that the old chimneys are emitting gases from burning raw materials, which have not been processed and are directly discharged into the air, which is a serious problem of air pollution. In addition, there are relatively few green trees and plants planted around, and it can be seen that most of them have withered, making it difficult to have a greening effect on the air, which has exacerbated the air pollution in Neijiang City.



Figure 3.1



Figure 3.2

(1) The following is the current situation of gas pollution in brick factories:

Main gas pollutants:

Sulfur dioxide (SO₂): Usually comes from fuel combustion, especially when using sulfur-containing fuels.

Nitrogen oxides (NO_x): They are also products of combustion processes and are harmful to the ozone layer and atmosphere.

Particle matter: not only solid particles, but also inhalable particles, which are part of aerosols.

Carbon monoxide (CO): mainly caused by incomplete combustion and harmful to the human body.

Brick factories usually use coal, natural gas, etc. as energy sources, and combustion produces carbon dioxide, sulfur dioxide, etc. The drying and firing stages of brick billets may release carbon monoxide, nitrogen oxides, etc. If limestone is used during the process, decomposition may release carbon dioxide. The emission of gas pollutants may lead to a decrease in air quality in the surrounding areas, posing a threat to human health and the environment. SO₂ and NO_x emissions may lead to acid rain and have adverse effects on soil and water bodies.

(2) Suggestions for gas pollution control measures include:

Replacing coal with clean energy is the most fundamental way to reduce SO₂, PM₁₀, and TSP pollution in the atmosphere^[7]. Change energy structure and optimize urban atmospheric environment. Firstly, use efficient combustion technology to reduce the generation of carbon monoxide and nitrogen oxides. Install gas purification equipment such as flue gas desulfurization and denitrification. Secondly, consider using cleaner energy sources such as natural gas to reduce gas pollutant emissions. The most important thing is that brick factories need to comply with local and national environmental regulations to ensure that gas emissions are within the specified range; Conduct gas emission monitoring and report emission data in accordance with regulatory requirements; Promote the use of more advanced brick firing technology to reduce emissions; Improve overall energy efficiency of brick factories and reduce fuel usage.

3.3 Water pollution

Brick factory water pollution refers to the problem of water pollution caused by raw material treatment, production processes, and wastewater discharge during the production process of brick factories. There are a total of 11 black and odorous water bodies in the urban area of Neijiang, including 4 severe black and odorous water bodies and 7 mild black and odorous water bodies^[3].



Figure 3.3



Figure 3.4

As shown in Figure 3.3; 3.4 is the impact of brick factory industry on water pollution, indicating that rural industry has a significant impact on the water environment quality of Neijiang City, as well as the water quality of major rivers. The governance of rural industry plays an important role in improving rural living environment and building beautiful countryside^[3].

Figure 3.5 Water quality evaluation results of major rivers in Neijiang City since 2015

县(市、区)	河流	断面名称	控制断面级别	水质类别			
				2015年	2016年	2017年	2018年1—8月
市中区	沱江干流	老母滩	国控	IV	IV	IV	III
东兴区							
隆昌市	九曲河	白水滩	市控	劣V	IV	IV	IV
隆昌市	三江河	三江河	市控	—	劣V	V	IV
威远县	威远河	廖家堰	国控	劣V	劣V	IV	V
威远县	越溪河	黄龙桥	自贡国控	—	III	IV	IV
市中区	乌龙河	双河口	市控	IV	V	V	IV
资中县	球溪河	球溪河口	国控	IV	劣V	劣V	V
东兴区	大清流河	砖瓦厂	市控	III	IV	IV	III

According to research data, the water quality of the control points of the main rivers in the Neijiang area is shown in Figure 3.5. As shown in the figure, the water quality of the main rivers in Neijiang City is showing a trend of improvement year by year. Especially in the sections of Baishuitan, Liaojiayan, Sanjianghe, and Qiuxi River mouths, significant improvements were made in 2018, basically eliminating the five types of poor water quality^[3].

(1) The following is the current situation of water pollution in brick factories:

The extraction and processing of raw materials (such as clay and limestone) in brick factories may introduce suspended solids and organic matter. During the mixing, forming, drying, and firing processes of bricks, wastewater may be generated, containing suspended solids, organic and inorganic substances. Wastewater discharge may contain high concentrations of suspended solids, nitrogen, phosphorus and other pollutants, including dust, sediment, etc., which can lead to water turbidity.

In addition, there may be organic components in the raw materials in the water, as well as organic waste from the production process, such as nitrogen, phosphorus and other inorganic substances, which may lead to eutrophication of the water and excessive growth of algae. The discharge of suspended solids and organic matter may lead to a decrease in water quality and affect aquatic ecosystems. The discharge of wastewater into the soil may cause soil pollution and affect the surrounding ecological environment.

(2) Suggestions for water pollution control measures in brick factories:

Firstly, the government should encourage the installation of wastewater treatment facilities, pre-treatment and treatment of wastewater to reduce pollutant emissions. Secondly, promote a circular water utilization system to reduce the amount of wastewater discharged to the outside world. Again, advanced wastewater treatment technologies such as biological and chemical treatments should be utilized. And further improve the supporting facilities of sewage treatment plants, adopt more advanced sewage treatment technologies, achieve professional, large-scale, and efficient treatment of collected sewage, and comprehensively improve the efficiency of rural and township sewage treatment^[8]. In addition, promote brick factories to use more environmentally friendly production processes to reduce their impact on water bodies.

II. Conclusion

With the rapid development of modern society, the industrial economy has been effectively improved, and the consumption level has steadily increased. At the same time, the development of the industrial economy has also brought a series of environmental pollution problems^[3]. Through on-site inspection of Neijiang Wenxin Brick Factory, it was found that there are a series of environmental pollution problems. Through reasonable process design, construction and management of wastewater treatment facilities, and compliance with environmental regulations, the pollution of the brick factory to the environment can be effectively reduced. At the same time, brick factories need to pay attention to the conservation and recycling of water resources in the production process to achieve sustainable production. It is suggested that in future industrial pollution source supervision work, the main pollution areas and industries should be listed as key management objects, and enterprises should be urged to implement advanced, mature, and applicable clean production technology transformation, effectively improve the level of clean production, and reduce the generation and emission of pollutants from the source; At the same time, it is necessary to clarify the responsibilities of the main body of enterprise pollution control, supervise enterprises to conduct strict pollution monitoring, and ensure the stable and normal operation of pollution control facilities^[4].

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