

Study on the Layout of Soil Monitoring Points in Contaminated Sites Investigation

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Abstract

With the rapid development of economy and city construction, the heavy industry which were located in the periphery of the city have to relocate. The left vacant site which has leakage of harmful substances, has become a high-risk area and a high-pollution area, causing great harm to the ecological environment and human survival. This has become a worldwide environmental problem. Therefore, it is necessary to investigate, analyze, statistic and evaluate the nature and damage degree of such polluted sites, so as to provide theoretical and technical support for the feasibility of site reuse and restoration. The specific investigation methods for these studies are also different due to the site differences. This paper studies the research methods for the pollution situation of the original site after the relocation of a polluting enterprise to ensure the authenticity of the data obtained in the later sampling survey.

Keywords

Contaminated site, Field investigation, Monitoring point, Sampling depth.

1. Introduction

Contaminated sites is China's new environmental problems emerge in the process of industrialization and urbanization, due to lack of environment management, old industrial enterprises sites, in the long-term accumulated during the production of various kinds of volatile organic pollutants, heavy metals, semi volatile organic pollutants and persistent pollutant strong toxicity, harm of pollutants, such as formation of contaminated sites. Faced with the serious problem of rapid population growth and very scarce land resources, the existing method is to transform the original industrial land into residential land, commercial land, public entertainment places and other construction land through land renovation, land restoration and development [1].

Taking a chemical plant as the research object, follow the guidelines for the site environmental investigation techniques (HJ25.1-2014), after the relocation site to carry out the environmental investigation of chemical plant, the layout of soil sampling points, formulate feasible sampling scheme, for the late samples, the environmental risk analysis and site repair design provides the basic data, also for the similar pollution site collection to provide the reference in the process of the sample.

Organization of the Text

2. Relevant Technical Standards and Methods for Soil Monitoring and Site Arrangement in China

At present, our country has been issued, including the guidelines for the site environmental investigation techniques (HJ 25.1-2014), "the guidelines for the site environment monitoring

techniques (HJ 25.2-2014)," brownfield risk assessment technology guideline "(HJ - 2014-25.3) and the soil environmental quality risk of soil pollution control standard" construction land (GB36600-2018), the specific site environment monitoring of related standards.

Among them, technical guidelines for site environmental investigation divides the field environmental investigation into three stages, and the layout of sampling points is mainly divided into systematic random point arrangement method, systematic point arrangement method, partition point arrangement method and professional judgment point arrangement method [2].

The system random placement method[3] divides the monitoring area into multiple grids with equal (or unequal) areas, randomly selects a certain number of grids, and sets a sampling point in each selected grid block, which is suitable for sites with even distribution of pollution. The point arrangement rule of the system is to set up one sampling point in each grid block, which is applicable to various types of contaminated sites, especially the sites with large pollution range or unclear pollution distribution. According to the use function of the land in the site, the zonal point distribution method is used to divide the site, and then the specific monitoring points are arranged in each zone according to the size of each zone according to the system point distribution method. It can be used in the site where the pollution distribution is uneven and the pollution distribution has been determined. For the site with clear potential pollution, it is suitable to use professional judgment method. The specific use method should make full use of the previous survey results and make a decision after a comprehensive analysis of the site's historical evolution, functional zoning of each block, potential pollution sources and pollution characteristics. For sites with a large area of land, which cannot be divided into blocks, or which are damaged by internal soil migration due to relocation, these four distribution methods should be adopted at different investigation stages in combination with the actual situation.

3. The First Stage Site Environment Investigation -- Taking the Original Site of A Chemical Plant as An Example

3.1. Site Overview

The chemical plant is located on the south bank of the weihe river, a narrow strip between the lianhuo expressway and the weihe river. The overall terrain is high in the south and low in the north, while high in the west and low in the east. There are weihe first, second, third - level terraces and loess tableland. In general, it is bounded by the loess ridge along the national highway 310, with the weihe river first class terrace in the north and the weihe river second and third class terraces in the south.

3.2. Site Use Status, History and Identification of Pollution Sources

The chemical plant mainly produces food-grade fumaric acid. The plant is mainly divided into office area, dormitory, factory building, distillation area, reactor, benzene reaction area and sewage pool, among which the key pollution areas are concentrated in the distillation area, reactor and sewage pool. According to its predecessor and the current production process of fumaric acid, it was preliminarily judged that the pollutants mainly include pesticides, heavy metals, vanadium, volatile and semi-volatile organic pollutants.

4. Site Environment Investigation in the Second Stage -- Taking the Relocation of the Original Site of A Chemical Plant as An Example

Based on the preliminary investigation of the basic information of pollutant identification in contaminated sites, the necessary way to obtain the information of pollutant concentration in

groundwater and soil is to conduct sampling and detection analysis of the soil and groundwater in contaminated sites [4]. According to the guidelines for the site environmental investigation techniques (HJ25.1-2014) and "technical specification for soil environmental monitoring (HJ/T 166-2004) and other documents of the relevant technical requirements, combining with field production history, existing situation and content such as comprehensive consideration has to identify suspected pollution area [5-7], the field potential contamination belongs to clear the field, and the area is larger, the professional judgment is adopted and the method of combining the field investigation system putting soil monitoring for layout.

