

Detailed Investigation and Evaluation of Site Environment for Construction Land Change

--Take Dazhou Jinchang Ferroalloy Limited Company Plot as an Example

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Abstract

As the process of urbanization continues to accelerate, soil pollution has followed, and the soil environmental pollution accidents on the site caused by environmental problems left by industrial enterprises have affected the human settlement environment. Based on the site history and soil pollution of Dazhou Jinchang Ferroalloy Co., Ltd., combined with the future use and development plan of the area, a detailed survey of the soil environmental quality of the survey site and surrounding areas is carried out to clarify the main pollution types, pollution levels and pollution scopes of the site, and calculate The restoration target value of the site. According to the conclusions of detailed site investigation and evaluation, the boundary of site pollution shall be divided, the scope of remediation and the plan for remediation of contaminated soil shall be calculated, and a certain theoretical basis shall be provided for the site pollution prevention and control or remediation plan.

Keywords

Site Survey; Soil Pollution; Environmental Assessment; Soil Remediation.

1. Introduction

In recent decades, in the process of rapid urbanization, the demand for urban construction land applications has also begun to increase. Many industrial enterprises in the suburbs of cities have suspended production or relocation, leaving behind a large number of polluted industrial sites that urgently need to be investigated, evaluated, and repaired. Long-term industrial production activities and improper environmental management have severely polluted the soil on the sites left by these relocated companies [1-3], and soil pollution has become an environmental pollution problem that needs to be solved urgently by the current land use [4]; The "Two-City Economic Circle" and the "14th Five-Year Plan" require that the restoration of abandoned polluted industrial sites around the city be initiated as soon as possible to eliminate environmental pollution and ensure the safety of human settlements. Therefore, this article takes the plot site of Dazhou Jinchang Ferroalloy Co., Ltd. as the research object, conducts a detailed investigation of the soil environment of the site contaminated by heavy metals, conducts plot history and status investigation, plot pollution identification, and soil sample collection and analysis. Analyze the content of heavy metal pollutants such as lead, copper, nickel and arsenic in the soil environment of the plant, carry out health risk assessment of contaminated sites, and propose corresponding restoration measures for redevelopment and utilization, providing environmental information for the development and construction of land types in Dazhou , To provide a scientific basis for government decision-making.

2. Land overview

Dazhou Jinchang Ferroalloy Co Ltd was established in 2007 and is located in Gaoyan Village, Luojiang Town, Tongchuan District, Dazhou City. The main business scope is the sale of ferroalloys, pig iron, charge and hardware. Due to the change of the company name, the original Dazhou Jinchang Ferroalloy Co Ltd related ground buildings and production equipment were all demolished. The planned land within the land parcel is a first-class residential land. The survey area of this site is mainly the plot of Dazhou Jinchang Ferroalloy Co Ltd. The center coordinates of the survey area are 107°32'15.059" east longitude and 31°18'30.643" north latitude. At present, the main business scope of the plot includes: health management, comprehensive medical services, recuperation services, tourism resource development, housekeeping services, sales, fitness equipment, etc. Site leveling has been carried out in the factory area of the plot, and office buildings have been built. Preliminary investigation results show that the presence of benzo [a] pyrene exceeds the screening value of the second type of land in the "Soil Environmental Quality Construction Land Soil Pollution Risk Control Standard (Trial)" (GB36600-2018) [5], according to the relevant laws and regulations of Sichuan Province on site environmental management In accordance with the requirements of standards and regulations, the site needs to conduct detailed site environment investigation and health risk assessment.

3. Detailed investigation of site environment

3.1. Investigation execution standards

The investigation and evaluation of this research are in accordance with the "Technical Guidelines for the Investigation of Soil Pollution Status of Construction Land" (HJ25.1-2019), "Technical Guidelines for the Control and Remediation of Soil Pollution Risk Management and Remediation Monitoring of Construction Land" (HJ25.2-2019), "Soil for Construction Land" Technical Guidelines for Pollution Risk Assessment (HJ25.3-2019), Technical Guidelines for Soil Environmental Investigation and Assessment of Construction Land (Ministry of Environmental Protection Announcement No. 72 in 2017) and other documents are implemented.

3.2. Sample collection and analysis

According to the requirements of "Technical Guidelines for Soil Pollution Risk Control and Remediation Monitoring of Construction Land" (HJ 25.2-2019), a total of 33 soil monitoring points were set up in this detailed investigation. This soil test mainly includes indicators such as heavy metals and inorganics, volatile organic compounds, semi-volatile organic compounds and petroleum hydrocarbons. The soil sample detection and analysis methods are shown in Table 1 [6].