4.1. Soil Monitoring Sites

The chemical plant is mainly divided into office areas, dormitories, benzene reaction areas, distillation areas, reactors and sewage ponds (see figure 1). In heavy pollution of distillation area sewage pool and reactors encryption points, distance of 20 ~ 30 m, other parts using radiant points according to the requirement, and can be divided according to the actual conditions to monitored plots of land, a single block area in principle is not more than 1600 m2, in the center of the plot sampling, every 40 m each direction at the same time set up a sample point [8, 9]. Because there are houses in benzene reaction area and plain color area which have not been demolished, the site of this investigation is not distributed temporarily. See figure 2 for specific monitoring locations.

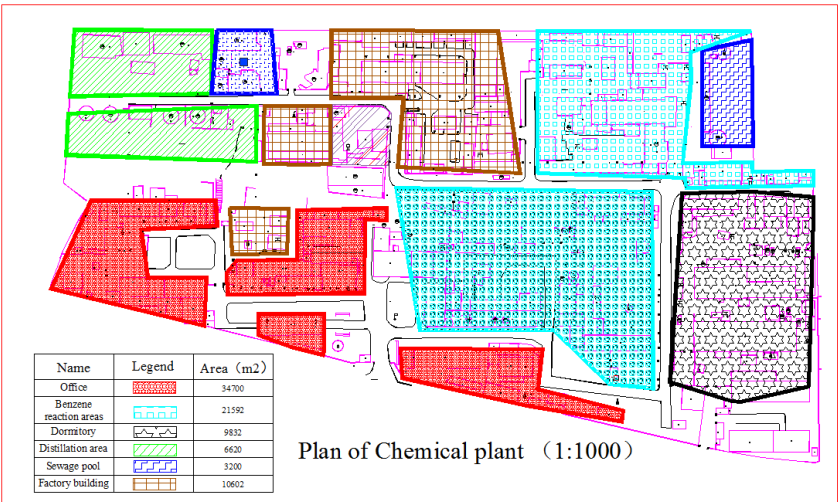


Table 1. Plan of chemical plant

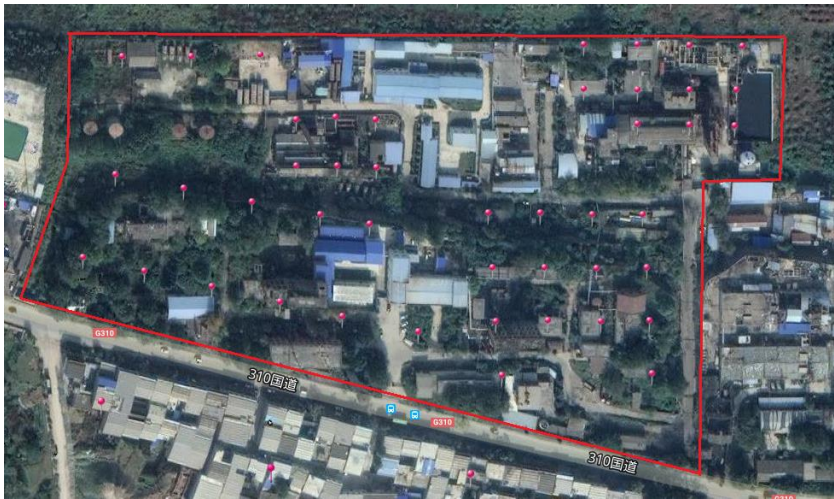


Table 2. Schematic diagram of soil sampling points

In the actual sampling process, when there is a local sampling condition obstacle, the above partition distribution points can be adjusted and corrected. At the same time, according to the requirements of site environmental survey, off-site soil reference points should be selected for sampling. Sampling points can be arranged at a certain distance from the site boundary on four vertical axes in the off-site area, and four soil samples with the same distance can be made into mixed samples (except for the site contaminated by volatile organic compounds).

4.2. Determination of Sampling Depth

After the completion of the soil sample points, the longitudinal arrangement of the points should be carried out according to the requirements of the investigation in different stages, that is, the sampling depth should be determined. Taking into account the stratification structure of the project area, pollutant migration path and migration rule, surface disturbance depth, distribution characteristics of underground water flow field and characteristics of pollutant generation, treatment and discharge of each enterprise, and combining with the site situation, the sampling depth is preliminarily determined to be 2m. If pollution is found, further sampling will be conducted until the uncontaminated layer. The depth of sampling shall be deducted from the thickness of the hardened layer of surface non-soil. The sampling interval of deep soil from 0~3m shall be 0.5 m, the sampling interval from 3~6 m shall be 1 m, and the sampling interval from 6 m to groundwater shall be 2m. For the soil of different classification, the interval should be adjusted appropriately to make the split characteristics of the soil in each layer consistent, and the specific interval can be adjusted appropriately according to the actual situation.

5. Comprehensive Analysis

As soil monitoring results have the most direct and fundamental impact on the site environmental investigation conclusions, it is required that the locations of soil sampling can represent and reflect the extent of soil pollution and its actual pollution distribution in the site as comprehensively and accurately as possible [10,11]. Generally, the density of the site is in direct proportion to the reliability of the monitoring results. However, overcrowding of the site will cost labor, expense and monitoring cycle in the early field soil environment monitoring. Therefore, the layout of the sampling site in the site survey is more worthy of careful study.

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