4. Detailed investigation of test results and evaluation

4.1. Soil sample testing methods and methods

In this paper, soil testing mainly includes 45 indicators such as heavy metals and inorganics, volatile organic compounds, semi-volatile organic compounds and petroleum hydrocarbons [7]. The test items are tested in accordance with the "Soil Environmental Quality Construction Land Soil Pollution Risk Control Standard (Trial)" GB36600-2018. According to the "Regulatory Detailed Planning for the Second Phase of Huancheng Road and Huanfeng Industry Avenue in Dazhou City", the plot of Dazhou Jinchang Ferroalloy Co., Ltd. is planned to be residential land (R), which belongs to the "Soil Environmental Quality Construction Land Soil Pollution Risk Management and Control" The first type of construction land specified in the Standard (GB36600-2018). In this paper, the current national standard for soil pollutant evaluation of

the site survey is selected, namely the "Soil Environmental Quality Construction Land Soil Pollution Risk Control Standard" (GB36600-2018), the first type of land risk screening value as the evaluation standard for this survey.

4.2. Detailed investigation conclusion of the site environment

Table 1. Statistical Table of Test Results of Various Indexes of Soil

Test items	Test method	Unit	Average value of test results ("ND" means that the test result is less than the detection limit of the method)	Screening value (first type of land)	Control value (first-class land)
PH	Determination of soil pH HJ 962-2018	Dimensionless	8.33	—	—
Arsenic	Determination of mercury, arsenic, selenium, bismuth and antimony in soil and sediment Microwave digestion/atomic fluorescence method HJ680-2013	mg/kg	6.35	20.00	120.00
Cadmium	Soil quality. Determination of lead and cadmium. Graphite furnace atomic absorption spectrophotometric method GB/T17141-1997	mg/kg	0.75	20.00	47.00
Hexavalent chromium	Soil and Sediment Determination of Hexavalent Chromium Alkaline Solution Extraction-Flame Atomic Absorption Spectrophotometry HJ 1082-2019	mg/kg	ND	3.00	30.00
Lead	Soil quality. Determination of lead and cadmium. Graphite furnace atomic absorption spectrophotometric method GB/T17141-1997	mg/kg	26.40	400.00	800.00
HG	Determination of mercury, arsenic, selenium, bismuth and antimony in soil and sediment Microwave digestion/atomic fluorescence method HJ680-2013	mg/kg	0.04	8.00	33.00
Nickel	Soil and sediment Determination of copper, zinc, lead, nickel, and chromium flame atomic absorption spectrophotometry HJ 491-2019	mg/kg	34.67	150.00	600.00
Copper	Soil and sediment Determination of copper, zinc, lead, nickel, and chromium flame atomic absorption spectrophotometry HJ 491-2019	mg/kg	28.67	2000.00	8000.00
Manganese	Soil and sediment determination of 12 metal elements aqua regia extraction-inductively coupled plasma mass spectrometry HJ 803-2016	mg/kg	760.00	—	—
Fluoride	Soil quality Determination of fluoride ion selective electrode method GB/T 22104-2008	mg/kg	379.00	—	—
Cyanide	Determination of soil cyanide and total cyanide isonicotinic acid-pyrazolone method HJ745-2015	mg/kg	ND	22.00	
Carbon tetrachloride	Soil and sediments Determination of volatile organic compounds Purge and trap gas Gas chromatography-mass spectrometry HJ 605-2011	mg/kg	ND	0.90	9.00
Chloroform		mg/kg	ND	0.30	5.00
Methyl chloride		mg/kg	ND	12.00	21.00
1,1-Dichloroethane		mg/kg	ND	3.00	20.00
1,2-Dichloroethane		mg/kg	ND	0.52	6.00
1,1-Dichloroethylene		mg/kg	ND	12.00	40.00
Cis-1,2-dichloroethylene		mg/kg	ND	66.00	200.00

Trans-1,2-Dichloroethylene	Soil and sediment determination of semi-volatile organic compounds gas chromatography-Mass spectrometry HJ 834-2017	mg/kg	ND	10.00	31.00
Dichloromethane		mg/kg	ND	94.00	300.00
1,2-Dichloropropane		mg/kg	ND	1.00	5.00
1,1,1,2-Tetrachloroethane		mg/kg	ND	2.60	26.00
1,1,2,2-Tetrachloroethane		mg/kg	ND	1.60	14.00
Perchloroethylene		mg/kg	ND	11.00	34.00
1,1,1-Trichloroethane		mg/kg	ND	701.00	840.00
1,1,2-Trichloroethane		mg/kg	ND	0.60	5.00
Trichloroethylene		mg/kg	ND	0.70	7.00
1,2,3-Trichloropropane		mg/kg	ND	0.05	0.50
Vinyl chloride		mg/kg	ND	0.12	1.20
Benzene		mg/kg	ND	1.00	10.00
chlorobenzene		mg/kg	ND	68.00	200.00
1,2-Dichlorobenzene		mg/kg	ND	560.00	560.00
1,4-Dichlorobenzene		mg/kg	ND	5.60	56.00
Toluene		mg/kg	ND	1200.00	1200.00
Ethylbenzene		mg/kg	ND	7.20	72.00
Styrene		mg/kg	ND	1290.00	1290.00
M-xylene*+p-xylene		mg/kg	ND	163.00	500.00
O-xylene		mg/kg	ND	222.00	640.00
Nitrobenzene		mg/kg	ND	34.00	190.00
Aniline		mg/kg	ND	92.00	211.00
2-chlorophenol	Soil and sediment determination of semi-volatile organic compounds gas chromatography-Mass spectrometry HJ 834-2017	mg/kg	ND	250.00	500.00
Benzo[a]anthracene		mg/kg	ND	5.50	55.00
Benzo[a]pyrene		mg/kg	1.50	0.55	5.50
Benzo[b]fluoranthene		mg/kg	6.40	5.50	55.00
Benzo[k]fluoranthene		mg/kg	ND	5.50	55.00
Qi		mg/kg	ND	490.00	4900.00
Dibenzo[a,h]anthracene		mg/kg	1.00	0.55	5.50
Indeno[1,2,3-cd]pyrene		mg/kg	ND	5.50	55.00
Naphthalene		mg/kg	ND	25.00	255.00
Petroleum hydrocarbon (C10-C40)	Soil and sediments Determination of petroleum hydrocarbons (C10-C40) gas color Spectral method HJ 1021-2019	mg/kg	42.33	826.00	5000.00

The test results show that all the test indicators in this paper, benzo[a]pyrene, benzo [b] fluoranthene, and dibenzo [a,h] anthracene do not meet the soil environmental quality construction land soil pollution risk control standards (for trial implementation)" GB 36600-2018 Table 1 (Construction Land Soil Pollution Risk Screening Values and Control Values (Basic Items) in the screening values of the first-class land standard limit; all other testing indicators meet the first-class land standard screening limit.

5. Suggested repair measures

Combining the location of soil sampling points, the distribution of buildings (structures), and the topography and geological characteristics of the site, make reasonable corrections, and

superimpose the restoration ranges of the three organic pollutants in each depth layer to form the final recommended restoration range for each depth layer. According to the requirements of "Technical Guidelines for Soil Pollution Risk Assessment of Construction Land" (HJ25.3-2019), combined with factors such as the accessibility of the actual remediation technology and the tolerance level of the local economy, a comprehensive analysis of the risk control value, the background value of the area where the site is located, and the The limit values specified in other relevant standards [8], detailed investigation of the site environment, laws and regulations, and technical and economic feasibility, reasonable proposed site restoration target values, as shown in Table 2.

Table 2. Soil remediation target values and related reference values

Pollutants	Unit	Screening value of the first type of land	Calculated value of risk land	Mean background value	It is recommended to fix the target value
Benzo [b] fluoranthene	mg/kg	5.5	5.44E+00	/	5.5
Benzo [a] pyrene	mg/kg	0.55	5.44E-01	/	0.55
Dibenzo [a,h] anthracene	mg/kg	0.55	5.45E-01	/	0.55

6. Conclusion

In this detailed investigation, 34 soil sampling points, 1 background point, and 6 groundwater monitoring wells were set up. According to the "Regulatory Detailed Planning for the Second Phase of Huancheng Road and Huanfeng Industry Avenue in Dazhou", the plot of Dazhou Jinchang Ferroalloy Co., Ltd. is planned to be residential land (R), which belongs to the "Soil Environmental Quality Construction Land Soil Pollution Risk Management and Control" The first type of construction land specified in the Standard (GB36600-2018), so the first type of construction land risk screening value evaluates the soil environment of the site. According to the analysis results, the following conclusions are obtained: Among the 97 soil samples submitted for inspection, 15 samples exceeded the standards, and the excessive pollutants were PAHs (benzo [a] pyrene, arsenic, benzo [b] fluoranthene, dibenzo [a,h] anthracene), which are harmful to humans. There are risks to health and a risk assessment is required.

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